

Deutsche Bahn – Digital Transformation and Long-term Challenges

Deutsche Bahn AG

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**„We are facing the
most radical
CHANGE since Rail
Reform.“**

Digitalization affects all of DB's activities - keeping up with the speed of innovation is challenging



Online booking platforms may substitute classic forwarder business



Autonomous trucks will increase competition to rail cargo transport



3D-printer will reduce the demand of cargo transport



Low Cost & Sharing will increase competition for rail passenger transportation



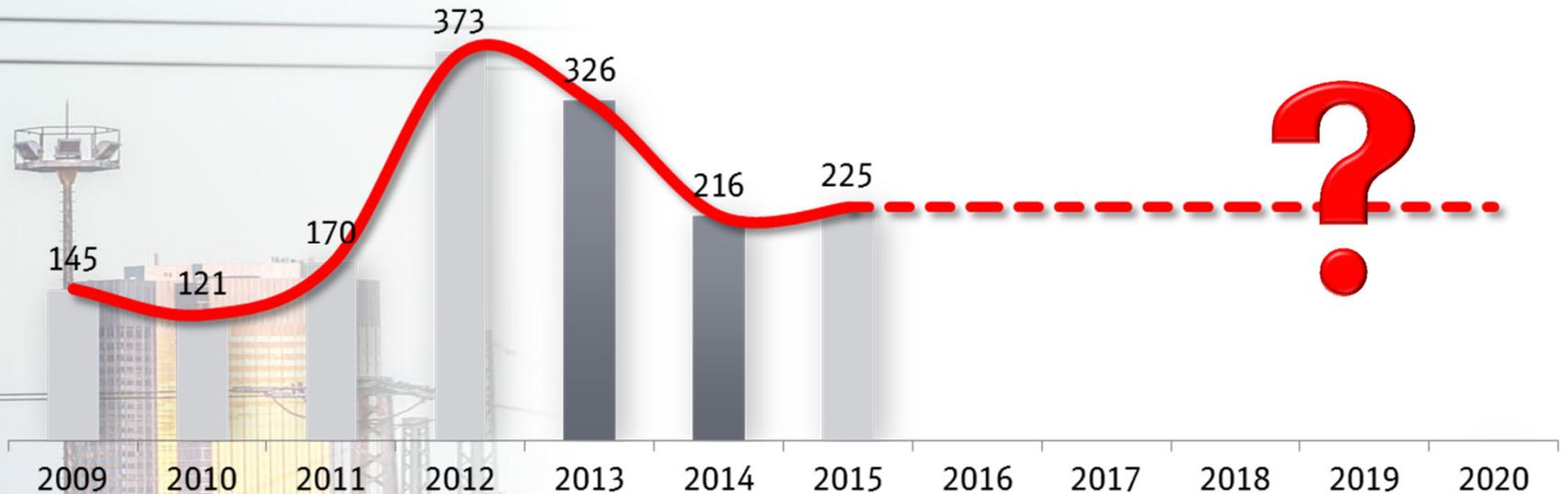
Digital life companions/ devices may lead to losing the customer interface



Autonomous cars will reduce the attractiveness of rail transport and cause higher pollution

Pressure on profitability from intermodal competition is increasing with digitalisation – example DB Bahn Long Distance

EBIT DB Bahn Long Distance (Mio. EUR)



Growth

Massive changes in the market

- Long distance buses
- Platforms, sharing
- Low-cost airlines 2.0

DB is taking digitalization as a great opportunity – many initiatives launched

DB has launched a number of initiatives:



Mobility 4.0



Logistics 4.0



Infrastructure 4.0



Examples

- New mobility products and services and networking across modes
- Digital customer interfaces and live information
- Digitalization of production processes
- Research partnerships and labs

We have identified three comprehensive clusters for digitalization at DB – and launched a range of projects and activities

Major objectives



Customer centricity



Neutral multimodal mobility platform **Qixxit**



Next-generation eServices based on app technology for logistics services



Digital schedule and semi-automated train-path allocation



Operational excellence



TechLoc as an online diagnosis tool for locomotives



Virtual planning and control of infrastructure construction projects



Maintenance using **digital devices**



Innovation culture



Establishment of **d.lab** for prototyping mobility services



Enterprise Lab for Logistics & Digitization set up by DB Schenker and Fraunhofer



Start-up bootcamp – Collaboration with start-up accelerator

Mobility 4.0

Until 2025, mobility will change...



