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The big issues

Critical Communications Today editor **Philip Mason** discusses two major developments that have recently taken place in the provision of mission-critical communications to the emergency services

MISSION STATEMENT

Critical Communications Today provides the global mission-critical community with insight into the latest technology and best practice required to ensure that its members always have access to the instant, one-to-many wireless communications that can make all the difference in moments of crisis. We work to stimulate and focus debates on the topics that matter most and provide our readers with a means to raise their concerns.

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elcome to the latest issue of *CCT*, the leading publication for those working in the critical communications sector across the world. In the time since our previous issue, two big developments have taken place in relation to the ongoing roll-out of mission-critical broadband to global emergency services organisations.

The first of these is the awarding by the French government of key contracts in relation to the planned build-out of its country-wide public safety LTE network. The development augurs well both for French first-responders and the sector itself, and you can read more about it in our news section located on page 9.

The second – more contentious – major piece of news this issue is the UK's Competition and Markets Authority reaching its provisional conclusion relating to the provision of Airwave to the country's emergency services. The potential implications are likewise considerable, with ESN also mentioned in the CMA's findings.

As will surprise no-one, the move to mission-critical broadband is also a key theme throughout the rest of the issue, not just in the news. For instance, turn to the Big Interview section starting on page 10 for an in-depth look at the work being carried out by the Canadian Public Safety Broadband Network Innovation Alliance. The PIA project is noteworthy not just for the technology itself but also the local/national model being employed in order to get the network rolled out.

Skip to page 14, meanwhile, for a look at the ongoing development of 5G-based technology for deployment within the rail industry. *CCT* talked to a variety of experts for the article, discussing the quest to replace the incumbent GSM-R solution.

Finally, we have two features anticipating next year's Critical Communications World, taking place in Finland. The latter is a key location in the roll-out of broadband to the global emergency services.

The first of these includes chair of TCCA's board, Mladen Vratonjić, talking about the key themes for the CCW conference, the programme for which is being put together as we speak. The second Helsinki-related piece, meanwhile, comes from TCCA vice-president Tero Pesonen discussing why it is such a pertinent location for the event.

Enjoy the issue.

Phil Mason

Philip Mason, editor







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Who, what, where

EUROPE











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Siemens gets on board with driverless train Al

German technology giant Siemens has announced backing for a €23m research project that aims to develop the automatic operation of driverless trains through the use of artificial intelligence. The project is known as safe.trAIn.

According to a statement, the German government has already deployed driverless trains in 'controlled and closed' environments, such as subway tunnels.

Siemens has claimed the safe.trAIn project will ensure that these can also operate safely in open areas, taking into account obstructions such as fallen trees and mudslides.

A spokesperson for the company said: "The challenge that has remained unresolved to date is that of finding a practical way to link AI methodologies to the requirements and approval processes that apply to railways."

UK police force launches community engagement app

Cleveland Police has launched a new app designed to give residents increased opportunities to engage with its officers.

According to a statement, the Cleveland Online Policing App, otherwise known as COPA, was developed by local digital agency Alt Labs, in collaboration with the force itself. It will, among other functions, "provide routes for people to report crime to Cleveland Police by directing to their website and via an emergency 999 call button".

Users will also be able to report concerns, as well as providing feedback on the force and access information about victim support services. The initial concept for the app came from feedback from the public about contacting the force, as well as growing demand in relation to the use of non-emergency number 101.

Police Service of Northern Ireland may receive spectrum

UK regulator Ofcom has announced proposals to make additional spectrum available for use by the Police Service of Northern Ireland (PSNI) in order to facilitate the service's usage of broadband-based comms.

Communicating in a statement, a spokesperson for Ofcom said it would make 2x3MHz of the 700MHz band, and 2x4MHz in the 800/900MHz bands, available for use by the organisation.

PSNI manages its own TETRA-based radio communications network, known as Barracuda, supporting approximately 20,000 users, including the police, fire and ambulance services. According to Ofcom, however, this has "a limited data capability and cannot match the bandwidth offered by modern mobile communications technology".

AUSTRALASIA





Motorola Solutions wins **NSW** Telco **Authority work**

New South Wales Telco Authority has awarded Motorola a five-year contract extension to support and enhance its public safety network.

The network spans 324,000 square kilometres and is one of the largest of its type. According to a statement, Motorola's work will include network lifecycle upgrades, as well as cyber security.

Software upgrades, meanwhile, will "provide further advancements to the network's location, vehicle and personnel protection capabilities". They will also provide NSW with the "flexibility to implement next-generation technologies".

Motorola Solutions' managing director for Australia and New Zealand, Con Balaskas, said: "[The] network provides exceptional performance in the harshest environments.'

For more on NSW Telco Authority, head to our two-way radio feature later in this issue.

NORTH AMERICA





Nokia appoints former Cisco VP to senior role

Communications industry veteran Shaun McCarthy has joined Nokia as its president of North America sales.

According to a statement issued by the company, McCarthy will be responsible for leading all aspects of sales across the US and Canada, "accelerating revenue growth, and helping customers to adopt transformative networking technologies that enable the next phase of digitisation".

McCarthy has over 20 years of sales experience in the technology sector. He has joined Nokia from Cisco, where he was vice-president of worldwide sales for mass-scale infrastructure.

Nokia chief customer experience officer Ricky Corker said: "Shaun has a proven track record of leading successful teams, building long-term relationships with customers."

SOUTH AMERICA





New TETRA comms for major Chile rail infrastructure

Hytera Mobilfunk is developing a new TETRA/ LTE system for Line 7 of the Santiago de Chile Metro, which is one of the largest infrastructure projects currently under way in Latin America.

According to a statement, the company will work alongside Spanish rail communications specialist SICE to install the system across infrastructure including stations, tunnels, workshops and garages. This is with the aim of "guaranteeing operational and emergency communications under the highest encryption and cybersecurity standards".

The project for Line 7 of the Santiago Metro is intended to extend the rail network by 26km across 19 stations. This project will be a first of its kind in Latin America and will feature a stateof-the-art LTE 3GPP topology, developed and manufactured by Hytera.

News round-up



CMA proposes Airwave price control

he UK Competition and Markets Authority (CMA) has published its provisional conclusions into the role played by Motorola Solutions in regard to the provision of Airwave.

According to a statement issued by the CMA: "A market investigation by the CMA, led by an independent group of experts, has provisionally concluded that Motorola, which operates the network, appears to be able to charge the Home Office prices well above competitive levels, resulting in higher costs which are ultimately paid by taxpayers. The CMA has therefore outlined a set of proposed changes to limit the price that Motorola can charge to a level that would apply in a well-functioning, competitive market."

The statement continued: "The Airwave network was originally commissioned by the Home Office through an open procurement exercise in 2000. The original contract, which was due to end in late 2019 or early 2020, was to build and operate the Airwave Network. The network was expected to be shut down and replaced by a new secure communications

solution using a commercial 4G mobile network – the Emergency Services Network – when the contract ended.

"However, because the new ESN network was not ready for switchover as planned and is not expected to be ready until 2026 and possibly later, the emergency services continue to rely on the Airwave Network, which is a monopoly provider of these essential communications services."

The CMA opened the investigation in October 2021 following what it called "concerns that the market might not be working well, resulting in a more expensive service". According to the statement, these concerns included the Home Office's "weak bargaining position when it came to the network". Another was Motorola's dual role in "providing the current network and in helping to deliver the ESN to replace it".

According to the CMA, it also wanted to understand "if the significant profits Motorola could earn from the Airwave Network affected its incentive to support (and not to delay) the delivery of ESN".

Martin Coleman, chair of the CMA's independent inquiry group, said: "It is vital that the market for critical mobile radio network services used by our emergency services works well and provides an excellent service at a fair price.

"As far as the price is concerned, the market does not appear to be working well at the moment. Our current view is that the Home Office and our emergency services are locked in with a monopoly provider which can charge much more than it could in a properly functioning market, while taxpayers foot the bill.

"We are therefore proposing a direct intervention through a price control to stop this and lay the basis for the Home Office to decide how it intends to ensure these vital services are to be delivered in future."

In its provisional findings, the CMA also stated that the Home Office is being charged more by Motorola to use the Airwave Network than it believes should be the case. This is due – again, according to the CMA – to the price of the technology in question remaining at the same level as when it was first rolled out.

To quote the statement issued by the government once again: "The price set under the original agreement entered into in 2000 included the capital costs of building the network. By the time the period covered by the original agreement ended, that cost should have been recouped, and the price should have fallen substantially at that point, in the same way that consumers can get cheaper mobile deals after they have paid off their handset.

"This did not happen, and prices remained at substantially the same level. But unlike consumers, the emergency services have no choice of an alternative supplier."

