Unity in diversity: integrating multiple radio systems to minimise cost and risk

Connect different platforms and technologies with a single, dynamic patching backbone to enable seamless communication.

Adopting new technologies never happens overnight, and organisations may find themselves supporting multiple critical systems for years. Ensuring that these solutions work together effectively and reliably for both internal and external stakeholders and across mixed infrastructure can present significant challenges for chief technology officers (CTOs) and IT teams.

This paper proposes the 'backbone patching' methodology as the best way to resolve interoperability issues for radio systems. Instead of painstakingly building and maintaining one-to-one bridges between different solutions, backbone patching can bring all radio channels and talk-groups into a single, technology-agnostic integration layer, offering improved, simplified management, enhanced reliability, and reduced operational cost.

The concept of backbone patching for radio systems follows the idea of having an enterprise service bus in the data management world, thus providing a shared language for systems interoperability. This approach makes it easier to introduce the latest digital mission-critical data, video, and location-based solutions, collectively known as MCX communications, and helps unlock new possibilities for collaboration both within organisations and with external partner agencies.

FREQUENTIS

Accommodating new technologies

Whenever new technology emerges, CTOs face a familiar dilemma: the desire for improved capabilities set against the operational demands to deliver robust, reliable continuity of service. To minimise this risk, CTOs seek to create an environment capable of absorbing new technologies without missing a beat.

For example, the latest digital MCX solutions offer significant benefits to blue-light and safety-critical organisations. As well as cutting infrastructure and operational costs, MCX applications deliver enhanced functionality, including multimedia communications.

While some organisations feel the potential disruption from introducing new systems does not justify the adoption, partners and neighbouring organisations may already be making the switch. As an industry or sector adopts MCX, it becomes difficult to avoid change, and finding the best way to adapt and evolve becomes increasingly urgent.

Key objectives for CTOs

- Network operators: create solutions to help customers transition to new radio technologies.
- Blue-light/public-safety organisations: ensure value for money while minimising operational disruption when adopting new radio technologies.
- Safety-critical industries: enable smooth collaboration with external partners regardless of the radio systems they use, today and in the future.

Shortcomings of point-to-point network bridges

For radio systems, whether in-house or at a partner organisation, interoperability between legacy and new systems is an essential baseline — especially when it can take years to complete a migration.

Proprietary network-level tools that bridge two radio networks provide an effective fix in some very simple use cases. However, the technology offers limited access to patched radio talk-groups, and setting up new bridges for additional networks can take significant effort with long development lead times.

Bridging multiple radio networks using network-level tools soon results in exponential complexity. In addition, each new deployment creates a fresh potential point of failure, as well as a new technology asset to manage and maintain. Each direct one-to-one link increases the number of possible network attack points, weakening cybersecurity and complicating security certification management.

