White paper: open, flexible, cost-effective communication for railways

A user-centric approach to managing the transition to bearer-independent communication

Users in railway control centres face increasing difficulties in assimilating all the information presented to them by multiple disparate systems. As centralisation and standardisation continue, the railway industry must ensure that control-centre operators can perform their tasks efficiently and make the right decisions. In this case, technology is both an enabler and an obstacle. To meet future challenges, railway organisations need to transition from GSM-R to new communication technologies, and the first step is to decouple applications from the underlying technology, replacing silos with a flexible layered architecture.

The Frequentis bearer-independent approach abstracts services from communication carriers, enabling railway organisations to run newer technologies alongside GSM-R during a controlled transition period. It also provides a single integrated working position, supporting operators in working more effectively and efficiently, while helping organisations reduce complexity, cut costs and accelerate the deployment of new services.

This white paper explains how a user-centric approach to bearer independence addresses some of the key challenges facing the railway industry today, and provides an outline of the challenges that organisations can expect to face as they look to the future of communications.

Railways

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Growing complexity and costs

In the railway industry, the trend towards centralisation and automation in control centres is increasing pressure on users. Organisations expect to achieve more with the same number of staff, requiring operators to efficiently manage increasing volumes of data from a growing variety of sources. In the typical control centre, each operator will need to constantly switch their attention between a bewildering number of distinct systems for reviewing operational data, making decisions and communicating with personnel and assets in the railway network. The requirement to master multiple different user interfaces also raises training costs and negatively impacts user acceptance.

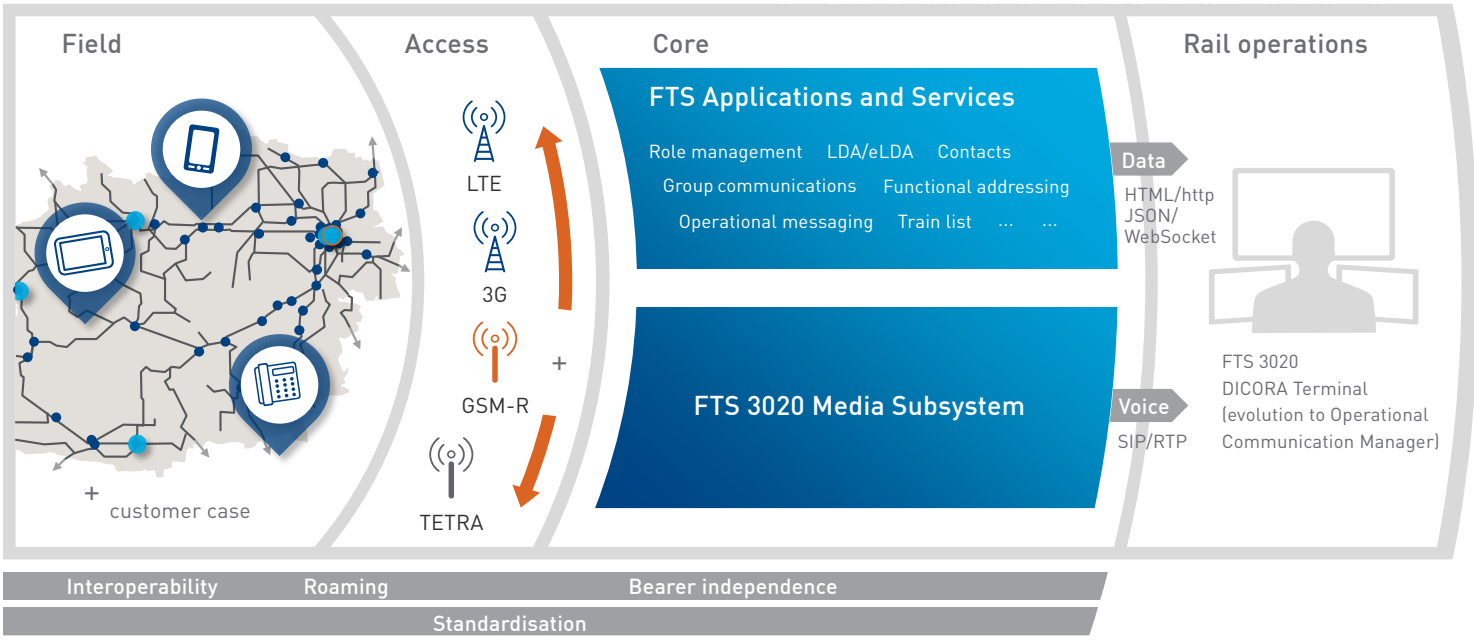
From the architectural perspective, the picture is no less complex: applications, data and communication technologies are siloed, leading to multiplication of capital and operational costs and difficulty in implementing new technologies. Existing railway-specific communication services tend to depend heavily on the outgoing GSM-R standard, deeply integrated throughout all parts of the communication stack.