Going back to the topic of the delayed ESN roll-out, the CMA has provisionally estimated that Motorola could make around £1.1bn excess profit from the continued operation of Airwave between January 2020 and December 2026. If the ESN delay continues, meanwhile, the company could, says the CMA, make around a further £160m excess profit per year post-2026.

As well as the price control intervention, the CMA has also recommended that the Home Office puts in place "a clear plan as soon as possible" to ensure that "a new, upgraded network, or more competitive

arrangements, replace the existing set-up by the end of 2029".

Responding to the findings, a spokesperson for Motorola Solutions said: "Motorola Solutions entirely rejects the CMA's unfounded and incorrect calculation of 'excess' profits, which is based on an arbitrary time period of the Airwave project. The fact is that Airwave, over its life, is a much better deal for the UK taxpayer than the Home Office originally agreed."

The spokesperson continued: "In 2016, both the CMA itself and the Home Office approved all of the Airwave contracts that remain in place today. Airwave has been relied upon by the UK emergency services for the past 22 years.

"Despite the CMA finding no shortcomings in Airwave's exceptional service, or any material change in the cost to run this mission-critical network, the CMA is proposing to forcibly reduce the contractually agreed price for the remaining years of the contract. Such unprecedented intervention would severely undermine confidence in long-term infrastructure investment and contracting with the UK government.

"As this is a provisional decision, Motorola Solutions will continue to work with the CMA to demonstrate the excellent value for money the Airwave network provides to the UK taxpayer. At the same time, Motorola Solutions will pursue all legal avenues to protect

its contractual position for the benefit of the 300,000 emergency services personnel who rely on the Airwave network – and the people they protect – every day."

Airwave is a narrowband (TETRA)-based network, designed to provide secure and reliable communications to emergency services agencies across the UK. Currently in the process of being rolled out, the Emergency Services Network is based on a 'hardened' version of a pre-existing commercial network. The core contracts for ESN were originally issued in 2015.

The CMA is currently inviting comments on its provisional findings. A final decision is expected to be made later in the year.

France awards key public safety broadband contract

he French Ministry of the Interior and Overseas Territories has appointed the 'Package 2 integrator' in relation to its Réseau Radio du Futur (RRF) project. The contract was won by a consortium headed by Airbus and Capgemini.

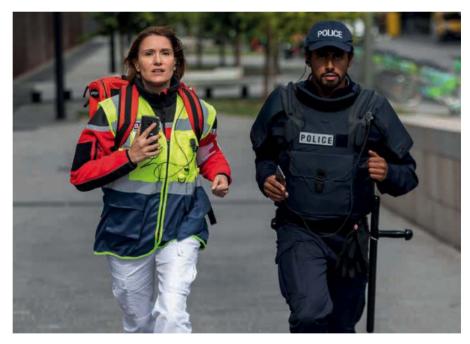
According to a statement, the RRF programme is focused on providing "a secure and resilient broadband network for domestic security and emergency rescue forces" in the country. This will take the form of a 4G and 5G "priority" system, boasting – as might be expected – a high level of resilience.

The project is intended to equip up to 400,000 users, including those in the national gendarmerie and national police force, as well as firefighters and other civil security forces.

Alongside Airbus and Capgemini, other companies involved in the roll-out include Econocom, Prescom, Samsung and Streamwide. Capgemini "will integrate the many sets of expertise provided by all the project partners. This includes Dell Technologies for the cloud infrastructure it will provide, in support of Ericsson's 5G telecommunications services."

Speaking of the project, Airbus CEO Guillaume Faury said: "I would like to thank the Ministry of the Interior for the renewed trust it has placed in us in the context of this strategic programme for French security and emergency rescue services.

"All our teams have been mobilised to provide a secure and sovereign solution to carry out missions of the utmost criticality in the service of French citizens. This



project demonstrates the importance of modernising critical systems, at a national and European level."

Aiman Ezzat, CEO of Capgemini, said: "We are proud to become a trusted partner of the French government for this major project. Capgemini is a key player for a critical project of this size and complexity, given its experience, industrial capacity and unparalleled expertise in the field of secure networks, telecommunication and 5G.

"RRF will be a crucial transition for the operational efficiency of the security forces and future uses of digital technology. It is a matter of national sovereignty and the starting point for a European sector of excellence."

Airbus has already been heavily involved in the roll-out of emergency services broadband in Europe, having been one of two consortium leads on the BroadWay project. This is a pan-European programme intended to enable public safety 'roaming' across borders.

The French RRF is only the latest of an increasing number of national 'mission critical broadband' projects. Other notable examples include the Emergency Services Network in the UK, Virve 2.0 in Finland and FirstNet in the US.

Canada's community spirit

Philip Mason talks to the Canadian Public Safety Broadband Network Innovation Alliance about its mission to deliver next-generation comms to the country's emergency services

s anyone with even a passing interest in the critical communications landscape will know, a – quite possibly *the* – key theme of the past few years has been emergency services organisations' ongoing move from narrowband to broadband technology.

Initiated by the likes of FirstNet in the US and the Emergency Services Network in the UK, an increasing number of countries are now looking to furnish their first-responders with country-wide, hardened LTE/4G coverage. These include the likes of Finland and France, both of which are well under way with their preparations for the move, as well as Norway and Australia, which are just starting to put their own plans in place now.

Needless to say, this theme is also becoming increasingly reflected at TCCA's Critical Communications World event, which for the past two years has included a 'government authorities' village. This offers, in the words of the organisers, "a dedicated space for representatives of national critical communications projects from around the world to come together to discuss ideas, challenges and best practice".

One such organisation is the Canadian Public Safety Broadband Network Innovation Alliance (PIA), which attended CCW this year for the very first time.

As might be expected given the above discussion, the organisation is likewise involved in the roll-out of broadband to first-responders. The real point of interest for CCT, however, is the unique way in which this is being accomplished, certainly compared with other government authorities involved in similar work.

The first key difference is that the PIA began as a local (Ontario-based) initiative whose influence is now spreading outwards around the country, rather than the other way around. The other crucial difference is the agility which is intended to be baked into all aspects of the work, from user uptake to the model used for the provision and roll-out of the network itself.

Network build-out

Communicating via the home page of its own website, the PIA describes its mission as: "Demonstrating leadership through the development of a PSBN governance framework for the Temporary National Coordination Office's [more of which later in the article] consideration as a viable model.

"Many public safety organisations and public-private partners in Ontario have led the formation of the first PSBN governance framework in Canada. The PSBN Innovation Alliance group has established working relationships between participating organisations in order to manage, coordinate, promote and maintain an Ontario PSBN."

Going deeper into the origins of the organisation, executive director of the alliance, deputy chief Anthony Odoardi, says: "The organisation was founded in 2019 by Halton Police, Peel Police and the Greater Toronto Airports Authority. The idea has been to establish public/private partnerships throughout all levels of government, critical infrastructure providers, innovation hubs and private organisations, both in and out of the tech space."

He continues: "We brought all these organisations together, not just as a think-tank but also as an entity to advocate for public safety, firstly in the province and then across the country, where it is desired to be established.

"We're seeing private tech organisations who would traditionally be competing with each other now working collaboratively, something which in turn has given us a better lens through which to understand the concept of community safety.

"The PSBN is operational in our geographic region here in Ontario. We cover close to three million people in the regions of Peel, which is the most diverse community in Canada. We're now seeing nearby regions also starting to build out that infrastructure. It is the only operational public safety network run by public safety agencies in the country."

According to Phil Crnko, who is the director of engineering and finance for the PIA, the nucleus of the new communications offering began in the greater Toronto area, with coverage now bleeding over into adjacent municipalities.

He conceptualises the network as "almost like private 5G" based around the concept of "neutral host cores, held in a public/private partnership". In terms of spectrum, the PIA also has the advantage of being able to leverage its own, with the project harmonised with the US in its use of FirstNet Band 14.

Going into greater detail about the anticipated direction of



the build-out, he says: "These cores are 100 per cent privately held by Halton Police and Peel Police. At the same time, we have the flexibility that the RAN could be deployed across a range of different partnerships.

"That could be a carrier partner, integrator, or national start-up. Ultimately, however, we leave that decision to the municipal regions, who will all have their own requirements. This flexibility – alongside strict service-level agreements and key requirements around reliability – have been the key to our success so far.

"We call the neutral host entity Trillium, which is the name of the provincial flower [also known as 'birth roots']. That runs the cores, the SLAs and so on."

Going more specifically in the subject of network provision, he says that the project envisages at least two primary carrier entities to provide nationwide coverage, as well as what he refers to as "seamless mobility" via the anticipated eventual use of network slicing.

The core would ultimately go from being privately owned (as it is now) to being operated via public/private partnership, with a multi-carrier model being the most appropriate for Canada due to the country's current "patchwork quilt" of providers.

"Last but not least," he continues, "we have the concept of private 5G RANs. Anywhere there's a private 5G RAN, all public safety organisations will have access to that via our core network, which quarterbacks slices and access.

