THOUGHT LEADERSHIP

DMR: How Continuity Beats Complexity in the Real World of Mission Critical Communications

It's ironic that a Land Mobile Radio (LMR) technology that, from the outset, was positioned as a low-cost alternative to the dominant public safety standards of TETRA (Terrestrial Trunked Radio) and P25 (or Project 25) should turn out to have the edge on the big beasts beyond simple economics.

What makes Digital Mobile Radio (DMR) such a compelling proposition can be summarised in four main areas. It makes the best use of the available radio spectrum in real world conditions. Its very design makes it more reliable and resilient to the inevitable failures in any network such as when someone cuts through a backhaul cable. It is uniquely equipped to embrace new hybrid communications technologies and applications.

Furthermore, for multiple reasons, not the least of which is its open eco-system, it is commercially more attractive to buy, to scale and to manage. For operators in utilities, transport, public safety, and industrial sectors, Simoco's DMR Tier-III solution provides a future proof, resilient foundation for hybrid communications - one that prioritises continuity over complexity and keeps teams connected when it matters most.

How it all Began

DMR Tier-III is, as you might imagine, is the successor to two earlier iterations of the standard, which started with a Tier-I, a simple, unlicensed consumer radio. Tier-II was designed as a replacement for conventional analogue radio. Tier-III is the trunked radio for critical communications, prioritising emergency traffic and allocating radio infrastructure, handling call controls in a similar way to mobile phones. DMR began life as a pragmatic digital evolution for LMR. Today, mature DMR Tier-III implementations provide mission grade voice and control with a cost, coverage, and low complexity profile that many transport organisations, utilities and regional public safety operators enjoy. Throughout this article when we mention DMR, it will be referring to DMR Tier-III.

DMR v TETRA and P25 a Quick Overview

The two major global standards in mission critical radio each has its own strengths but, as you will see in the chart below, DMR offers a number of technical and commercial advantages.

TETRA is widely used and trusted by large state-level public safety organisations. The largest TETRA user is the UK's Airwave network with over 350,000 users in police, ambulance and fire services across Britain.

P25 enjoys similar market dominance among federal and state level organisations across the North America, Australia and New Zealand. Both systems, like DMR, offer high quality voice, strong levels of security and encryption. TETRA is configured to cope with the high-density traffic of urban areas while P25, broadly, has been designed for both urban zones and the wider geographies with more sparse populations of the north American continent. Owing to the large state investment in TETRA and P25, DMR is often not an option. However, it can offer a powerful argument to operators outside the national government sphere, in areas like transportation and utilities where its resilience to failure, more efficient use of spectrum and lower cost to deploy, operate and scale come into play.

Why Spectrum Efficiency Matters

In order to get a better understanding of the differences between DMR and the other two standards we have to dig a little deeper into the technical choices made and the reasons behind them. In mission critical communications the way you use the limited resource of the licensed radio spectrum is central to how well your users will be served.

When we talk about 'spectral efficiency,' we often mean 'how many conversations fit into a given slice of spectrum.' However, what really matters operationally is how predictably and flexibly that spectrum can be used in different scenarios. DMR uses two-slot Time Division Multiple Access (TDMA) within a standard 12.5 kHz channel, which means a single licensed channel supports two simultaneous voice or data paths.

This design aligns extremely well with how spectrum is actually allocated to utilities, transport operators, and regional public safety organisations. In these markets the available spectrum tends to be fragmented, scarce or, for historical reasons allocated in smaller chunks so it is usually allocated as individual 12.5 kHz channels rather than large, contiguous blocks.

TETRA, by contrast, uses four-slot TDMA within a 25 kHz channel. While this delivers high capacity in dense urban deployments, it requires access to wider, contiguous spectrum blocks and a more centralised, carrier-style network design.

P25 Phase 2 uses two-slot TDMA, but only on traffic channels; control, data, and direct modes still rely on FDMA. This mixed approach increases planning and infrastructure complexity without materially improving the ability to deploy in constrained spectrum environments.

Strategically, DMR's 2-slot/12.5 kHz model gives operators capacity exactly where they need it, without over-engineering the network. Commercially, it reduces the need for customers to acquire additional spectrum simply to unlock usable capacity. Operationally, it allows systems to scale site-by-site, using the channels that organisations already own. In short, DMR's spectral efficiency isn't about bits per hertz, it's about fit-for-purpose deployment in the real, regulated world.

Commercial Impact of Spectrum Agility in Fragmented World

In theory, contiguous spectrum blocks make radio planning more efficient and effective. In practice, you are likely to inherit fragmented, non-adjacent channels accumulated over decades of licensing, mergers, and regulatory change. This is particularly true for utilities, transport authorities, councils, and private networks - outside national public-safety frameworks. DMR is inherently well-suited to these realities. Because each 12.5 kHz channel is treated as an independent resource, DMR systems can be built using non-contiguous channels across a band without compromising functionality.