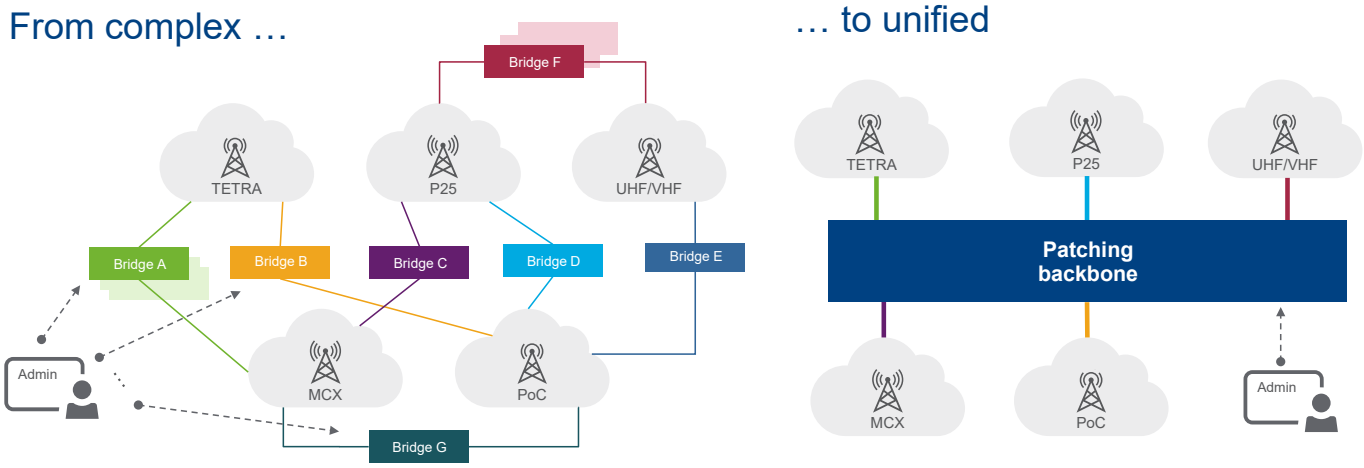

Figure 1: The patching backbone concept

Introducing a patching backbone

An alternative approach to building many point-to-point connectors is to bring diverse radio technologies together by implementing a single patching backbone, which provides a universal translator between multiple systems to create a robust, flexible interconnection.

Each radio network connects to the patching backbone using a system-specific gateway, and the patching backbone automatically retransmits communications to other connected talk-groups or radio channels.

Users of any of the connected solutions, both analogue and digital, can efficiently and reliably interact across technological boundaries.

To add to the flexibility, as new technologies and proprietary systems emerge, gateways can be added to the backbone even during operations, enabling the system to be extended while critical communications are fully maintained.