Low price mobility and sharing

- Low low price mobility will be established
- Sharing offers as part of regional and urban mobility



Autonomous cars

- Flexible and individual mobility on highways
- First prototypes of Robo-cabs

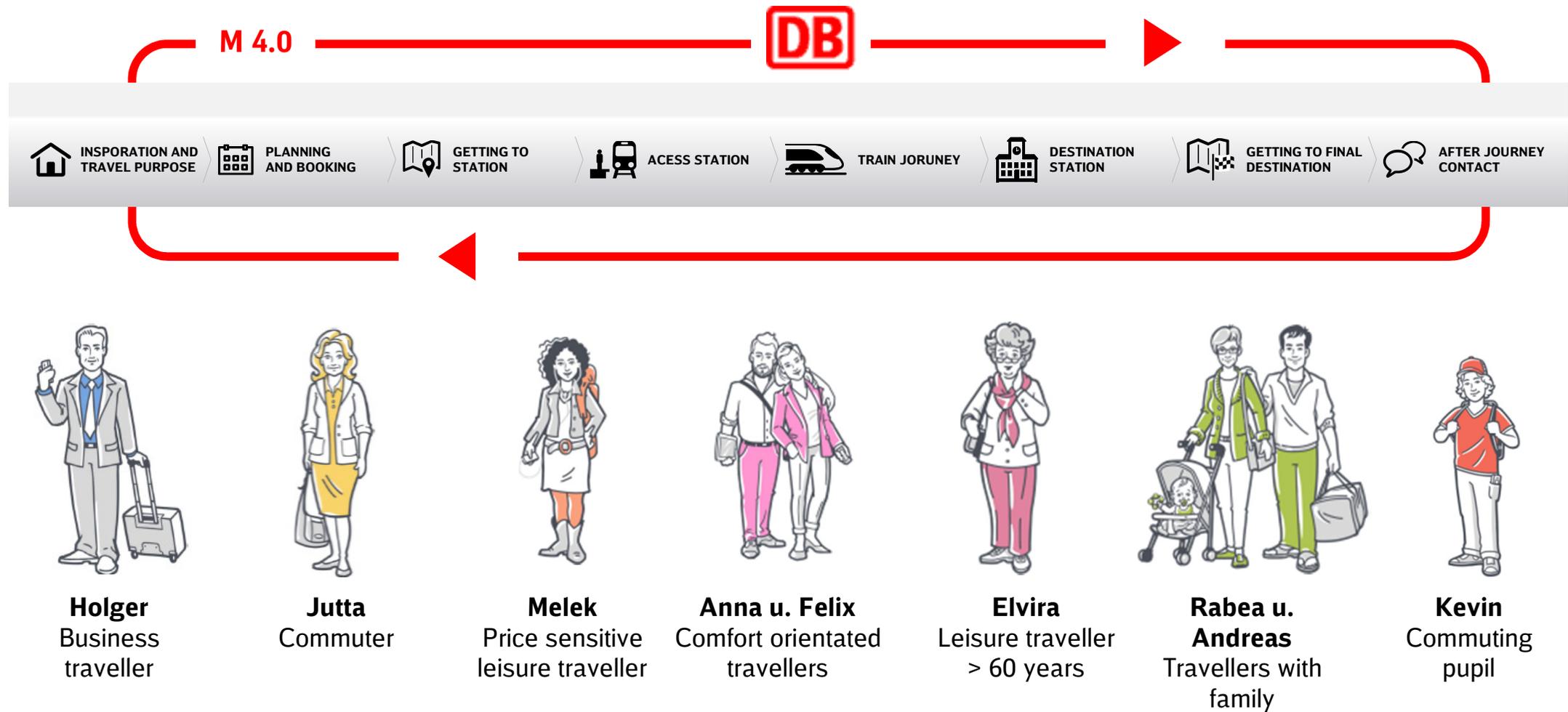


Digital journey

- total supply transparency
- Digital personal assistant influences mobility choice