"One final secret sauce item is the involvement of satellite operator Telesat in the project. We see a strong role for low Earth orbit technology going forward, and satellite access is really key for our remote communities as we continue to build fibre out."

Multiple business cases

As with any large-scale project of this kind, many factors have informed the decision to fund and build out the Ontario-based public safety broadband network.

In the first instance, this obviously includes the need to increase the effectiveness of Canadian public safety organisations, taking advantage of the opportunities presented by new communications technology. There are, however, also broader societal issues that need to be addressed around the

PIA was founded by Halton and Peel Police and the Greater Toronto Airports Authority provision of (non-emergency services) broadband coverage across the country as a whole.

Both of these factors continue to be key concerns for the Canadian Temporary National Coordination Office (TNCO), which is the governmental organisation mentioned at the beginning of this article as a key partner for PIA. Established in 2018, the organisation is charged with overseeing the roll-out of public safety broadband across the country.

It published its latest PSBN progress report in August of this year, outlining nine defining 'principles' for such a network, ranging from interoperability and uninterrupted access to affordability and efficient use of spectrum.

Discussing support for the PIA project at governmental, regional and international levels, Josh Johnson, director of strategy for the PIA, says: "The TNCO report has informed a lot of the work that's already been done, including looking at the management of chronic urban/rural divide issues.

"The TNCO essentially provided an endorsement of the hybrid model which Phil was talking about earlier. That is, where you have this 'core project' network, which is then able to utilise commercial partnerships as and when required.

"Peel and Halton really were visionaries in this in that they decided to go ahead and build out the core network while the report was being written. Sometimes it's just not desirable to wait for everyone else to do all the work – you have to take a little bit of a leap of faith."

Picking up on the subject of rural broadband provision and how the PIA's 'multi-provider' model is being used to help facilitate it, Crnko comes back into the conversation. He says: "There were six major problems to be solved, informing what we've done with the network.

"One of the key ones was the massive digital divide, which is linked to some of our geographical challenges in terms of the sheer size of the country, coupled with some very low-density populations. There are communities which are currently connected only by satellite, and we wanted the PSBN to be a factor in solving that problem."

Other 'societal' issues informing the project, meanwhile, include the ever-increasing cost of mobile data and the subsequent implications for the continued use of commercial broadband by emergency services organisations.



Another one is reliability when it comes to the use of commercial broadband itself. Johnson illustrates this via the mention of a recent network outage afflicting national network provider Rogers. "That really hammered home the value of our policy suggestions," he says. "This is not about big government at all, but resilience through public/private partnerships."

Community safety and wellbeing

As crucial as all this is when it comes to establishing the business case for the network, the most important factor has to be the anticipated ways in which it will increase the efficiency and effectiveness of Canadian emergency services.

It will therefore come as no surprise to learn that both PIA and the Canadian authorities have given this aspect plenty of thought as well, conceptualising broadband connectivity as integral to how they want public safety to do business going forward.

Giving an overview of Canadian police jurisdictions, and the general operational structure of first-responders, Odoardi says: "A good way to conceptualise it is by comparing it to the United States. Both have similar models when it comes to the emergency services, taking place at three levels, with organisations working together to co-ordinate missions.

"The difference lies, firstly, in the [comparatively few] public safety agencies in comparison to geography. There is also a fundamental difference in the approach to public safety itself, something we define – certainly in Halton and Peel – as the concept of 'community safety and wellbeing'."

According to Odoardi, the latter sits "outside the paradigm of traditional policing" with an increasing focus on societal concerns, rather than just law enforcement and crime prevention. It too is integral to the rationale driving the PSBN project.

Odoardi continues: "Over the last few years, certainly since the murder of George Floyd and the social unrest which it led The PSBN is operational in the geographic region of Ontario

to, policing has had to differentiate itself from the traditional model. It now has to meet specific community safety needs.

"The network is intended to help do that, and we're tying it to an overall framework in relation to providing services to the community as a whole. The idea is to look for upstream intervention resources, in order to mitigate negative interactions with the police. A key area in relation to that could be mental health."

He describes a relevant scenario as starting with a call to 911, which could potentially be in the form of a video feed. Broadband connectivity would enable officers to see the footage in question, which in turn can be shared with public safety partners.

The aim – he says – is to assess any potential crisis in advance of police attendance, while simultaneously looking for "appropriate upstream resources" and giving them access to the situation. The latter could, for instance, include livestreamed footage from a body-worn video camera straight to a mental health professional.

"Our vision is to make sure that in crisis situations we do our best to provide our public safety and critical infrastructure partners with the information they require to maintain public safety," he says. "At the same time, we're also looking at what our communities genuinely need, and the day-to-day operations around that.

"Eighty per cent of what police deal with is non-criminal in nature, which could mean issues around precarious housing, security and the protection of vulnerable people. Having a reliable network that allows us to do that allows other public agencies to come on board with confidence and partner with us in total response."

The PIA is responsible for some of the most interesting work currently taking place in the realm of mission-critical communications, both in terms of concept and execution. Its strong community focus also marks it as a project to watch very closely moving forward.



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scenarios















GSM-R 2G radio technology is deployed throughout Europe's railways to provide voice services and data support for train safety control systems, but it faces obsolescence.

James Atkinson reports on progress so far on developing its 5G successor, the Future Railway Mobile Communication System

ore than 100,000km of GSM-R has been installed on European railways since the first operational system began in 2004. GSM-R currently supports voice services from trains to controllers and trackside workers, railway emergency calls (REC), some data messaging and passenger information systems.

In addition, GSM-R is used as the data bearer for the European Train Control System (ETCS). GSM-R and ETCS are the two components of the European Rail Traffic Management System (ERTMS), which was designed to provide a homogenous train protection and signalling system across Europe.

GSM–R is a 2G technology, but as Josef Doppelbauer, executive director, EU Agency for Railways (ERA), concedes: "We have to admit it is still fit for purpose, except for some limitations in capacity. We have recently upgraded the specifications to include GPRS and Edge."

Some rail infrastructure managers are deploying GPRS and Edge to cope with these capacity issues, but that aside, it is clear that the railways are facing a larger existential crisis when it comes to their radio communications.

Existential crisis

The threat takes the form of two related issues. The first is that the rapid development of new radio standards

every five to seven years is leaving the railways behind, with 5G being implemented now and 6G in discussion.

"This means that certain services that would be attractive to rail cannot be used, because we are still in the 2G world," says Doppelbauer. "But, more importantly, the main risk is the obsolescence of GSM-R."

GSM-R is a niche technology developed purely for use by the railways and it cannot be evolved to a modern radio standard. So, it is vital that the supply side continues to support it while a replacement is developed.

That commitment is now in place. In July 2021, the UNITEL Committee, comprising the major GSM-R railway telecom products suppliers and companies of UNIFE (European Rail Supply Industry Association), published a GSM-R Long-term Support Statement. This was to the effect that they would "provide support for GSM-R at least until 2030 on a general basis and beyond 2030 on a per contract basis".

This commitment should not be underestimated, as suppliers rarely have



any incentive to keep near-obsolete radio technologies going. Emanuele Di Liberto, head of global rail business Centre at Nokia – a key member of UNIFE and UNITEL – observes: "There are not too many GSM-R suppliers left these days. But we are committed to extending the lifecycle of GSM-R.

"It is really difficult for the [supply] industry, but I'm not sure we had a choice. It takes a lot of planning and a lot of commitment from both sides to keep something like GSM-R out there for, at the end, almost a 35-year lifecycle, which is a lot."

In the meantime, the International Union of Railways (UIC) and ERA have been working hard to develop a strategy to replace GSM-R. Discussions began in 2010, and the successor Future Railway Mobile Communication System (FRMCS) was launched as a project in 2014.

The UIC is keen to ensure FRMCS is based on a future-proof technology capable of evolving as radio technology develops. But FRMCS also has to deliver railways-specific quality of service requirements. It is no secret that

In terms of architecture, we want to separate the communications layer from the applications layer

"

FRMCS will be based on the 3GPP 5G standard, but this means that, as with other mission-critical sectors such as public safety, railway-specific applications need to be built into 3GPP releases.

Current work is based on 3GPP Release 17, but Di Liberto says: "The general agreement is that railways will use R18 as the foundation release, although there might be a couple of things left for R19 to cover. But the crucial topic of the railway emergency call (REC) should be fully defined by R18."

In February 2020, UIC published a mammoth document outlining over 70 possible use-cases for FRMCS. These use-cases can be broken down into three broad categories: critical, performance, and business communications.

Critical communications includes applications essential for control of train movements and assured data communications for ETCS. ETCS needs highly reliable connectivity to transmit frequent updates on position, speed and train-integrity information from train to track, and the signalling of movement authorities (MAs) from track to train, at the appropriate time to guarantee safe operations.