Control and traffic channels do not necessarily need to sit next to each other (although in reality the normally do), and additional capacity can be added wherever spectrum becomes available. This matters because it directly affects time-to-market and cost. In countries where contiguous 25 kHz blocks are unavailable or expensive, TETRA deployments can stall at the regulatory or commercial stage before any technical work begins.

Even where spectrum exists, re-farming and re-planning can take years. DMR overcomes that hurdle. You can deploy using what you already own, expand opportunistically, and adapt to regulatory changes without redesigning the network. From a commercial perspective, this reduces spectrum acquisition costs and de- risks long-term expansion. From an operational perspective, it enables incremental growth aligned to real demand, rather than theoretical peak capacity. This flexibility is a key reason DMR has succeeded in markets where TETRA struggled to gain traction, not because TETRA is technically weak, but because its assumptions may not always match the spectrum reality on the ground.

Planning to Fail but With Built-in Resilience

It seems odd to be talking about planning for failure but people in mission critical communications know exactly what we mean. They operate in a hostile environment not a cosy office suite and things can and do go wrong. What you are looking for is to manage the inevitable failures with systems designed to reduce their impact to a minimum.

A typical failure is a backhaul 'partition' or breakdown. Backhaul refers to the links that connect radio sites to each other and back to control rooms or core infrastructure. These links might be fibre, microwave, leased lines, or IP over public or private networks.

A backhaul partition occurs when those links are partially or fully disrupted, not necessarily everywhere, but in specific regions or paths. In the real world, backhaul partitions are common. Fibre cuts, power outages, microwave fade, civil works, and natural events regularly isolate sites or regions for hours or days. The critical question is not whether this happens, but how the radio network behaves when it does.

In a highly centralised architecture, like TETRA, a backhaul partition can effectively shut down otherwise healthy sites because they can no longer reach the central controller. Users may have radios, coverage, and power but no service. In a distributed Simoco DMR architecture, a backhaul partition is treated as a degradation, not a catastrophe.

Sites continue to provide local trunking, emergency calls can be engineered to continue working, and communications persist within the affected area. Where SIP or telephony gateways are placed strategically, external connectivity can also be preserved into selected clusters.

Operationally, this means field teams stay in contact during infrastructure outages, and that's exactly when communications matter most. Commercially, it reduces the need for expensive, highly engineered, ultra-reliable backhaul everywhere.

Strategically, it aligns with how organisations build networks: incrementally, pragmatically, and with uneven infrastructure quality. Simoco DMR is 'continuity-first': a network that assumes links will fail and is designed to keep working anyway.

DMR limits the extent of the impact of an outage. Control intelligence is distributed across the Simoco base stations rather than concentrated in a single central server. When parts of the network fail, the impact is contained.

If an inter-site link or regional backhaul connection goes down, affected sites don't simply drop out of service. Instead, they continue operating locally or as part of smaller clusters. Users retain communications where they are, rather than losing access because a distant core is unreachable.

Technically, this reduces dependency on perfect WAN conditions. Operationally, it means fewer 'all or nothing' failure scenarios. Commercially, it avoids the need to buy resilience by duplicating expensive central infrastructure. TETRA and P25 can certainly be engineered to be highly available, but that typically involves more cores, more redundancy, and more specialist skills. Simoco DMR achieves resilience in a different way: by designing the system so that failure is expected, restricted in their impact and survivable.

The Commercial Realities

We're not keen on the idea of DMR being seen as just a low-cost alternative to TETRA and P25 but for operators not tied into statewide public safety regimes, it has some powerful commercial factors in its favour.

We have talked about its more flexible approach to spectrum utilisation and the lower cost of providing failure resilience compared to centralised systems but there are a number of reasons why the capex and opex costs can be much more sustainable.

For a start DMR is a far more open standard with more suppliers than TETRA and P25 which can be hampered by additional vendor proprietary features. Competition drives down prices of base stations and radio terminals. Secondly DMR is more cost effective to scale compared to P25 or TETRA.

For example, the simplest base site could consist of one Simoco base station unit. No duplexer would be required for this; it would provide one control channel and one traffic channel. The equivalent in P25 would require two base stations plus duplexer, one for an FDMA control channel and one for a TDMA traffic channel.

With Simoco's implementations of DMR, if you want to extend the scale of the network you simply add more base stations. There is no overhead for additional hardware such as a central server as each base station contains its own controller. While only one controller runs the system at any given time, it means that, if isolated any controller can run a fully operational system, spreading the control function across a distributed network over an IP backbone.