DB Bahn systematically aligns product and service design with customer needs along their journey



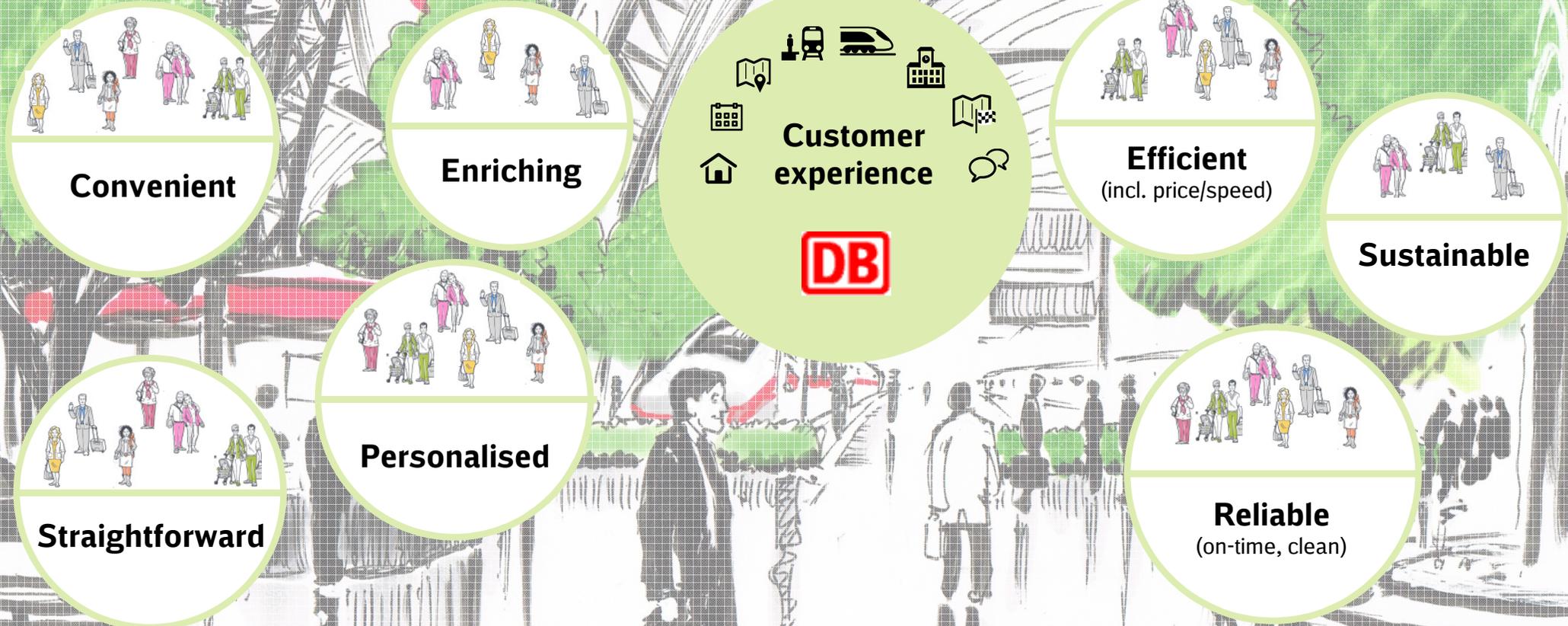
Product design aims at complying with unsatisfied and latent customers needs

Customer needs analysis indicates that four factors aside from basic quality impact the DB customer experience

Customers

Aggregated experience factors

Aggregated basic factors



Basis: 330 pain points from customer journeys from DB Sales and Long Distance
Source: Study by DB Long Distance and DB Sales, 2014

Customers already benefit strongly from strong digital platforms and applications

