Towards a 4G world

DATA NETWORKS As GSM-R starts to approach obsolescence, railways need to appreciate the benefits offered by 4G/LTE, for both commercial and safety-critical functions. The industry must lobby hard for the spectrum it needs, and realise IP-compatible ETCS, argues Olivier Andre.

Hands up who has bought a 4G-enabled smartphone? Demand for high-bandwidth mobile communications is such that, by the end of 2012, there will be nearly 150 commercial 4G networks in operation around the world,all using Long Term Evolution technology.[1] And last year, the USA officially sanctioned LTE for its nationwide public safety network for emergency services. These two developments fully endorse LTE as suitable for both consumer-facing and mission-critical applications.

There is now growing acceptance that LTE will fulfil the future communications needs of the rail industry as well. Its primary characteristics — namely high speed, high security, standardisation, and high bandwidth capacity — make LTE an ideal candidate; it can carry voice and data communications for train control, traffic management, maintenance diagnostics and other operational needs while retaining enough bandwidth for onboard video surveillance, emergency notification systems and infotainment. The multiple radio networks used today could be consolidated into a single, cost-efficient and easy-to-manage LTE backbone. With GSM-R reaching the end of its life sometime around 2020, there is no longer any real debate on what will replace it; only how.

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On the face of it, replacing a GSM-R network with an equivalent LTE network would be a costly exercise. However, as GSM-R gets closer to life expiry, it will inevitably become more expensive to maintain; all technologies do as replacement parts and expertise become scarcer. One day, the cost of keeping GSM-R will equal the cost of replacing it. My guess is we will see that day sooner rather than later.

What we won't see is the development of LTE-R. Adding the R to GSM made it several times more expensive than its commercial counterpart. By keeping to common LTE standards and using commercially-available off-the-shelf components, the railway industry can reap the economy of scale benefits of commercial LTE. The bespoke functionality needed for rail, such as group calls, will be provided by an application layer rather than modifying LTE itself, as was the case with GSM. So in main line railway applications, we are likely to see a stepping-stone approach with LTE running alongside GSM-R and applications including ETCS progressively being moved onto the LTE network. Metro operators are likely to be first to adopt LTE as the self-contained nature of their networks and lack of formal standardisation for CBTC means deployment is more straightforward.

> 'The industry must lobby for the spectrum it needs'

Spectrum challenge

The biggest challenge is spectrum availability, and this is an issue that the industry as a whole needs to address. The 900 MHz spectrum in Europe is an obvious candidate for LTE data transmission as it is already available for infrastructure managers under the extended GSM-R band which exists today. There is bandwidth available in the 2·6 GHz range too, where LTE gives excellent transmission speeds but over shorter distances. Further down the spectrum, many rail operators have licenses for Tetra radio in the 400 MHz range. Here, too, LTE can provide good performance, although increased range is offset by lower transmission speeds. As was the case for GSM, the rail industry must take a strong stance and lobby the relevant licensing authorities for the spectrum it needs. And the sooner the better.

But regardless of its many other benefits, ultimately LTE will stand or fall based on how it handles train control functions. In other words, we have to make sure we get signalling over LTE absolutely right.

The first steps are already underway. ETCS Level 2 is currently being modified and tested to run over General Packet Radio Services, a sort of '2·5G' mobile communication technology which is being introduced in busy hubs where GSM-R is struggling to provide enough capacity. ETCS currently uses old-fashioned — but reliable — circuit switching. However, to run on GPRS, ETCS must use packet switching, ie Internet Protocol. Once ETCS is successfully tested on GPRS, it will by default be ready for LTE, which is also an IP-based technology.

Once we have an IP version of ERTMS compatible with LTE, the rail industry can accelerate its journey to 4G telecoms, which offers significant operational and whole-life cost benefits to railways around the world.

Reference

1. 'Evolution to LTE'. A report by the Global Mobile Suppliers Association, June 2012.