



›THIS IS **THE WAY**
TO IMPLEMENT GSM-R COMMUNICATIONS
WHILE MAINTAINING DAILY OPERATIONS
›THIS IS **NORTEL**



Field Report - Deutsche Bahn

Technical/operational challenge:
To implement GSM-Rail (GSM-R) communications throughout the rail network while maintaining daily operations

Business challenge:
To lower capital and operational costs in the future while achieving international harmonisation

Deutsche Bahn is Europe's largest railway company, employing some 250,000 people. Its regional, long-distance and freight divisions run almost 30,000 trains, transporting 4.5 million passengers and 5,500 cargo trains on a daily basis.

Back in 1999, Nortel was selected to deploy the GSM-R network for Deutsche Bahn across Germany. Nortel began working with Deutsche Bahn to supply what is expected to be the world's largest GSM-R network. In 2002, Deutsche Bahn's 'InterCity Express' high-speed train route Cologne–Frankfurt gained the distinction of being the first high-speed railway line in Europe to use GSM-R in revenue service.

Nortel has been a pioneer in the GSM-R standards process since 1992 and continues to work with UIC (Union Internationale des Chemins de Fer) and ETSI (European Telecommunications Standards Institute). Nortel supplied the equipment for the MORANE (Mobile Radio for Railways Networks in Europe) trials and was a major contributor to the EIRENE (European Integrated Railway Radio Enhanced Network) GSM-R standard.

The idea of GSM-R: enabling travel without telecommunication boundaries

Railways have a long history as the most important and reliable national transport medium for passengers and goods. Over time, proprietary systems for railway communications were independently developed in the different European countries. Consequently, to meet the voice and increasing data communications requirements essential to an efficient railway service, railway drivers nowadays need to use multiple communications devices. The introduction of GSM-R by all major railways in Europe reduces the number of terminals and related cost in the future.

In addition to these communication issues, railway operators were also looking to achieve some specific objectives:

- › **Interoperability** of European railway traffic by standardising voice and data communications
- › **Effectiveness** of operations through the introduction of the European Railway Traffic Management System (ERTMS)
- › **Cost reduction** in the areas of operations and maintenance from a medium-term point of view
- › **Simplification** of communications compared to the current analogue radio

A decision was therefore made to develop a common communication platform for all European railways that provides for specific railway functions. Based upon public GSM technology, this railway-adapted version is known as GSM-Rail or simply GSM-R.