Examples from DB Bahn



Online ticket



Mobile phone ticket



Call a Bike app

Qixxit



DB Navigator

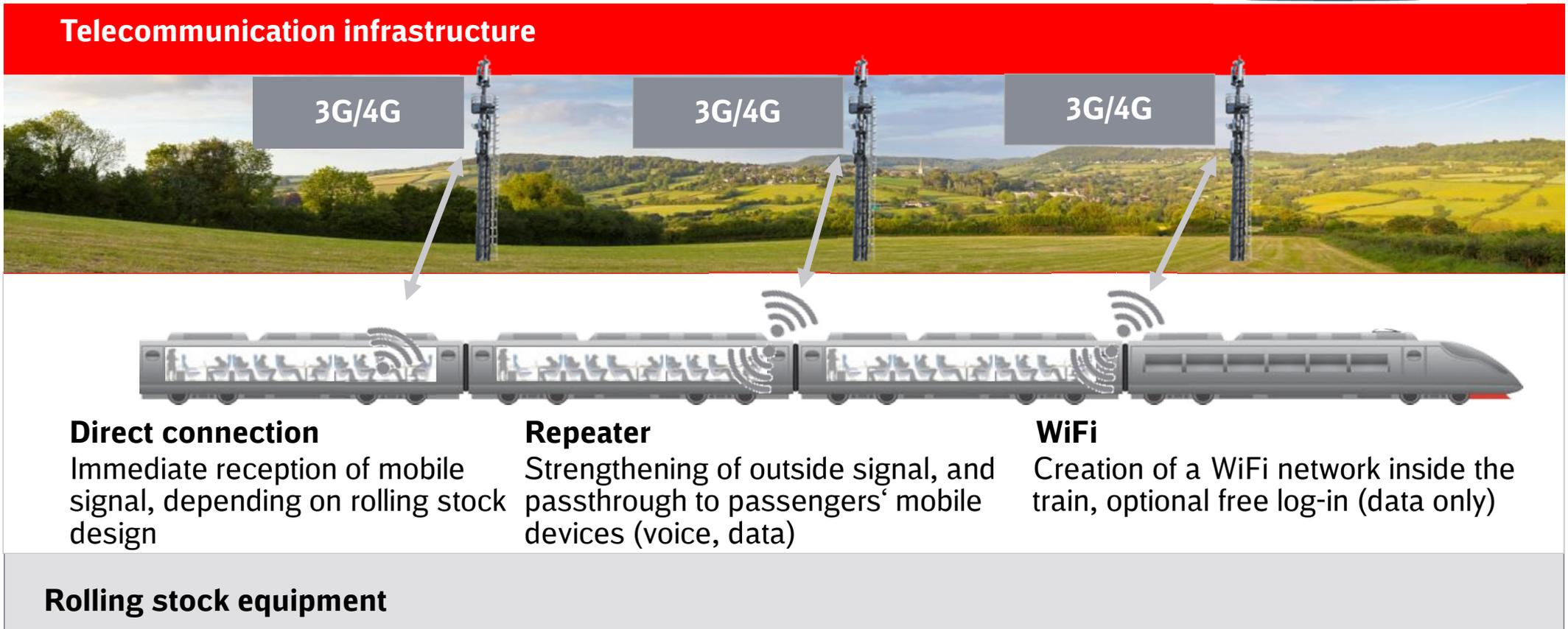


Flinkster app

Full mobile connection of passengers requires further investment in telecommunication infrastructure and rolling stock

Mobile access: technical pre-requisites and options

... relevant players:



... relevant players in regional passenger rail, e.g.:



Source: AT Kearny 2015

DB Schenker addresses digital transformation through Logistics 4.0



1

Target picture: Logistics market of the future

- Key developments
- Business models
- Competitive landscape

2

Product of the future

- New digital solutions
- Customer interface of the future

3

Optimized processes & assets

- Asset intelligence
- Workplace of the future
- Data analytics

4

Enablers

- DB Schenker Labs
- Research cooperations
- Customer innovation projects

Eight key developments in digitization will shape the future of transportation and logistics

<p>Digital workflows</p>  <p>Paper based operations are replaced with digital workflows (e.g. in production processes)</p>	<p>Customer interaction</p>  <p>Customer interface will change due to increasing demand for transparency, visibility, real time information and convenience</p>	<p>Digital platforms</p>  <p>Online booking platforms will help to pool supply and demand and increase market transparency</p>	<p>E-commerce</p>  <p>Growth in e-commerce is offering opportunities in parcel / fulfillment business</p>
<p>(Big) data analytics</p>  <p>New technologies emerge to manage increasing volumes of heterogeneous data in short time</p>	<p>Asset intelligence</p>  <p>Assets are increasingly equipped with smart technologies / sensors which leads to permanent generation of data</p>	<p>Automomization</p>  <p>Things will increasingly act and interact autonomously (e.g. automated vehicles, warehouses)</p>	<p>3D printing</p>  <p>Various 3D objects of various shapes can be produced from a 3D model (additive processes)</p>

DB SR will consistently pursue its innovation activities aiming at Automated Train Operation for rail freight

Automated train operations examples



Automated metros running worldwide

“It’s not a lack of technology that’s keeping trains from going driverless.”