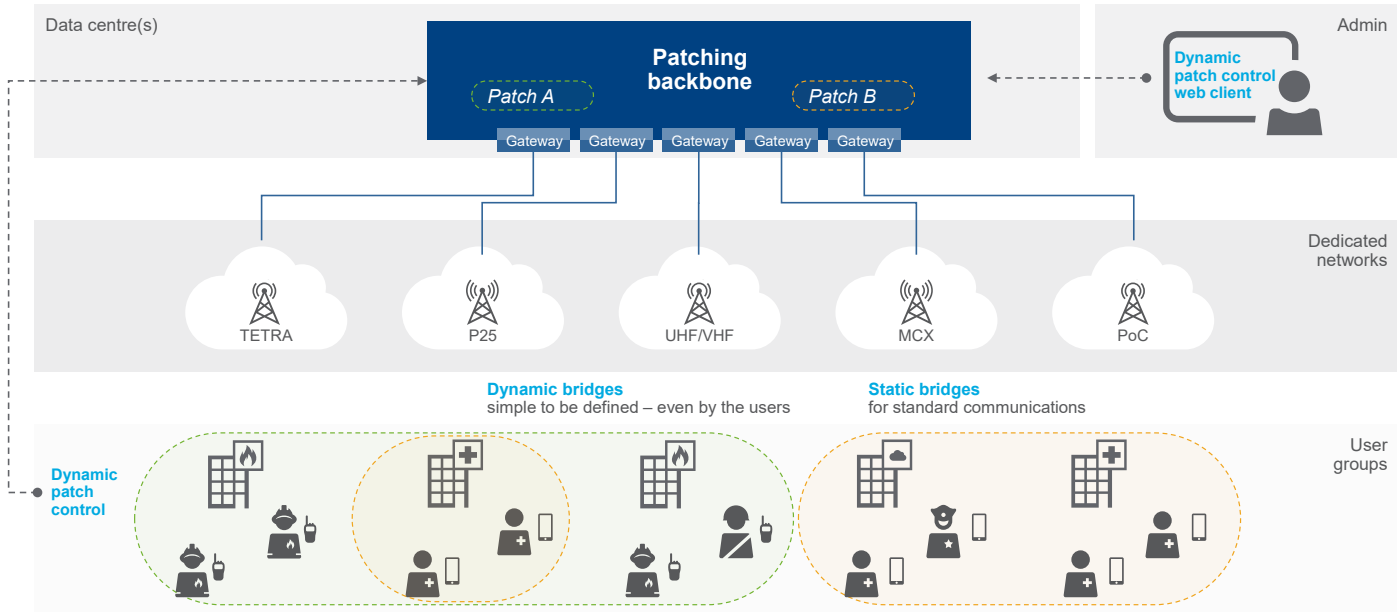

Figure 2: Patching backbone for diverse radio technologies

Dynamic radio connections

By creating a single-layer integration with backbone patching, organisations can dynamically patch any two or more radio systems without disruption. It becomes a simple configuration job to interconnect any talk-group or radio channel in advance, or even handle it on the fly.

When tasked with working with a new organisation, patching can be continual or enabled on an ad-hoc basis. The patching backbone methodology provides central security and access management, to ensure that patches can only be enabled by authorised users, and system administrators control channel authorisation for patching.

From the control room, operators can access the patching backbone to communicate directly with field units via a single, unified user interface, and use their own radio channels without the need to know the underlying technology.

Further, as the patching backbone carries all communications traffic, it can also provide a single recording interface for all communications on the connected radio networks, including new media like MCX.

Faster, more-effective emergency response

With dynamically cross-connected radio networks using a patching backbone, first responders and emergency management personnel can communicate regardless of the underlying technology or network. By removing technical barriers, the patching backbone methodology greatly improves the speed and effectiveness of emergency response, potentially saving lives and protecting property.

When a critical situation escalates, demanding a broader coordinated response, control-room operators can easily define temporary patches spanning multiple networks. The patching backbone approach supports dynamic collaboration scenarios without exposing technological complexities during an already stressful situation. By effectively masking the technical details, users continue to rely on familiar systems that they have been trained on, while communicating effectively and reliably over multiple networks.

The technology includes safeguards against signal delays, throughput errors, and signal dropouts, helping to eliminate communication errors at critical moments.

Efficiency, cost-savings

From a business perspective, patching backbones improve operational efficiency, making it fast and easy to cross-connect different teams of radio users. Creating a new patch is little more than a click of a button, with no delay or administrative workload.

Importantly, a patching backbone simplifies change management while reducing risk and expenditure during new technology roll-out. Typical phased deployments, with both legacy and new radio systems running in parallel, will run smoothly as the patching backbone enables easy connection between technologies, while also extending the useful life of existing equipment.

Selecting a patching backbone solution

To manage multiple existing radio systems, or to introduce new communications technologies, a patching backbone will almost certainly offer cost and operational advantages. A well-designed patching backbone will support flexible many-to-many patching, offer multiple gateways, and provide a centralised management console to help improve administration efficiency. In addition, the ideal patching backbone will include embedded cybersecurity features and advanced signal processing capabilities to ensure robust, reliable performance in safety-critical environments.

Frequentis for safety-critical communications

Frequentis is a leader in the provision of voice and data communication solutions in safety-critical environments. The Frequentis 3020 LifeX patching backbone platform supports dynamic interconnection for multiple and diverse radio networks, including legacy analogue, TETRA, MCX, P25, TetraPol, and more.

In addition to providing radio-to-radio interconnects, Frequentis 3020 LifeX supports conferencing with telephony, and enables the sharing of information received from the public using next-generation (NGX) call services (Europe NG112, USA NG911, and UK NG999 networks). Emergency, critical, and many other organisations use Frequentis 3020 LifeX technology to connect radio transmissions between analogue and TETRA networks. Frequentis 3020 LifeX includes pre-built radio gateways to enable connections to radio technologies from all the major suppliers, and additional gateways for niche suppliers are added on a continuous basis.

For more information on how Frequentis 3020 LifeX can reduce the cost and risk of running multiple radio systems, see https://www.frequentis.com/sites/default/files/support/2024-02/Frequentis_PS_product-brief_LifeX.pdf.

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