Other critical apps include: REC; voice and messaging between controllers

and train drivers; communications to trackside workers; monitoring and control of critical infrastructure; automatic train operation (ATO); and automatic train protection (ATP).

Performance applications cover those features that help to improve the performance of the railway operation, such as train departure procedures, telemetry and IoT. Business applications include aspects such as passenger information systems and ticketing support. Passenger on-board and platform Wi-Fi also comes under this heading.

End-to-end system

FRMCS, based on 5G specifications, will be used for the complete end-to-end system, including the network and the on-board system, which covers both the terminal and the functionality implemented on board.

"In terms of architecture, we want to profit from the [3GPP] evolution and we want to separate the communication layer from the application layer. We want to have standardised interfaces between on-board and trackside, in order to be flexible for future expansion, and possibly, changes in the radio system," explains Doppelbauer.

The UIC has identified eight key challenges FRMCS needs to solve: QoS,



ETCS bearer independence, future proofing, equipment, applications, spectrum availability across countries, interoperability, cyber security, and time/cost-effectiveness.

As Di Liberto points out, QoS is inherently part of 3GPP releases, so that should be built in. Ensuring ETCS bearer independence is one of the most important aspects of FRMCS, as in the current GSM-R system, the radio and the ETCS functions are tightly coupled.

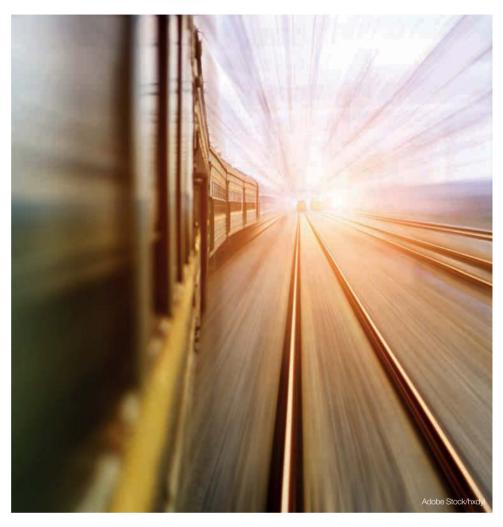
5G will enable a clear separation between the communication functions and the train protection functions, as well as other functions. FRMCS will be based on the UIC's technical specification for interoperability (TSI). Doppelbauer says that the latest 2022 TSI has introduced the modularity needed to decouple the radio and the ETCS functions.

"This is available and already submitted to the EC and it now needs the agreement of a vote by the member states," reports Doppelbauer. "We have also specified the interfaces between these building blocks, and they are available. What is missing is some of the functionality of FRMCS itself, mainly related to the voice part and the mission-critical factors. But as far as the on-board architecture is concerned, the modularity is there."

Basing FRMCS on 3GPP standards will give the railway the future proofing it needs in terms of an upgrade path with backwards compatibility, as well as allowing it to take advantage of the economies of scale that a global radio ecosystem provides. 5G also comes with much better cyber security compared with 2G.

Sorting out spectrum is obviously central to the future success of FRMCS, and this has largely been achieved, at least as far as Europe is concerned. The EC has agreed to allocate harmonised spectrum across Europe for railway mobile radio by assigning 2x5.6MHz in 900MHz (the existing GSM-R band) and 10MHz in the 1900MHz band.

The assumption is that FRMCS will start out using 1900MHz, while 900MHz will only become fully available after the complete migration of European railways to an FRMCS-based network. Some 900MHz might be used for both GSM-R and FRMCS



during the transition period, so long as co-existence solutions can be developed.

Interoperability covers not just FRMCS equipment from different vendors, but also between GSM-R and FRMCS systems. It is essential that there is a standard interworking function between the two radios during the transition period.

"The on-board equipment will have to be capable of supporting both technologies," says Di Liberto. "The ETSI railway radio telecoms committee is working on the specific technical requirements and there will be a specific interworking standard for this."

One potential issue is the lack of chipsets for the railway bands. The concern is that the big chipset vendors may not have much incentive to cater for these more niche mission-critical 5G bands.

Replacing GSM-R is going to be expensive

Multi-application support

Naturally, replacing GSM-R is going to be expensive, but FRMCS should be cost-effective because it will support many more applications, including ATO and ATP. Also, as Di Liberto points out: "If you compare the cost of telecoms to the overall budget of the railways, it is very, very small compared with the civil works and so on."

In terms of timelines, Doppelbauer says the current TSI has captured as much of FRMCS as possible so far, including the interface specifications and a list of the mandatory specifications. "The full specification is not yet ready and we expect the final version in 2024, so that an update of the TSI can be published in 2024, or more realistically in 2025."

Products can be developed on the basis of these final specifications and then the member states can decide on their deployment and FRMCS migration plans. The EC has already requested member states report on their plans regarding this.

However, Doppelbauer says it is

Sorting out spectrum is obviously central to future success and this has largely been achieved



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clear from these reports that "practically no member state is planning full decommissioning of GSM-R before 2035. So, what we can say is that all member states want to keep GSM-R as long as possible. The majority of member states intend to start [migrating to FRMCS] around 2027 to 2030.

"Of course this will heavily depend on the full specification [being available] and, for us, full specification means validation. So, one of the critical steps will be that the set of FRMCS specifications will be validated, so that we are sure that when we include those specifications in the TSI that the quality and stability of FRMCS is assured."

An FRMCS European trial, based on updated specifications and 3GPP R17 products, is targeted for 2025. Of course, all this has to be funded and Doppelbauer is hopeful that Europe's Rail Joint Undertaking, a public-private partnership which began its activities earlier this year, might provide an appropriate funding vehicle.

What will be absolutely critical is how the migration from GSM-R is handled. The UIC has set out four key considerations that need to be addressed. These are: telecom onboard architecture (TOBA); signalling operations continuity to ensure ETCS is supported and trains continue to run safely; migration spectrum needs; and GSM-R and FRMCS co-existence.

The UIC has been working to determine the best on-board architecture to enable ETCS migration to FRMCS and to introduce the ETCS bearer independence concept. This will be followed by a similar process for the voice cab radio. Doppelbauer says the UIC is trying not to be too detailed in its specifications.

"If we specify the on-board system in greater detail, we, on the one hand, restrict the design freedom of the suppliers, and on the other hand from the supplier's perspective, we make it possible for a customer to buy individual bits and pieces from different suppliers."

Doppelbauer notes that the latter is "not to the full liking of the suppliers because they usually live off the very attractive service contracts". The advantage for end-users is that they can negotiate better contracts and escape vendor lock-in.

"But strategically, it is the only way forward to bridge the gap between the long lifetime of railway systems and the rather short lifetime of mobile

FRMCS 5G design options

Nokia, Deutsche Bahn and Digitale Schiene Deutschland published a white paper last year entitled 'Highly resilient FRMCS/5G design for future rail operation', which sets out a range of possible design options. The options have differing levels of reliability depending on the number of UEs and radio units (RUs) supporting different frequency spectrum which are present on board the train.

- A single UE using only one spectrum is the least-reliable option, as the failure of the UE –
 or of an RU that the UE is connected to will disrupt connectivity.
- A single UE supporting both 1900MHz and 900MHz offers a similar scenario, but should the 1900MHz RU fail, the UE can attach itself to the 900MHz RU.
- A third option is a double UE using single spectrum. Here, one UE is active and the other
 passive, so it can take over if the first UE fails. Alternatively, both UEs could be active
 but connected to different RUs to provide reliability in case of both a UE and a base
 station failing.
- Finally, a double UE with double spectrum provides the highest level of reliability. It is
 likely one UE will be deployed at the front and the other at the rear. The two UEs could
 be connected to different RUs of the same spectrum, as well as to an RU with different
 spectrum. In this scenario, the communication between on-board and trackside can
 survive the failure of an RU as well as a UE.

The paper also examines a number of options for the RAN design, including:

- The classical approach using 'all-in-one' base stations.
- Separated RU at antenna locations with BBU (base band unit), distributed units (DUs) and central unit (CU) in a 12-15km edge range (BBU hotel concept).
- Separated RU/DU at the antenna locations; CU in regional centre.
- Separated RU at the antenna locations, DU in a 12-15km edge range, CU in regional centres.

These options range from least to most expensive, largely due to the increased number of equipment installation locations required by the more distributed models.

communication systems," observes Doppelbauer.

Di Liberto says that the trackside installation of FRMCS equipment will be a fairly standard radio implementation. He also states that it is important that a transport network with sufficient backbone is in place to support 5G features such as synchronisation and low latency. But this is something rail infrastructure managers can address now.

Edge computing for low-latency apps and video, along with cloud-based services, will also be needed. "Video will be one of the killer apps demanding edge computing," points out Di Liberto. "If they want to run trains with higher levels of automation, they will need more video to know what is going on. So, you will need to build some kind of remote edge computing capability."