In 2015, AutoHaul creates the world’s first **fully-autonomous heavy haul, long-distance railway** for iron ore transports in Australia

Chances for DB Schenker Rail

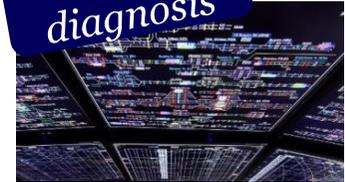
Auto pilot



Obstacle detection



Self-diagnosis



Reducing complexity in customer-visible areas – customer driven, easy and digital



Digitalization and simplification

Low complexity

High complexity

Frontend

Reduced complexity



Angebot

Einfachbahn-criteria:

- Customer driven
- Easy and intelligent
- Digital



BackBone

Operational excellence

Finanzierung

Grenzlasten

Politik

IT-Schnittstellen

SNB / NBS

Kapazitätsmanagement

Belegung

Fahrplan

Bauen

neXt lab

Regelwerke

Stellwerksbesetzung

Topologie & Ausstattung

Infrastruktur-entwicklung

...

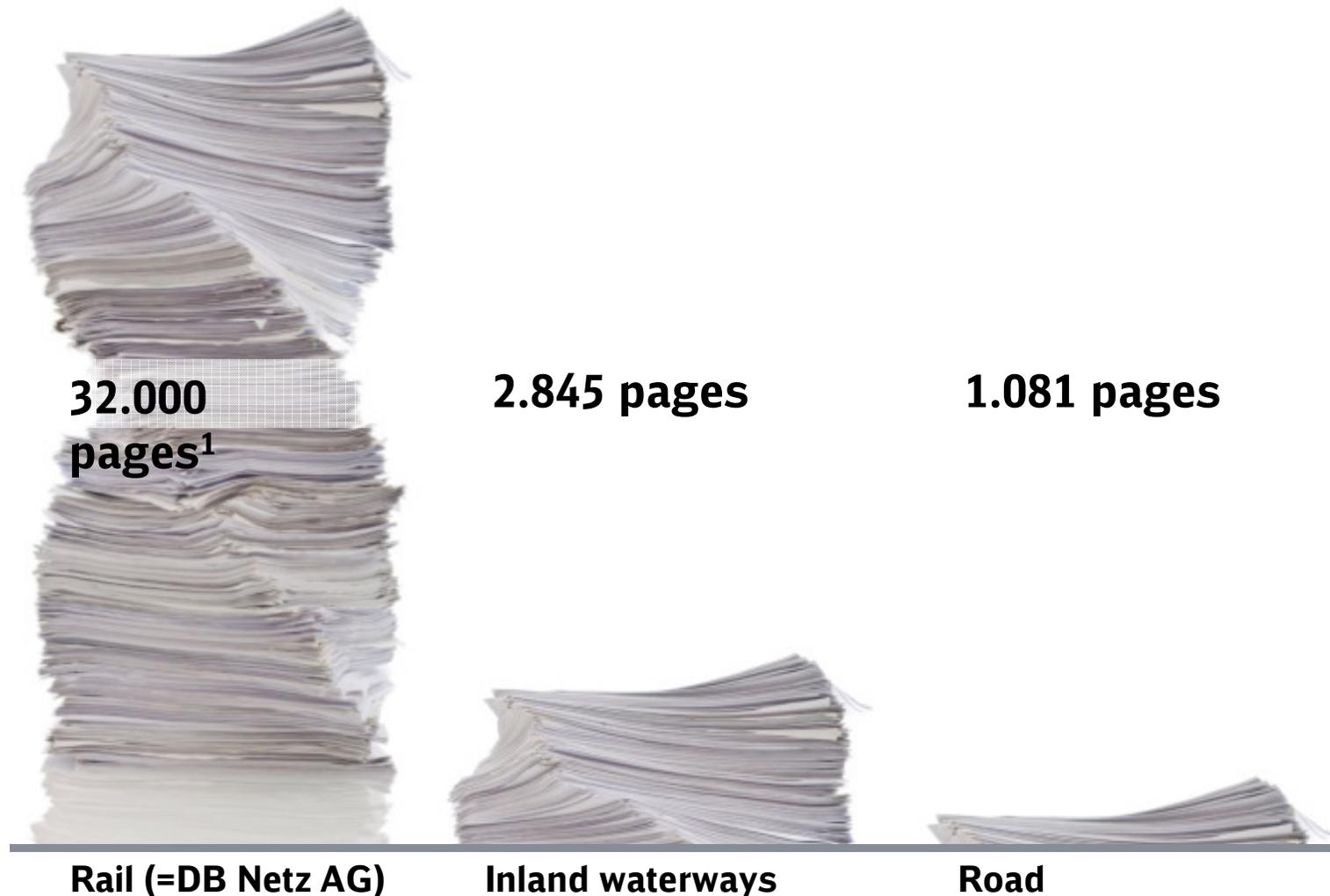
Grünschnitt

Regulierung

Terms of references for rail is by far more complex than for Inland waterways and for Road