This dependence on GSM-R, combined with the long infrastructure lifecycles typical in the industry, makes it difficult and costly for railways to adopt new carrier options as they become available.

As new technologies like intelligent Internet of Things sensors come into play, data communication will become more prevalent in the railway industry—but voice communication will remain the preferred option in crisis situations when safety is at stake. Although mission-critical voice communication will be used relatively rarely, it absolutely must not fail when needed.

While GSM-R covers both data and voice, it lacks the capacity and flexibility to meet future demands. Maintaining or upgrading existing GSM-R networks is exceptionally costly, and railway organisations do not want to invest heavily in obsolescent technology. As a result, new carrier options for both data and voice must be accommodated. Equally, railway organisations need to consider growing pressures on control-centre operators, and ensure that future approaches are user-centric.

Figure 1: Complementing GSM-R with public, private and shared networks



Flexible integration

Today, control-centre operators must work in multiple communication and information silos using different terminals to gain situational awareness, use workflow and decision-support tools, access operational data and communicate with colleagues.

Frequentis proposes that by decoupling applications from the underlying networks, railway organisations can phase in new communication carriers while enabling an integrated working position for control-centre operators. Instead of a vertically siloed "stovepipe" architecture in which each application has its own stack of supporting technologies, this approach provides horizontal layers of functionality connected using open interfaces. Within each layer—for example, the communication network layer—multiple technologies can be used interchangeably, without impact on the layers above or below.

The Frequentis bearer-independent approach to communication can use any suitable transmission network while providing unified access for the operator at an integrated working position. By adopting a new architecture that converges data and voice, and that abstracts services from communication carriers, railways can reduce complexity, cut costs and accelerate the deployment of new services. In a bearer-independent implementation, railway-specific communication services are layered on top of the underlying communication networks, rather than being inextricably integrated into them. This means that services can run over public or private networks, such as GSM, UMTS, LTE—greatly increasing flexibility, simplicity and speed of deployment.

From the user perspective, applications are united in an integrated working position that shields the operator from any underlying complexity and enables them to rapidly access the information and functionality they need. Multiple communication systems can be accessed through the same single user interface, dramatically simplifying mission-critical communication and reducing stress on operators during safety-critical incidents.

The flexibility provided by decoupling services from carriers makes the bearer-independent approach ideal for steadily transitioning away from services based on GSM-R. It also introduces the future potential of sharing infrastructure and networks with other domains—for example, enabling railway organisations and public safety organisations to reduce their costs and increase cooperation by sharing private networks.

Transition challenges

Giving the deeply embedded nature of GSM-R, introducing new communication technologies such as GSM, 5G, TETRA and LTE will not be fast or simple. There is no practical possibility of achieving an overnight switch: railway organisations must plan carefully for a period of coexistence between GSM-R and newer technologies.

With many organisations likely to include public networks in their future architecture, security planning is particularly important. Likewise, careful attention must be paid to the future provision of railway-specific feature sets that are not delivered on public networks,

for example: Functional Numbering, Location Dependent Addressing, Voice Group Call Service, Voice Broadcast Service, and Enhanced Multi-Level Precedence and Pre-Emption. In some cases, meeting existing requirements around performance and quality of service will be challenging, and railway organisations will need to validate the SLAs, capacity and coverage offered by public networks.

