



Tackle the curse of information overload with Digital Transformation in Rail

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LEADING NEW ICT



Higher Bandwidth, Lower Latency, More Connections

20 Gbit/s

1 ms

1 M/km²

20x ↑

30x ↓

100x ↑



Writing a New Chapter in Intelligent Operation

Analog and Digital Era

Optical Imaging Technology
Captured video can be collected and stored.

Difficulties:
small scale, small coverage, and unreliable storage



1970~

Network Era

IP and Storage Technologies
Large-scale video networking, long-term video storage, and intra-network sharing

Difficulties:

- Difficult to find clues and low video utilization
- Duplicate and uncontrollable data across the network
- Weak controllability



2000~

Intelligent Era

AI – Cloud - Pipe

- Manual video Playback => AI recognition
- Post-judgment turns => pre-warning
- On-demand Elasticity Deployment, Global Coordination



2018~

Future mobility strongly depends on New ICT where

Everything Is

**Sensed
Connected
Intelligent**



Digital Transformation

New ICT



Cloud



Big Data



IoT



AI



5G

5G as an enabler for Digital Transformation in Rail

Digitalization and Real-Time Monitoring Cargo Facilities



Examples:

- AGV
- GPS Positioning
- Vehicle Management
- Oil Pressure
- Water Temperature
- Fuel Level
- Battery Voltage
- Maintenance Info



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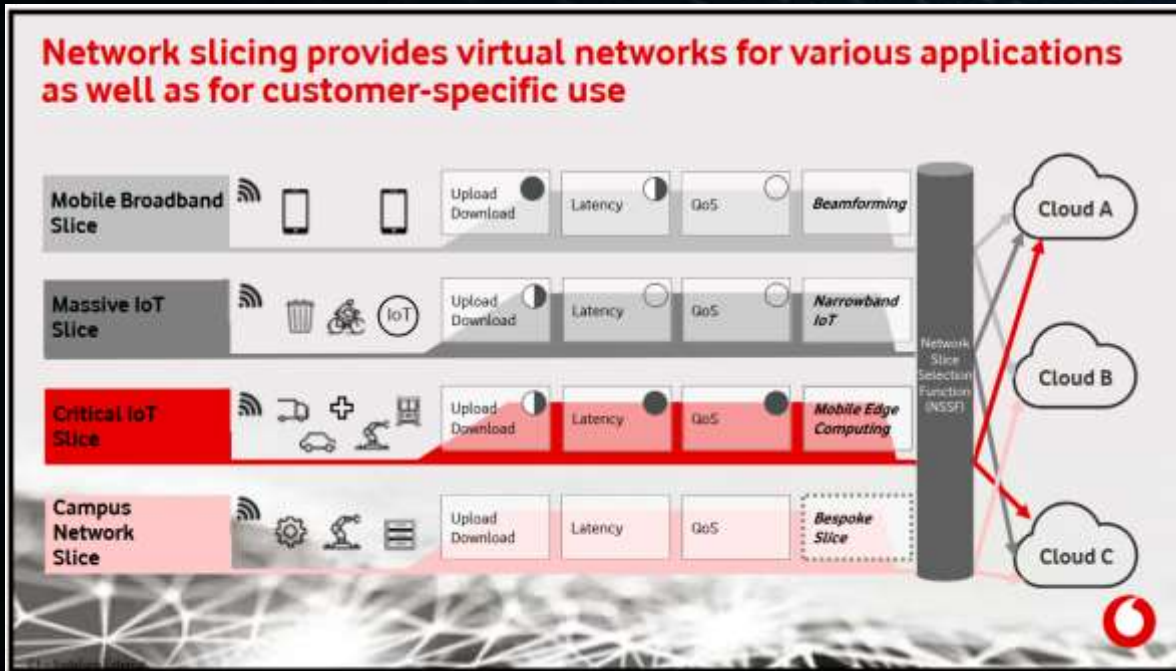


5G driverless train & interlocking conducted

September 2019

Smart Rail Connectivity Campus

Annaberg, Germany



IRJ
International Railway Journal

Thales and Vodafone conduct driverless trial using 5G

THALES and Vodafone are claiming a world first by operating a driverless train controlled remotely via a 5G mobile network.



Sep 18, 2019

Written by

David Briginshaw

Thales is using its Lucy laboratory train for the 5G driverless trials.

The driverless trials are being carried out at the Smart Rail Connectivity Campus in Erzgebirge, Germany, using Thales' Lucy laboratory train, while Vodafone has installed one of the first 5G base stations in the Erzgebirge region of Saxony, Germany.