Status quo: Complexity of German rail system



1) Terms and Conditions, Policies, Rulebooks etc.
DB Netz AG - European Corridor Management (I.NMC)

Digitalisation of timetabling is a competitive boost to the rail system: click and ride, the customer simply "drives off straight away"



Project example: neXt

Vision of future customer interface (especially freight transport)



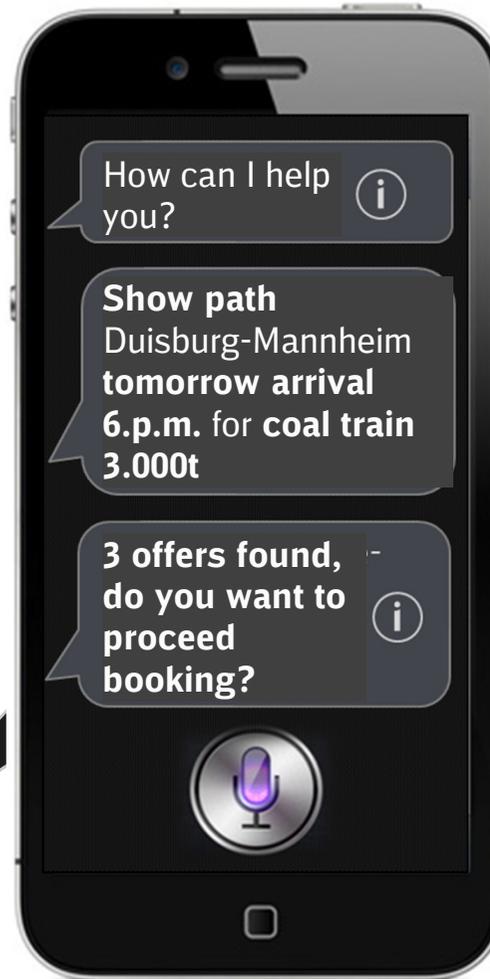
"Digitalised" rail system



Strengths:

- High degree of planning certainty (each train has a place in the timetable)
- One of the safest modes of transport
- Positive environmental footprint compared to lorries/cars

- Access is quicker, easier and more transparent



- Customer has direct online access to available train paths
- Data is in real time and processed rapidly
- Track request and actual train run can be almost "simultaneous"