Deutsche Bahn—an early adopter of GSM-R

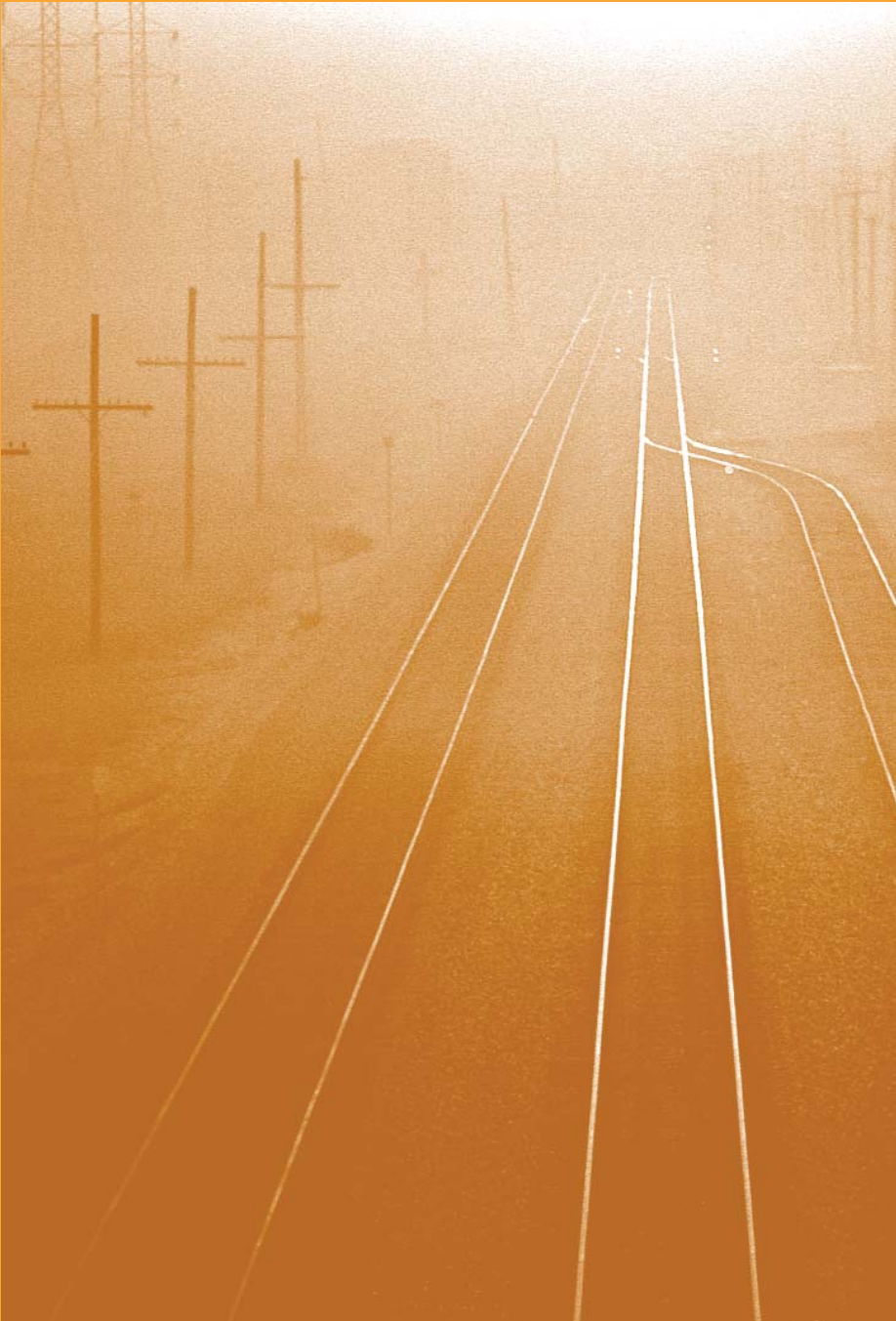
In 1999, based on comprehensive studies and comparing business cases with the existing analogue radio systems, Deutsche Bahn decided to deploy a nationwide GSM-R network. This decision was specifically driven by the long-term cost and operational benefits of the GSM-R technology over the existing analogue radio systems.

>GSM-R: The new wireless standard for railway communications



Cologne-Frankfurt High-speed Line

Total length	219 km
No. of tunnels	30 (total lengths: 47 km)
No. of bridges	18 (total lengths: 6 km)
Maximum speed	300 km/h (185 mph)
Maximum pitch	40%
Mobile network	2 BSC/56 BTS + 155 antennas
Trains	112 ICE 3 (Intercity Express - High-speed Trains) cabs equipped with GSM-R digital cab radio
Train radio system	GSM-R digital train radio (without fall-back solution)



World's first GSM-R enabled railway line

In August 2002 Deutsche Bahn introduced the world's first high-speed (300 km/h) railway line, which operates on GSM-R without an analogue fallback solution between Cologne and Frankfurt. In so doing Deutsche Bahn achieved its main objective: the reduction of the number of communication systems used. In July 2003 Deutsche Bahn started the world's first European Train Control System (ETCS) Level 2 high-speed pilot line between Berlin and Leipzig, which allows train movements to be controlled centrally. Additional benefits that Deutsche Bahn will achieve by implementing new applications and services include:

- › **Electronic time schedule**—Replacing the paper schedule resulting in cost reduction and greater flexibility
- › **Remote control diagnostics**—Controlling many outside services from a distance
- › **New functions**—Implementation of additional applications such as a new signalling system, logistic tools for freight tracking and tracing, etc.