5G

5G Smart Rail Connectivity Announcement

Teleoperated driving in a station
Schlettau, 2019-09-17

The future is exciting.
Ready?

Sunrise and Huawei Open the First European 5G Joint Innovation Center



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Sunrise and Huawei Open the First European 5G Joint Innovation Center

Oct 14, 2019

[Opfikon/Dübendorf, Switzerland, October 14, 2019] Working together with its strategic partner Huawei, Sunrise has built the leading 5G network in Europe. Now with the first 5G Joint Innovation Center in Europe, Sunrise and Huawei will work together to research and develop 5G applications for both the private and business sectors. The joint innovation center will additionally help to build a Swiss 5G ecosystem, using Sunrise's headquarters in Opfikon to introduce live 5G application scenarios that have already been launched or are about to be commercialized. ([link](#))

5G FRMCS Research Collaboration Project, Germany

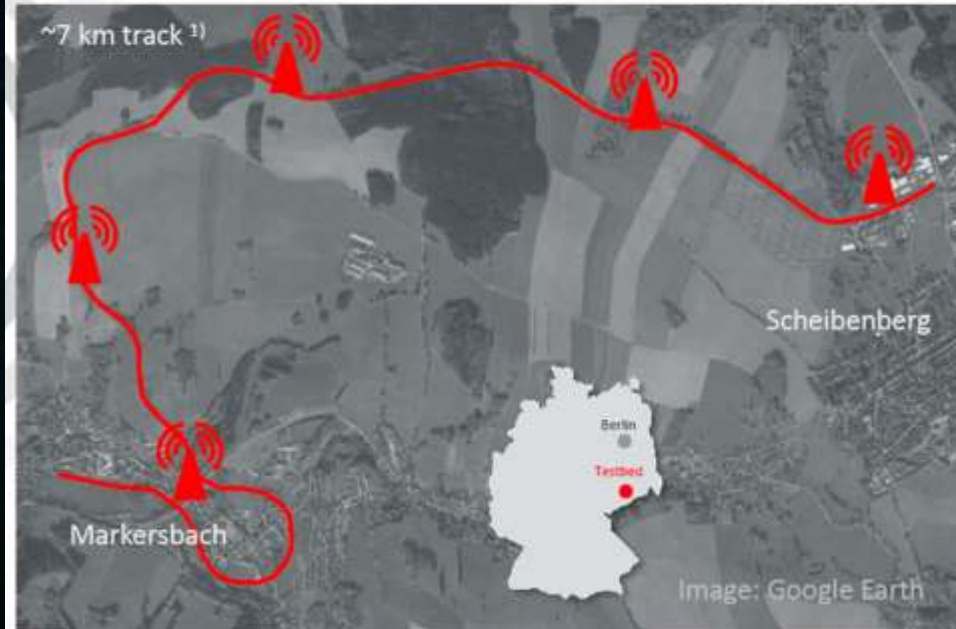


- investigate **5G for FRMCS** as successor for GSM-R
- started a 5G Program on FRMCS to evaluate throughput for **900MHz** and **1.9 GHz**

Ambition: Comprehensive testbed alongside practically unused track for research & innovation, integration and verification of future rail operation applications on FRMCS/5G and Cloud technology

• **Core network:** 5G

• **Radio / spectrum:** Likely initially 5G @ 3.7 GHz and LTE @ 1.9 GHz, later also 5G @ 900 MHz and 1.9 / 2.3 GHz



Envisioned approach and tentative timeline:

Basic infrastructure setup

- antenna masts
- fiber-optic conn.
- cabinets
- connection to DB test center Eschborn

(DB-owned, vendor-neutral, well-dimensioned)