Vision

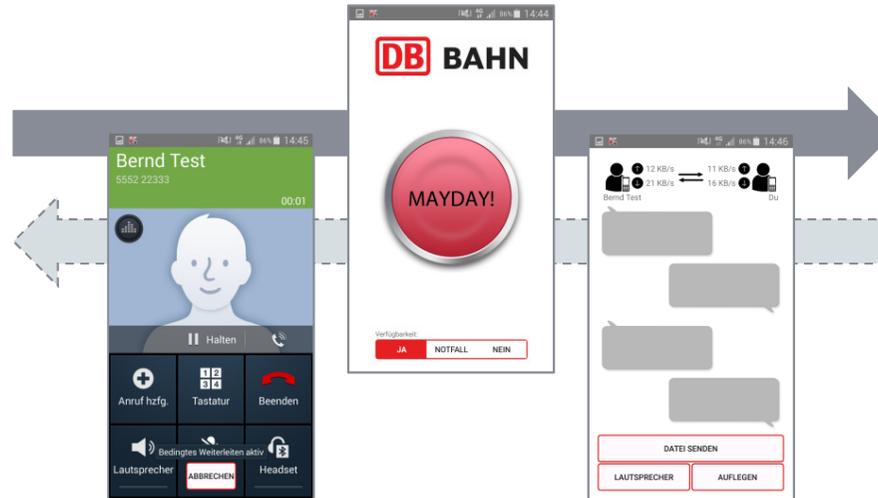
The Mayday app – an example of how digitization can be used in maintenance

Project example: Mayday Button

Maintenance worker

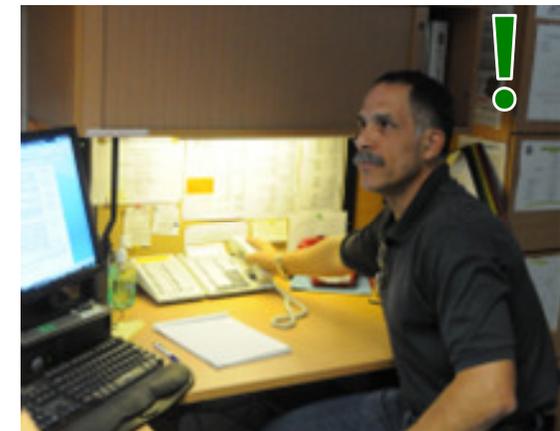


- Cause and solution of disturbances **not always immediately identifiable**
- So far, only **telephone assistance** possible by experts



- Maintenance App with **Mayday** button connects maintenance worker on site quickly and easily with a real expert
- **More effective and rapid breakdown repairs** by sharing photos, plans and videos
- Increase **employee and customer satisfaction** through successful suppression