The on-board installation is a rather more tricky prospect, however. Di Liberto says: "The main migration bottleneck is the rolling stock itself and that is a concern. Retrofitting trains is very expensive and takes a long time."

A dual-mode cab radio supporting GSM-R and FRMCS is the most likely way forward during the migration period. "Clearly, what will happen is that for a very long period of time you will have two networks in parallel and then the cab radio. Depending where the trains are, they will be using one or other technology with some sort of interworking," says Di Liberto.

"And don't forget you need to support both frequencies, so you need antennas and coaxial cables. That will be a bit nasty to sort out, but it will happen. So, for us, the big challenge is the on-board migration timeline."

European governments may want to keep GSM-R in operation even beyond 2035, but the rail industry is doing its best to get FRMCS prepared. "We want to provide the specification on time, so that this does not block the further downstream development," says Doppelbauer.

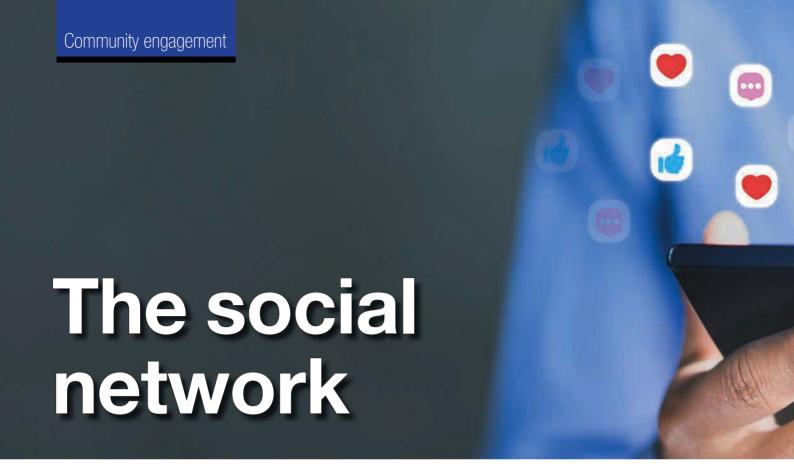
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Following his presentation at Critical Communications World 2022, UK Police Digital Service digital engagement manager **David Bailey** discusses the evolution of the use of social media by law enforcement

How has the UK police's use of social media changed since the conversation about online engagement first started over 10 years ago?

We've come a long way from what things used to be like. For a while, social media became the answer to everything in terms of engagement. As long as we were shouting about something, it was good. A lot of the early days of the police using social was just 'look at what we're doing', rather than thinking about the responses we were getting.

I was working with some of the early advocates of social media in policing, and the question I was asking all the time was what value are we actually getting out of this? At what point does it stop being just noise, and becomes something we use to help genuinely influence our relationship with the public? Or, allow the public to influence us?

Could you give some specific examples of how the strategy was wrong at the beginning?

It was new and unknown so it wasn't wrong at the time, but things have changed as the platforms changed. In the first instance, some forces had a huge number of accounts, none of which were co-ordinated in a strategic way, although that worked at first.

We did a piece of work a few years ago – around 2018 – and at the time some UK forces had hundreds of social media accounts associated with them, but they were barely getting any engagement. For every message they sent out, they were getting an average of one reaction. At the same time, other forces, which had [far fewer] accounts, were getting more engagement.

In the eyes of the social media platforms – regardless of whether something's part of a corporate structure or not – each of those multiple accounts within a single force were

Some forces had huge numbers of accounts, none of which were co-ordinated in a strategic way seen as separate accounts. So, they're viewed as competing with each other for the audience's attention.

You mentioned that the messaging being put out by some forces wasn't receiving a great deal of engagement from the public. Other than competition within forces, what was the reason for that from a content point of view?

It just wasn't giving the public what they wanted. Going back to the piece of research that we carried out, we had 26,000 responses from the public across all 43 UK forces, specifically about what they would expect from a policing social media effort.

That included things like crime and incident updates, missing persons appeals, what's happening at court, traffic updates and so on. Social media is about what's happening in the moment, and that's what they wanted to hear about.

Rather than those things, there was a huge amount of content that we categorised as 'other'. That included posts about people buying doughnuts for their team, what people were making for tea and so on.

In terms of the engagement that was going on, the police constable accounts were mainly being followed by their friends and colleagues. So even that figure is a bit confusing, because most of the reactions were coming from other police accounts, not the public themselves.

I essentially had to tell all the chief officers and police and crime commissioners that we were unconsciously incompetent when it came to social media. We had over 5,000 different Twitter accounts, hundreds of Facebook accounts, just shouting. We were damaging trust with the public because we weren't listening and responding, and with social media, people can see that.



Following the research, what strategy was put in place to rectify the mistakes which were being made?

Taking the figures into account, we came up with a tiered approach prioritising the larger corporate accounts, which the police officers themselves will likely say are boring. They're the accounts which in the main were being followed by the public.

In terms of the strategy itself, ultimately you have to think – again – what value are we getting out of this? You go back to the stated purpose of our effort on social media, which is to engage with the public in order to build trust and confidence.

So, the tiered approach included the concept of 'level one' and 'level two' accounts, which are the only ones which can have blue ticks next to them. There's the force account itself – @MetPolice – which is crucial because it's so recognisable. At the same time, it's never going to be local enough, so then you have specific accounts based on local authority area.

The point was to make accounts easy to find. So, for



instance, if you're in Lewisham in London, you'll be able to find the account for Lewisham police, rather than having to search for 'Borough Command 542'. That's the way we'd structured it before, because that's what made sense to us. Essentially, fewer accounts, with more content, aimed at more people.

At the same time, we also came up with the pillars of good outbound social media. The first of those is the achievement of a tactical operational objective, something which every piece of content which is sent out should relate back to. Success is then measured by 'did you achieve what you set out to?', not whether something went viral.

That's quite different from the generally accepted measure of success on social media...

A good example of the difference is the 'David Schwimmer shoplifter,' who was a guy who stole beer from an off-licence who looked the splitting image of actor David Schwimmer. That was tweeted by Blackpool Police – some heralded it as fantastic engagement – David Schwimmer himself made a meme of it, and it went viral.

While a lot of people may have seen the post, the crucial question is, did it actually lead to the arrest of the suspect? What's more, following the post, did Lancashire Police have to spend hours going through all this inbound social media from people who have no idea where Blackpool is, and aren't even in the UK.

Actual success is if you tweet a picture of someone, and within 10 minutes they ring you up and say: "Can I come in to be arrested?"

Going back to the more informal way that officers were interacting on social media, isn't that just a natural extension of the policing model? In other words, demonstrating that 'the police are the public, and the public are the police'?

Ultimately, it wasn't what the public wanted because it was too much about personality. The public made it very clear it didn't need police officers to prove that they're human, because they already knew that they were.

What they really wanted to know about was anti-social behaviour which was going on in their area, and what was being done about it.

If you think about it, one of the measures of a successful day for most people is that they don't have to communicate with the police. People generally don't wake up in the morning and think to themselves, 'Oh, I'm going to interact with the police today'. In fact, if you are interacting with the police, something has probably gone wrong in your life, and you've been driven to us by fear and concern.

This was again borne out by 46 per cent from the perception survey who said that they would never like, share or comment on a post from the police. They were, however, invested enough to fill out a 10-minute survey, which reinforced that the whole 'chasing the metrics' idea is meaningless.

If nearly half of the people who really value your posts have said they won't leave you a measurable metric, what's the point of chasing likes? They simply didn't want to be seen as interacting with the police.

Was there any pushback from officers themselves when it came to the new strategy?

One of the biggest challenges we had was convincing officers

we weren't taking their voice away. What we really wanted, however, was for them to have a bigger audience, in order to make it easier for the public to engage with them. They have fantastic stories to share with the public – we wanted more of that to more people.

Going back to 2010, at what point did the social media strategy start to evolve? Were there any incidents which were a particular catalyst for that?

The [country-wide UK] riots in 2011 were a massive driver. I was heavily involved on the social media side in Staffordshire, and our strategy worked so well I ended up explaining to the prime minister of the time how we did it.

From my point of view, the idea was simply to provide a credible, trusted voice throughout the time that the riots were going on. That was in contrast to some forces who actually unpublished their Facebook page as soon as the comms team went off for the day, because they didn't want any risk. There was one very large force without a single social media account.

What the 2011 disorder proved was that the public want to hear directly from us.

What strategy did you specifically employ during those riots?

I worked in the control room, essentially listening to what people were saying on social media, giving us the opportunity to influence the narrative. For instance, you'd spot a rumour that a shop was on fire somewhere, which I would then respond to with a CCTV shot of a PCSO standing outside of the shop in question. We were literally saying, no, we're in control of the streets and here is the proof.