A Pragmatic Path to a Hybrid Future

The foundation stone of a mission critical communications network is narrowband voice because it's predictable, local, and resilient under stress and this is where DMR excels. In addition, DMR has the capability to handle the core data features that most LMR users actually need such as GPS, status, messaging and telemetry.

At the same time DMR offers a clean IP/SIP integration path for hybrid architectures, to allow you to bring on broadband applications as you need them, without the cost and complexity of a wholesale migration to a broadband only network.

Examples of hybrid solutions that Simoco has developed, taking advantage of DMR's ease of expansion and integration are the DCE coverage extender and its mobile intelligent edge router-based ROAM offering. The DCE provides a range extension function centred around a field vehicle.

Portable radios in the vicinity of the vehicle can connect to a DMR system via the vehicle. To all intents and purposes, the portables appear to the network as if they were directly connected. This application makes use the higher power of vehicle mounted antenna to secure a solid connection to the network where the portables would not.

The ROAM solution hands over to 4/5G or satellite when the DMR mobile loses radio service. A network gateway combines the 4/5G path back to the infrastructure so that the system despatcher sees continuous connectivity with the radios. Simoco's Velocity vehicle and communications router provides a platform for standard and custom DMR applications.

So, with DMR and without the need for additional fixed infrastructure, we have the pragmatic approach to scale and functionality. The operator has the choice to extend the network coverage using DMR technology or, where that is no longer an option there is the choice on integrating a broadband solution to keep the control room and the user in the field connected. In addition to simply extending the network DMR is the right platform to bring on intelligent applications. Simoco has deployed a number of bespoke applications based on the Velocity router/ edge computing platform. Because of the IP backbone in DMR, such solutions can be integrated into the wider critical communications network without wholesale change out.

From Challenger to Contender

The fact that DMR has managed to hold its place against two heavyweight standards that have such a dominant position in state level public safety is a testament to its pedigree. Far from merely competing on price, DMR gives operators the flexibility to deploy in areas where spectrum is fragmented.

It is, by design, far more resilient to network disruption, supported, in the case of Simoco's DMR, by its 'no single point of failure' distributed architecture. It offers resilience without the fragility of a centralised core, keeping communications alive across multiple sites when links fail.

DMR offers a financially rational path to safety and control, delivering meaningful safety features and operational control without forcing heavy economics and procurement complexity. It provides hybrid readiness without a rip-and-replace programme. And we have evidence at scale in real deployments supported by the operational wrap that many of our customers need.

DMR has proven itself in some of the most demanding environments on the planet from coal mines to offshore windfarms, from fighting fires and floods to managing public transport operations. Its success has been in meeting the practical needs of operators at the frontline, not on delivering theoretical performance metrics in laboratory conditions. Its no longer just a hopeful challenger but a realistic contender for the title of the operator's choice of mission critical LMR.

DIMENSION	DMR	TETRA	P25
Primary design goal	Security Updates, Robustness, Performance, New Features	Large-scale, centrally managed public safety networks	Interoperability for US public safety
Typical users	Utilities, transport, industry, local/ regional public safety	National / regional emergency services	Police, fire, EMS (primarily North America, Australia)
Spectrum efficiency	High – TDMA, 2 voice paths in 12.5 kHz	High – wider channels	Moderate, High on TDMA voice paths
Voice behaviour	AMBE+2 good	ACELP very good	AMBE+2 good
Geography	Medium user density larger geography	High user density, smaller geography	Medium user density larger geography
Data capability (slow narrowband)	Free form text, GPS, IP data	Free form text, GPS, IP data, aggregation	Fixed text, GPS, voice-centric
Encryption	High – AES-256 supported	Good – TEA1/2/3/4	High – AES 256 supported
User Safety	Man Down, GPS, Lone Worker, Emergency Button	Man Down, GPS, Lone Worker, Emergency Button	Man Down, GPS, Lone Worker, Emergency Button
Scalability model	Scales down and up well	Optimised for large national systems	Optimised for large agency systems and multiple network operation
Infrastructure cost (CapEx)	Low–medium	High	High
Operational cost (OpEx)	Lower (simpler networks, skills availability)	High	High
Vendor dependency	Lower (multi-vendor ecosystem)	High	Higher
Upgrade path from analogue	Strong (dual-mode, phased migration)	Weak	Moderate
Broadband / 5G coexistence	Good	Complex	Moderate
Edge & IP integration	Strong	Limited	Limited
Procurement complexity	Flexible, modular	Heavy, long-cycle	Single vendor domination
Best when…	Hybrid LMR + broadband environments are required	Centralised national PS networks	Mandated interoperability regimes apply, interconnected networks
Weak when…	Poorly architected or treated as "cheap radio"	Budget, agility or integration matter	Budget, ease of integration matter