2019

Setup and test of FRMCS / 5G and Edge Cloud

through tenders and collaboration with external partners

2020

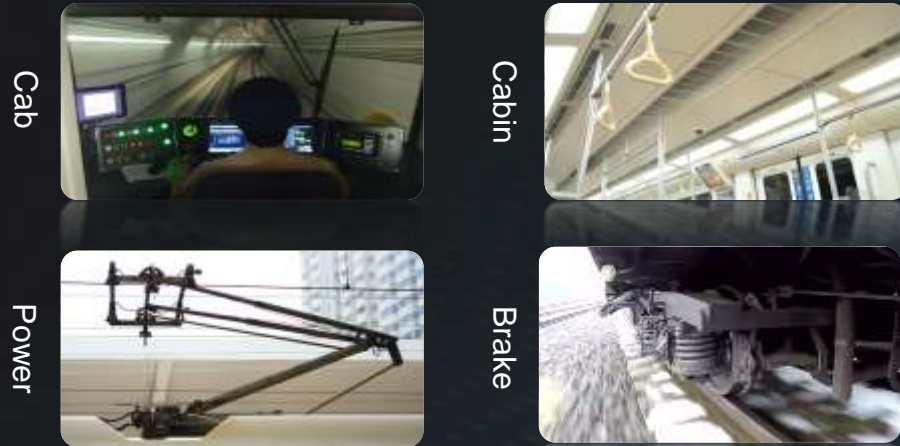
Integration and test of rail applications

through tenders and collaboration with external partners

2021+

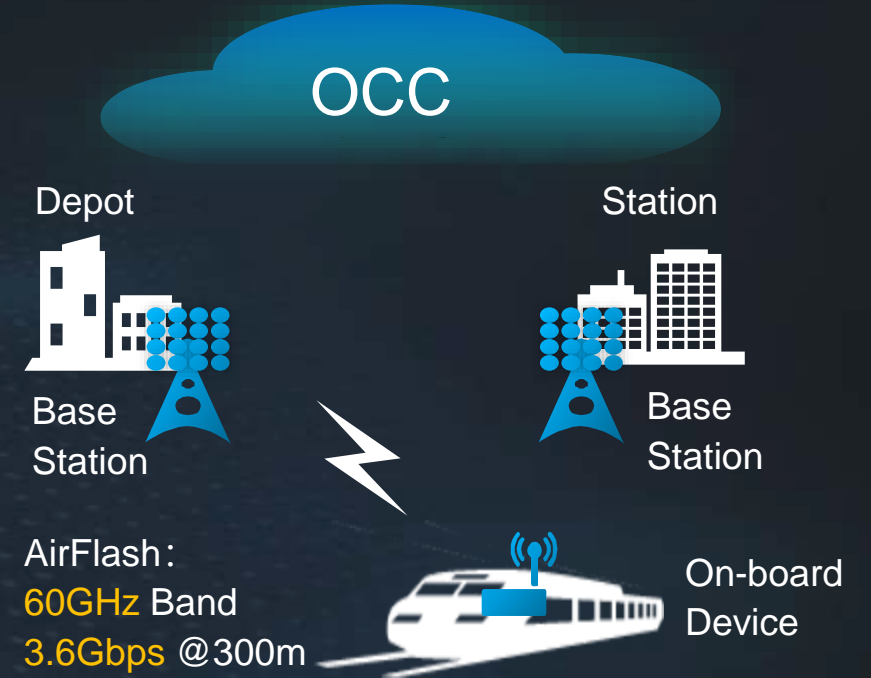
AirFlash, 5G Enable Industry Digital Transformation

Huge CCTV Data during Operating Period



1200GB/Train/Day

5G



Highest Throughput



2 Carrier Aggregation @ uplink, get to **3.6Gbps**

Strongest RF



5G Massive MIMO aim at device, ensure best coverage

Simplest Engineering



90° Scanning



Automation
Antenna Beam
Aligning

China: Shanghai Yangshang Port

the World's Largest Automated Port

Coordinated Dispatching of 130 AGVs

4 Men @ 1 AGV → 1 Man @ 4 AGVs
28 TEU/HOUR → 40 TEU/HOUR

- ✓ **Low latency:** AGV signal latency under 20ms with "zero" package loss
- ✓ **Multiple users:** concurrent access from 80 AGVs in an area of 2000 m²
- ✓ **High reliability:** CPEs support IP67 protection rating, adapting to the damp environment. Network reliability ≥ 99.999%.



AGV dispatch platform



5 AirNode/20m-towers cover 2000+m shoreline



Antenna along AGVs for full coverage

Huawei Global Cases in Port Industry



Partner with:



Huawei Transportation

Spanning more than **40** countries and regions in **5** continents



120,000+ km
Railway

Germany's DB, Spain's ADIF,
China's CRC ...



120+ Lines
Metro & Light Rail

London Underground, Amsterdam
Metro, Shanghai Metro...



50+ Airports
15+ Airlines

Dubai Airports, Changi Airport,
Malta Airport, Heathrow Airport,
Shanghai Airport, Thailand
Airport...



100,000+ Km
Highway & Roads

Brazil's CCR, France's SANEF...



12+ Seaports

Port of Durban in South Africa,
Shanghai Yangshan Port in
China ...



THANK YOU

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