We fed into that whole operation, putting out what was happening. Saying that patrols were being proactive in relation to any disorder and so on. One Friday night we had a car fire in one of the little towns in the area, and I responded by saying, "It's nothing to be concerned about – there's often a car fire there at the weekend. It's nothing to do with the riots."

The idea was to become part of the conversation with the public, which also fed into our media communications as

well. I was doing hourly interviews at the local radio station, and at one point they tweeted that they'd just been out for a drive and that everything the police were saying on social media was true. We quadrupled our followers in a week.

Has a strategy been developed to deal with negative publicity, for instance in relation to particularly high-profile events?

There is absolutely strategy around negative publicity. And once again, it comes back to what is the operational objective. In every case it's to maintain trust, maintain peace, provide information and challenge 'facts' if they're not correct.

What if there are many hours of unremittingly negative social media feedback about a particular issue or event?

Then that should be fed into the Gold command which is managing the incident. That will then help them to understand the public reaction to the issue in question in order to help drive how our organisation responds to it. And then they can respond to it as well, demonstrating what they're doing, posting videos and so on.

There was one particular job I dealt with back in force, when we deployed a full firearms team, alongside helicopters, dogs and three ARVs. These were all pointed at a group of teenagers standing at a bus stop in the city centre, who were reported as waiving guns around which later were established as toys.

First of all, we got this huge negative reaction, both from the public and the families of the teenagers. We responded to that by putting a firearms commander up to do an interview, while I posted the CCTV footage of what had been reported.

We basically said, "Faced with this, what do you expect us to do?" Frankly, the footage looked like three kids with guns. This is the information we had; this is what we could see. And the only response was to send someone wearing the right body armour with the right tools.

Having talked through our rationale and posted the footage, half the negative comments we got were then deleted by the users themselves.

The idea is simply to provide a credible, trusted voice



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Always changing, always evolving

Critical Communications Today talks to two organisations – one manufacturer, one user – about the development, provision and deployment of two-way radio technology for public safety

constant theme now running through almost every issue of *Critical Communications Today* is the way in which the use of traditional radio technology on the frontline is being increasingly augmented by 'new' broadband solutions. Indeed, this trend is now so ubiquitous and far-reaching, several years ago we went as far as to change our name from *TETRA Today* to the title you currently hold in your hand (or, view on your screen).

As increasingly important as broadband is becoming, however, there is still some fascinating work taking place when it comes to the development and deployment of narrowband-based solutions. This could be in the realm of TETRA (which is still widely considered the gold standard for the technology), P25 or indeed in relation to the DMR standard. The sector is also seeing the introduction

of an increasing number of hybrid solutions, as demanded by users.

In this article, we are going to zero in on the work of a single manufacturer doing some truly interesting work in the field, working in close collaboration with users themselves. We will also provide examples of how radio technology is being deployed from the user perspective, focusing in particular on the extraordinary work being carried out through the New South Wales Telco Authority.

From analogue to digital

When it comes providing mission-critical communications, technology manufacturers and their partners service a wide range of verticals. These include utilities, mining, aviation, and more.

Perhaps the most high-profile deployments, however, take place within the emergency services context, certainly when it comes to nationally rolled-out mission-critical networks. One company which is doing some interesting work with the emergency services is Tait Communications, particularly in relation to its technology for the fireground.

Discussing the deployment of its DMR Tier 2 solution to East and West Sussex fire and rescue services in the UK, as well as London Fire Brigade, the company's managing director, Dave Turner, said: "We've been carrying out work with fire services in the UK, essentially to try and change the way they perceive the role of two-way radio on the fireground.

"Traditionally, the technology which has been used by British fire and rescue services on the fireground is analogue-based, which comes with a certain set of restrictions. In terms of the fire and rescue organisations that we've been working with, their analogue equipment was also proving to be less effective than it was. It started off really well but had aged quite poorly."

He continues: "Regarding East Sussex, they were also having issues with coverage, so we talked to them about different intrinsically safe ratings to provide them with higher power. When the UK's Fire Chiefs Council start to move towards digital [for the fireground], they're going to be ready for that journey. The devices in question have the capability to switch between digital and analogue mode."

As well as the work being carried out in relation to fireground radios themselves, Tait has also been involved in a project to make communication easier for firefighters while wearing personal protective equipment/breathing apparatus.

Elaborating on this, Turner says: "Historically speaking, there has been little integration between the radio itself and the breathing apparatus being worn by firefighters in the field. So, we worked with safety equipment manufacturers MSA and Drager in order to customise some of the settings and audio processing abilities of the radio. Now, when the BA gear is plugged into the radio equipment, it's already tuned, and the audio's already set up.

"For us, it's all about continuity and quality of communication, certainly in that environment. It's one thing to be able to get a path across from the radio to the incident site, but you also have to understand what's being said. That can be difficult when you've got someone breathing heavily into a mask in a very hostile and dangerous situation."

From Turner's perspective, Tait Communications is doing important work in the development of new two-way radio solutions for use by firefighters on the frontline. This is being carried out in collaboration with the UK fire and rescue services mentioned above, but also public safety-orientated organisations elsewhere in Europe.

One of these is a Swiss fire authority which has likewise also started to deploy DMR on the fireground, alongside a private LTE system. The purpose of this, according to Turner, is to provide the opportunity to leverage PTT over Cellular devices which can also communicate with the aforementioned DMR.

"The exciting bit," he says, "is the biometric monitoring. We've been working with a UK company called Hidalgo, who provide a really good biometric harness, linking data to the back office. We can take their data and feed it back over the narrowband LMR network."

As well as communications purely for the fireground, meanwhile, the

company is trying to extend its 'continuity of communication' concept by attempting to link the frontline back to the control room.

This idea was outlined by the company's senior business development manager Richard Russell when *CCT* spoke to him earlier in the year. He explained the company's AXIOM concept, via which users leveraging different handsets are able to talk to each other across multiple carriers. (For instance, LTE broadband, analogue, DMR and so on).

Discussing this, Russell said:
"Fundamentally, this part of the
Axiom concept enables those working
in the control room to convey voice
information via an LTE connection to
the incident itself.

"This information is then rebroadcast from the command vehicle in real time, with very little latency. In terms of the fireground, it would then be re-broadcast over the UHF bearer to both the firefighters on the ground and at the bridgehead.

"That being the case, it could also conceivably enable firefighters to receive information from the person actually reporting the incident. The member of the public in question could give incident information via the controller, as well as details about the location."

Turner elaborates further: "The next step will be linking the fireground back to the control centre, which is something that we're absolutely looking at. At the moment, there's caution around that particular approach, basically because organisations don't want a voice in the firefighter's ear when they're in the middle of a life-or-

death situation.

"That being the case, in the first instance we'd plan to allow communication from the control room to the incident commander. We have the flexibility to do that, allowing different talk groups across the network."

Going back to the topic of the DMR roll-outs discussed above, one element that makes the work particularly interesting – over and above the technology – is the level of collaboration with the emergency services organisations themselves. According to Turner, this was a lengthy process, beginning as far back as 2018 when one of the radio leads at East Sussex FRS witnessed a presentation given by the company in the UK and liked what they saw.

Rather than simply selling the service as much equipment as they could as quickly as possible, however, the company embarked on what Turner describes as a lengthy process of trying to understand how the firefighters in question carry out operations on the fireground.

This work was in turn followed by the development of customised firmware for the aforementioned radios, with the aim of providing a specific quality of service when it came to voice. There was also, naturally enough, a testing process, during which firefighters would "go into the fire box, make some calls, and tell us what worked and what didn't".

Going into greater detail about how this level of collaboration also benefited the company going forward – particularly in terms of gaining





The network is continuing to expand through a 'once in a generation' \$1.4bn investment



additional business – Turner continues: "We were very lucky that West and East Sussex in the UK share a team, meaning that the person that we worked with at the latter then took the learning to the former.

"The West Sussex deployment was slightly different to East Sussex. It's the same equipment but set up slightly differently in order to take account of their processes, which are very specific. Since then, it's been an iterative process with other fire and rescue services across the country."

Model of innovation

One user organisation which is proving to be a model of both innovation and best practice when it comes to the integration of a variety of different technologies including two-way radio, is New South Wales Telco Authority.

Giving an overview of the organisation and the radio equipment used by it, its chief digital and technology officer, James Pickens, says: "NSW Telco Authority operates and maintains the public safety network [PSN] for the Australian state of New South Wales (NSW). [The state] has a population of around eight million and extends across more than 801 square kilometres.

"The PSN uses mission-critical LMR digital P25 technology. P25 technology is secure, reliable, interoperable with other LMR networks and allows operation in high-power mode to provide coverage over large

areas. To maximise geographic coverage, we also use low-band UHF spectrum [400MHz], [which is] essential for such a large catchment area. The network operates at a 99.95 per cent target availability."