Nortel – Provider of advanced GSM-R solutions

Nortel's global leadership in GSM-R is the result of an early and significant investment in this new technology. In addition, Nortel has used its operational experiences to enhance its product portfolio and service offerings. The size, scope and fast deployment of the German railway system have enabled Nortel to develop and maintain technical leadership in the GSM-R market. As a result, Nortel has been awarded the largest GSM-R networks in Europe and currently has a 65 percent share of the market in kilometres of tracks covered to date.

GSM-R – Nationwide deployment

Deutsche Bahn and Nortel have worked closely together to evolve GSM-R performance and products. The Deutsche Bahn GSM-R network today constitutes the largest and most advanced operational GSM-R network in the world.

By the beginning of 2005, GSM-R is due to be put into commercial use in the entire German train system region by region. Deutsche Bahn and Nortel have ambitious objectives, which can only be reached in a powerful partnership.

For more information about Deutsche Bahn, visit: www.db.de/gsm-r

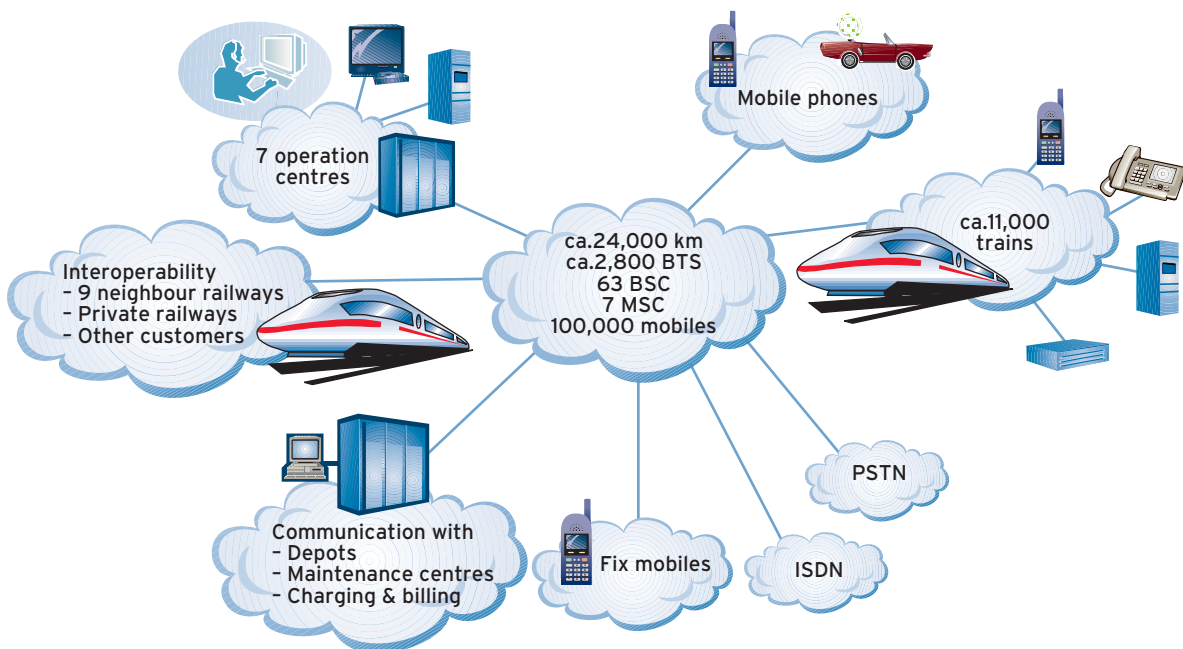
For more information about Nortel GSM-R products and solutions, please visit: www.nortel.com/gsm-r

Nortel would like to thank Deutsche Bahn for their contributions to this Field Report.

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investment in this new technology.

GSM-R – Integration of over 100,000 subscribers



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