The transition phase can be long, complex and challenging, with significant impact on most—if not all—operational areas. Railway organisations need to consider change management not only technically, but also from the user perspective. Here, the experience of early adopters of bearer-independent technology both in Europe and globally could be invaluable. It is vital to bring users on the migration journey, and to ensure that systems continue to meet their needs both during and after the transition.

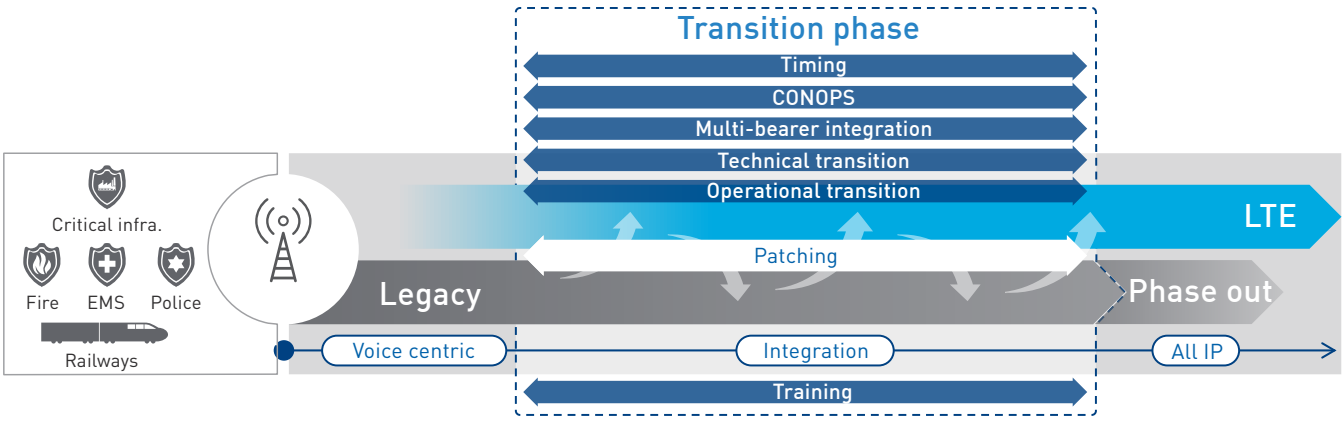
By providing access to existing and new communication and information systems through a single, unified interface, railway organisations can take a big step towards minimising the operational impact of the technology migration.

Benefits of bearer independence

By adopting the Frequentis bearer-independent model for voice and data communication, railway organisations can simply and cost-effectively implement newer communication systems and access them through standardised interfaces. As new systems become available, or economically beneficial, these can be integrated and immediately made available through a single end-user device.

Railway organisations will benefit from lower complexity, greater choice of technology, faster deployment and reduced costs. With a single, integrated working position to access all communication and decision-support services, control-centre operators can work more efficiently and effectively. They can also start using new communication technologies with no additional training, as the abstraction between the user interface and the underlying carriers means that everything remains the same from the user perspective.

Figure 2: User-centric, intuitive working environment



The bearer-independent architecture is scalable, enabling railway-specific feature sets to be added independently of the underlying communication systems. Where public communication systems are already available, the architecture will enable railway organisations to implement rail-specific services on top, and it will also allow the use of systems such as WLAN networks in stations to provide localised access to communication and information services.

By taking a user-centric approach to adopting bearer-independent technology, railway organisations can cut costs while smoothing the transition and reducing risk. The resulting integrated working position delivers everything the user needs on a single screen, with flexible links to the underlying technology layers to maintain agility and keep long-term costs low.

Conclusion

With a patent for its Bearer Independent Rail Communication Architecture (BIRCA) and multiple client implementations in progress, Frequentis is a recognised global leader in bearer-independent communication. Frequentis also provides integrated working positions, as well as unified radio gateways for introducing new technologies alongside existing standards, helping railway organisations ensure a smooth transition to more efficient ways of working.

For more information on how a user-centric approach to bearer independence can cut costs and improve operational efficiency, please contact Frequentis.

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