According to Pickens, the organisation is also continuing to expand the network through what he refers to as a "once-in-a-generation" \$1.4bn investment from the NSW government. This expansion – which is 40 per cent complete – will enable the network to grow from 150 sites to 675.

Discussing what this means in terms of increased coverage, he says: "[Our] baseline 150 sites provide less than 80 per cent population and 35 per cent land coverage. Following the new investment, this will increase to cover 97.7 per cent of the population, while extending across 85 per cent of the state. On completion, the PSN will be one of the world's largest P25 networks in terms of coverage area and site count."

In situations where P25 coverage is unavailable, meanwhile, the organisation adopts what it calls "supplementary coverage solutions", relying on either coverage from commercial carriers or satellite as a transmission medium linking back to the PSN core.

At the same time, the authority is also rolling out a fleet of what it calls 'cells on wheels', which are essentially portable mobile towers. These are primarily designed for deployment in locations without PSN coverage, as

well as during disasters and periods of network maintenance.

The organisation is likewise working with public safety organisations to develop a framework of other portable technologies, such as additional MESH networks, 'vehicle as a node' solutions and additional cells on wheels. Again, these will be in areas where connectivity is difficult to maintain, such as major highways, remote locations and during outages.

This article began with a discussion of the increasing interest in broadbandenabled communications technology on the part of global 'mission critical' organisations, something which is likely only going to increase as we move forward. That being the case, it should be no surprise that NSW Telco Authority is also planning for its own public safety mobile broadband capability.

Discussing this, Pickens says: "The Australian government, along with the states and territories, are working to develop an interoperable PSMB capability. [This is] to provide mission-critical voice and data services to enable emergency services organisations to adopt data-heavy technologies such as personal location tracking, body camera live streams and bushfire monitoring drones.

"Under this federated model, PSMB will form the backbone of the solution NSW is developing to ensure first-responders have prioritised access to the resilient, reliable mobile broadband spectrum they need to send and receive data, video and voice to and from the field."

NSW Telco Authority is currently undertaking a customer-led solution design process in relation to the network, once again involving public safety organisations.

This is to "ensure that the solutions we create meet first-responders' needs, providing the reliable communication they need when they need it most. [This could be] during floods and bushfires, when commercial carrier networks often fail."

The mission-critical sector has traditionally been dependent on twoway radio in all its forms to provide reliable, resilient, mission-critical voice.

While this is still very much the case – and will be for a long time to come – this model is now being continually augmented through the adoption of other, increasingly diverse technologies.

Clear communication on the fireground is crucial



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Setting the agenda

Chair of TCCA's board, **Mladen Vratonjić**, discusses key topics at Critical Communications World 2023 in Helsinki

he critical communications sector is crucial to ensuring the safety and security of citizens, property and infrastructure around the world. Yet we are a small community, in the context of consumer communications.

With the stability of society being threatened in some countries, and others being thrown into chaos by extreme weather – as well as the ever-present threat of terrorist attacks – it is even more essential that our critical communications community works together for the benefit of all.

Our theme for the Critical Communications World (CCW) 2022 event in Vienna earlier this year was 'Evolving the Ecosystem'. This was a call to further build and strengthen the foundation upon which the critical communications of the future will be developed and delivered.

Our theme for 2023, meanwhile, is a further step in consolidating this evolution. It is based on us being a stronger and more effective sector when we combine our relevant expertise; when all the elements of our ecosystem come together to form a cohesive force to drive our industry forward. Next year, therefore, our theme is 'Success in Cooperation'. It comes from the successful Critical Communications Finland initiative and is highly topical and relevant, as CCW 2023 will be held in Helsinki.

So under this banner of cooperation, what can we expect in CCW's 23 conference sessions, panel sessions and focus forums?

As critical broadband networks continue to develop, the importance of open standards is underlined. There are myriad moving parts to a broadband network, and ensuring compatibility is essential to seamless operation. How do we secure critical broadband networks? What are the cybersecurity challenges and solutions, and what are the steps being taken to ensure that critical users' access to networks and services is not compromised?

We'll also be looking at the ongoing strength of TETRA and other narrowband network technologies as critical voice remains the bedrock of instant communications in a crisis. Hybrid networks will be essential to maintaining that service to critical users while broadband networks come into use for an innovative range of data applications. Therefore, interoperability, interworking and MCX are key topics.

Next – with timelines being reset, and spectrum availability remaining uncertain in some countries – we are looking to

We'll also be looking at the ongoing strength of TETRA and other narrowband network technologies

"

CCW will
examine how
technology can
help achieve
full situational
awareness

the mobile network operators (MNOs) for perspectives on how they view the development of the critical broadband market. How can they best support critical users and operations across not only public safety but the vertical industries such as transportation, power and utilities? How can they bring technology innovations for the network – edge and cloud computing, AI and more – to the table?

The rapid rise of the IoT will also be a key area for discussion, as it is brought into play for an increasing number of smart applications. It is estimated that today, several tens of billions of IoT-connected devices are in operation in the world. How do we ensure that critical IoT is robust and resilient across its operation? It is already delivering huge benefits in areas such as healthcare. We now need to work together to ensure that, as people become reliant on connected care, it doesn't let them down. Likewise manufacturing, with Industry 4.0 transforming many areas, requiring that networks are stable and reliable.

There is also much in the news about non-terrestrial networks, with consumer smartphones now being launched with satellite connectivity. Our panels on communications from space in previous events have proved hugely popular, and at CCW 2023 we will be exploring new developments and their potential impact on the delivery of critical communications services.

The most important of all, however, is the user aspect. Superior technology cannot solve problems if it is not fully subordinated to the needs of the users. Therefore during the event, we will deal with ways of extracting and using useful information from the sea of data.

We will also look at how technology can help achieve full situational awareness, and discuss how the evolution of command and control centres can efficiently meet operational demands. We will also look at why mutual trust, lasting partnership and the joint work of industry and users is crucial in ensuring effective critical communications.

Integral to all activity is the need for sustainability and efficient energy management. As a sector we must work together to reduce our impact on the environment and innovate to ensure the re-use and recycling of as many network elements as possible. We look forward to hearing from those leading the way in addressing climate change.

From control rooms to the cloud, from situational awareness to the use of social media, Communications World 2023 in Helsinki will be setting the agenda for the future of our sector. The topics mentioned here are just a taste of what to expect from our conference next year.

Please take the opportunity to submit your content proposals – CCW is the showcase event for our sector, help us to maximise its impact.



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CCT reports on the Australasian Critical Communications Forum's *The Future is Here* webinar, which took place earlier this year

ollowing an introduction from TCCA CEO Kevin Graham, the event began in earnest with a presentation by Peter Scarlata, who is the chief executive officer of Simoco Australasia. The title of the session was 'New and evolving technology standards providing new concepts in critical communications LMR/LTE hybrids, 4G and 5G'.

Scarlata began his presentation by providing some context in relation to the critical communications environment as a whole, talking in particular about the increasing demand for data-driven applications across the user base. He illustrated this through the use of a diagram including a variety of potential usecases, including augmented reality, smart city cameras, automated driving and more.

Talking about the increased appetite for data among mission-critical users in particular, he stated that rather than trying to make the jump straight to broadband-enabled voice, the majority of organisations are using data-rich applications and traditional radio in parallel. For him, this is exemplified by FirstNet in the United States.

He continued: "What we're also now enabling is the convergence of LTE and traditional radio as a smooth transition to mission-critical broadband networks. Such mission-critical networks – like the PSNB in New South Wales – have been well publicised, so it's imperative that we as a manufacturer look to the future and expand our products and services."

Scarlata followed this by going into detail about Simoco's Velocity LTE 'communications hub', which he described as "the key to introducing hybrid networks to our customers". It connects to the company's SDM 600 radio and satellite bearer, having the ability to "automatically roam" to the bearer with the best signal quality.

The next speaker was Tait Communications product manager for unified solutions Dion Stevenson, who spoke on the topic of 'Tait AXIOM – RSM on steroids'. (To read more on Tait, see our two-way radio feature, beginning on page 24.)

Dual-mode solution

While comparatively short at just shy of two and a half hours, the ACCF webinar was packed with content, mainly taking the form of brief

presentations delivered by individual manufacturers. This continued with the third session of the day, which came from BDM Oceania for Sepura, Colin Bresnahan. The title of this session was 'What does it mean to be mission critical?'.

Bresnahan began his presentation by reiterating the various different elements which mission-critical users currently demand from their communications networks.

These included that they should be purely dedicated to the task, boast a high grade of service for availability, reliability and security, as well as being designed to cater for "geographic coverage". He also included two operation-specific requirements: that comms are designed for command and control operations, and that they focus on group-orientated services, voice and data.

Moving on, Bresnahan said that as user needs continued to evolve towards LTE, the characteristics of the network would have to evolve as well. He illustrated this by comparing capacity calculations between TETRA and broadband networks.

