With the rapid development of railway transport, simple voice and constraint data services can not satisfy the high-speed data requirements both from train operators and from passengers. For train operators, a more efficient way to guarantee train operational safety and on board security is becoming more and more important. Services such as on board broadband video service are beyond the reach of GSM-R but are readily available on Huawei’s LTE solution. For the passengers, many people are enthusiastic about using mobile broadband services while on the move with laptops, mobile phones and cloud computing devices. Many business travelers today have the ability to connect to their work space from outside the office. Continue working while travelling allows travel time to be converted into productive working hours. With the understanding of rail operational demands as well as rail passenger communication demands, Huawei eWBB LTE solution is designed to providing broadband services that are far exceeding capabilities of standard GSM-R. Video surveillance solutions implemented on board, along the track or on platforms help to further improve Railway services and customer satisfaction by allowing centralized security staff to monitor situation on individual trains. At the same time the system can be configured to deliver broadband wireless connectivity to passengers allowing them to access up to date travel information, access internet services during the trip or watch real-time TV. With its wide portfolio, Huawei is the right partner for railways to pull all these technologies together into one Smart Railway solution allowing railways to focus on passenger needs and railway operational demands.

Current Communication Service Requirements for Railway Industry

Huawei eWBB LTE solution permits railways to establish high speed Broadband Data connections on board the train. As for GSM-R, LTE based eWBB includes specifically designed algorithms to deliver superior Quality of Services at highest train speeds. Huawei’s solution has been tested at speeds of 430km/h on Shanghai’s Maglev line. Based on LTE technology, Huawei’s solution on maglev with FDD 20MHz, 2 × 2 MIMO configuration, the Peak downlink rate can reach 50Mbps. With its flat network architecture eWBB is a cost efficient solution delivering shortest bit transfer delays. Overall reliability of the system is carrier grade with additional options to further improve overall system reliability by implementing geographical redundancies. A wide range of frequency bands are supported for eWBB and flexible bandwidth configurations allow custom specific frequency situations. Today, Huawei’s eWBB solution is considered the most advanced rail telecommunication solution merging synergies between GSM-R operation, non safety critical rail operational voice and data services and passenger communication.

Huawei E2E eWBB Solution Can Satisfy Customer Requirements
CCTV cameras installed along the track provide video feeds from trackside, platforms or specific hot spots such as level crossings. This information is fed into centralized control centers, stored in Huawei’s data cloud solution, processed by our video analysis software and transmitted via eWBB into the train or played back for analysis. This implementation allows ground based staff as well as staff on board the train to have visibility well ahead of the train. In connection with eWBB, cameras can also be installed inside the carriage allowing surveillance inside the coach through centralized ground based staff or mobile security units along the line. Huawei’s CCTV solution allows real time video analysis and storage of video streams in Huawei’s Data Centre solution for post incident analysis.

**Trackside & Carriage Inside Video Surveillance**

- Driver and control center can get the video of 2–3km ahead of the locomotive simultaneously
- Monitoring center on the ground can survey what’s happening on the train

Huawei High-speed Railway broadband wireless Communication system, HRC is a further example on how eWBB can improve railway communications. HRC is an advanced mobile communication system delivering multiple data and voice services on board the train. Thanks to the outstanding mobile data performance of LTE, HRC maintains a continuous high data throughput between trackside radio stations and vehicles running at speeds of 350km/h or above. The quality of HRC data connections can be compared to services connected to your computer’s Ethernet port from your cable DSL or optical network operator.

**Huawei eWBB LTE HRC Solution**

- **For High-speed Train Broadband Access**
  - 430KM/H High-speed Mobility, Multi-mode Radio Access, and Average Throughputs Up to 20Mbps@20MHz
  - Voice Service
  - WiFi
  - Video Monitor
  - Online TV
- **Broadband Services**
Board Level Redundancy:
One RRU can be connected with two LBBP (LTE Baseband Processing) boards working in a local redundancy mode. In case functions on one LBBP board fail, services are automatically provided through the redundant board.
Huawei’s eCNS600 main board supports 1+1 standby mode holding highest reliability figures.

Network Element Backup:
Huawei’s railway solutions support 1+1 core network redundancy through geographical redundant nodes. For an example one eNodeB connects to two eCNS and one eCNS connects two PTT servers further improving the overall system reliability.

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Redundancy for High Reliability
- Network Element Backup:
  - Huawei’s railway solutions support 1+1 core network redundancy through geographical redundant nodes. For an example one eNodeB connects to two eCNS and one eCNS connects two PTT servers further improving the overall system reliability.
  - Ruggedized Railway & Tunnel Coverage: 594 KM including 34 stations. Phase I: 40.7KM including 15 tunnels (5.722 KM).
  - Very difficult network deployment: distributed eNode B for railway coverage. BBU + RRU + Leaky coaxial-cable.
  - High performance & broadband:
    - Performance guarantee under high-speed with line-shape coverage.
    - EPC and eNode B redundancy for high reliability.
    - All-IP and flat architecture to ensure low latency.
    - DL 14.4Mbps, UL 3.6Mbps (1.8G, 5MHZ, 2T2R, DL/UL=2:2).
  - Multi-service:
    - Voice / Data & Video
    - Help customer to meet the aim of 350 million tons transportation capacity per year.
  - Redundancy for Core Network and Server:
    - eCNS Board Level Redundancy: One RRU can be connected with two LBBP (LTE Baseband Processing) boards working in a local redundancy mode. In case functions on one LBBP board fail, services are automatically provided through the redundant board.
    - Huawei’s eCNS600 main board supports 1+1 standby mode holding highest reliability figures.
  - Board Level Redundancy:
    - One RRU can be connected with two LBBP (LTE Baseband Processing) boards working in a local redundancy mode. In case functions on one LBBP board fail, services are automatically provided through the redundant board.
  - Network Element Backup:
    - Huawei’s railway solutions support 1+1 core network redundancy through geographical redundant nodes. For an example one eNodeB connects to two eCNS and one eCNS connects two PTT servers further improving the overall system reliability.
  - Redundancy of the radio coverage is critically important for railway operation. For this reason Huawei introduced the unique concept of a Master eNodeB and a Slave eNodeB. The eNodeB’s are deployed along the track to provide redundant coverage. Without manual intervention the slave eNodeB will take over from the master eNodeB in case of loss of function (i.e. fire, flood..) of the master eNodeB.

Synchronization of locomotives:
Our customer awarded Huawei to help them with a solution to double their actual cargo capacity in order to meet a targeted 350 million tons transportation capacity per year. Our solution helps the operator to reach their targets by providing multi-locomotive synchronization control command transmission, substantially enhancing the carrying capacity of each train. In order to meet the operational demands, both traditional data service and broadband service were offered.