"TETRA delivers the same level of service throughout the whole cell," he said. "It can deliver a group call to many participants using a single TETRA channel. With LTE, the cell edge must be dimensioned for a target level of service, [and for] many unicast

There is an increased appetite for data among mission-critical users

bearers. This can impact cell capacity."

Continuing with the presentation, he then referred to the current lack of device-to-device functionality available via LTE, something else which users of TETRA currently have access to as standard. With ProSe currently looking unclear due to lack of investment by device chipset suppliers, he postulated that 'dual mode' might be a solution to this problem, at least in the short term.

Elaborating on this, he said:
"Combining the two technologies
into one device can provide higher
availability of service to the user,
using the best available of the LTE or
TETRA service.

"An alternative to using dual mode would be to re-use an existing TETRA device functioning in a 'dual operation' mode, in co-operation with [an] MCX device."

The next presentation came from senior solutions manager at DAMM, Simon Riese. He spoke about 'Native hybrid networks – MCX integration into LMR networks'.

This was followed by Airbus regional manager Marc Maton discussing integrated solutions and applications for LMR/critical broadband, and Nokia's BDM transportation for Oceania, Rory McDonnell, talking about future railway mobile communications systems. You can learn more about the latter in our rail feature, published earlier in this issue.

Coming towards the end of the manufacturer presentations, the next session was delivered by the acting managing director of Aqura, Alan Seery, discussing developments in private LTE.

Talking about the differences between the early days of LTE private networking and the current situation, he said: "Back in the early days of LTE, the first network core occupied three fully populated 42RU racks, but now a single RU server can suffice. Furthermore, we're seeing developments which can be hardware independent."

He continued: "We're also seeing an era where 4G and 5G core network environments are moving from sizeable hardware tied to network cores to being software driven and able to run in an appropriately sourced container.

"We have a trailer containing a complete 4G network, which is a core and RAN, deployed with a software-enabled core that runs on a Users will continue to require deviceto-device functionality micro server. We have configured it from scratch according to the client's specifications and delivered it onsite within about two weeks. This used to be a two- to three-month exercise."

The final manufacturer to speak was Zetron, looking at the command and control room piece. The session was delivered by the company's sales director, Gary Botley.

He began by acknowledging the themes of the day up until that point, including hybrid technology, interoperability, MCX and so on. He used this as a basis for his presentation, stating that "all this culminates in the control room"

He continued by saying that current control rooms are primarily voice-based, provided across a range of standards and technologies. He also said that integration with third-party technology such as mapping and location services is also part of the picture.

"Control room integration continues to evolve," he said. "A lot more inputs are also coming into the control room, things like vehicle telematics, Internet of Things and social media.

"We're hearing from a lot of emergency services now that people report issues on Facebook before they bother to ring 000. There's more information to assimilate in the control room than there ever has been."

With that in mind, he said that the future of control room design is finding ways to sift information on behalf of the dispatcher, so they can take "predictive decisions". Other key factors to consider within the control room going forward, he said, were open standards, with "proprietary solutions typically [not supporting] a great deal of interoperability".

The user perspective

The day concluded with compelling presentations from two organisations – New South Wales Telco Authority in Australia and the New Zealand next generation comms lead entity – discussing the use of comms from the user side.

Giving an overview of the authority's offer, New South Wales chief digital and technology officer James Pickens said: "Our role, under the state emergency rescue and management act, is to work with the emergency services to provide that

critical comms piece, and protecting the infrastructure that supports both customers in the community and, of course, the emergency services."

He continued: "One of our mandates is to work with carriers and emergency services to protect all assets. Connectivity is of critical importance now, and by co-ordinating efforts when events take place, we can protect as much infrastructure as possible."

Continuing the presentation, he listed a variety of work streams the organisation is involved in, including its critical communications enhancement programme, the connection of rural communities, public safety mobile broadband (PSMB), and a mobile black spot programme.

Echoing his comments from earlier this issue, he said: "New South Wales Telco is taking a very front-seat role. Our feedback from emergency services organisations is really demanding a greater level of capability. The requests for data are increasing.

"We firmly believe that having a strong, capable, public safety mobile broadband capability is going to be at the heart of what we need for Australia. And NSW is deeply involved in a couple of the workstreams associated with that."

The final presentation came from Neal Richardson, technical strategy manager for the New Zealand authorities.

He too said that they were looking at a "cellular centric" approach to public safety communications, supported by LMR and satellite.

"We went through a requirements process with our agencies," he said. "And I can't speak enough about how working directly with [them] and having them develop together the requirements for the market process really gave a great foundation."

The organisation is now in the process of identifying vendors and solutions, while all the time keeping in mind the key user requirement of resilience and reliability, and the continued involvement of digital LMR.

Richardson said: "I use an analogy with people who tell me that [LTE will replace LMR].

"It's a little bit like someone coming into my shed and asking me to replace my saw with a hammer. They're two different tools and they do two different things."



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HAD PURCHASING
AUTHORITY
OR INFLUENCE



82%

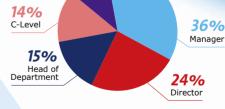
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AND SERVICES

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Components

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Cyber security
Data & intelligence

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and mapping
Hybrid devices
ICT

In-building coverage
Infrastructure and
network

Internet of Things
LTE devices

Mission critical broadband devices Mission critical broadband network Narrowband devices

and apps
Network services Broadband

Network services – Narrowband Robotics and emerging technologies
Ruggedized devices
Satellite

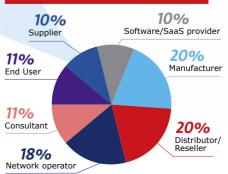
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Speaking with a united voice

During his quarter of a century anniversary year, TCCA board vice chair **Tero Pesonen** talks about his 25 years working with the organisation, and his hopes for CCW 2023 in Helsinki



Tero Pesonen

Could you tell me about your professional background and the early part of your career?

As an electrical engineering student, in 1997 I was offered the opportunity to write my Master's thesis on TETRA for Nokia. It was an exciting time, as almost weekly, new capabilities and features were introduced.

While TETRA clearly offered substantial benefits in terms of security, clarity of voice and functionality following the fragmentation of MPT-1327 technology, the lack of interoperability was a great concern. I was tasked to drive multivendor cooperation and common implementation towards interoperability certification.

How did you become involved with TCCA, and what have been your activities with the organisation?

My first interaction with TCCA and the global critical communications community was at the very first TETRA World Congress, held in Berlin in 1998. I remember reaching out to colleagues in other companies to participate in TETRA interoperability discussions, then hosted by Tele Danmark.

These discussions led to the process that resulted in the creation of TETRA interoperability profile [TIP] specifications as well as TETRA interoperability [IOP] testing and certification.

Around that time, TCCA's Technical Forum [TF] – the longest-established open TCCA Working Group – was also founded. This was to bring all TETRA stakeholders together to prioritise the huge technical work, as well as to find consensus on how different features should work.

This has proven to be a success. TETRA is today a global multivendor, interoperable standard providing critical communication service around the world.

I served in the TF for many years, leading subprojects such as contracting an independent certification body for the TETRA IOP process, as well as supporting TCCA outreach programmes around the world.

In parallel I worked closely with many user organisations developing ever more efficient, and typically more dataoriented, ways of working.

I was first elected to TCCA's board in 2010, and again in 2016 representing Erillisverkot. I have been chair of TCCA's

Critical Communications Broadband Group [CCBG] since 2014.

In terms of important achievements, I am most proud of the development of the TETRA IOP process, which remains a gold standard today. I am also proud of the growth of the CCBG and the work it undertakes in helping to ensure that users will be able to depend on and trust critical broadband networks and services.

However, these achievements are not mine alone. I have the privilege to work with likeminded, committed people from end-user and industry organisations. Success is in the cooperation.

Critical Communications World 2023 is being held in Helsinki. As someone from Finland, why is it beneficial that the event is located there?

I find it remarkable that alongside Finland, also Denmark, Estonia, Norway and Sweden are committed to be the host operators and contribute to the event. Each of these countries is an advanced TETRA user with significant experience in how to operate across borders.

Now, they all are working diligently with their plans to benefit from critical broadband services. At the same time, they are paving the way for others in a very cooperative way. I believe this alone is a great reason to participate in CCW 2023.

As a bonus, Helsinki as a city is easily accessible, compact enough to get around easily and the time of the year is really well suited with long, dry, sunny days. In fact, it is certainly worth taking a couple of extra days to explore the city and the country.

What do you think will be the key issues being addressed at CCW next May? How will the critical communications landscape have altered since this year's Vienna event?

The Russian war against Ukraine has given rise to questions related to energy supply and availability. Cyber resilience is a hot topic. In parallel, we will gain increasingly in-depth experiences from the forerunners on narrowband migration and the use of broadband services. We'll see new products and, most importantly, operational concepts in how to benefit from information-centric operations.



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