Expert



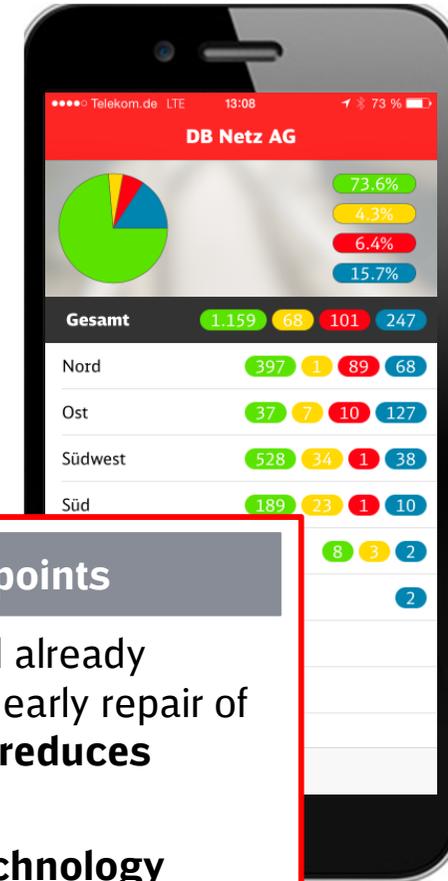
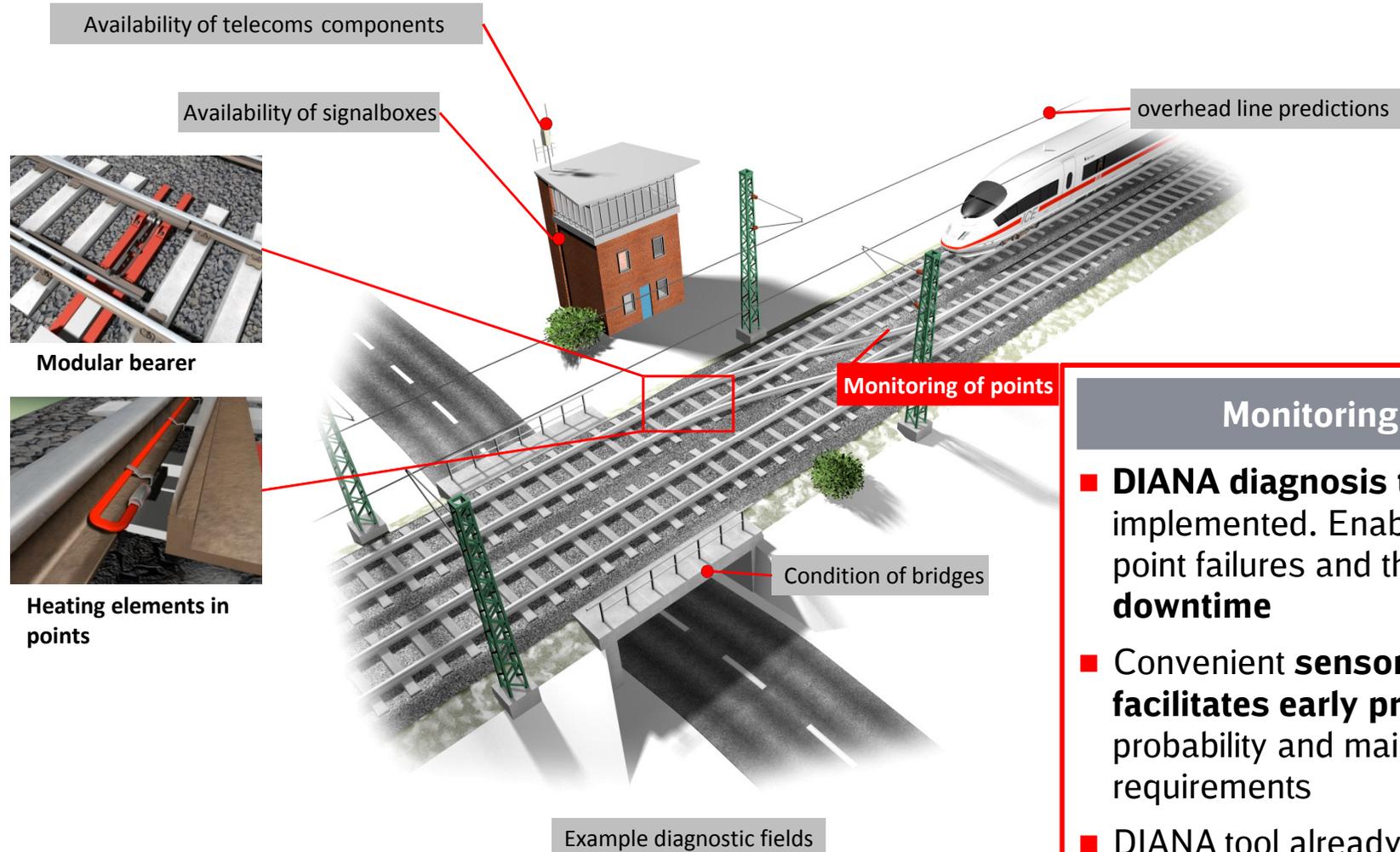
- **Expert supports** with detailed knowledge of **breakdown repairs**
- **Expert** has access to **additional information and documents**

Use of digitalisation to improve infrastructure availability (e.g. with remote diagnosis tool “DIANA”)



Infrastruktur 4.0

Project example: DIANA



- ### Monitoring of points
- **DIANA diagnosis tool** already implemented. Enables early repair of point failures and thus **reduces downtime**
 - Convenient **sensor technology facilitates early prediction of** failure probability and maintenance requirements
 - DIANA tool already in rollout, design underway for further components



CUSTOMER

Optimize customer interface and increase customer value



Mobilität

New data based business models

Demand-oriented pricing

Intelligent customer relationship management



Product and customer experience including connectivity



Autonomous driving (Road) Intermodal travel planning and companionship



Logistics



Simplification and digitization of the customer interface

Tender optimization and pricing with data analytics

New data based business models



Logistics concepts 3-D Printing



Logistics platforms and e-fulfillment



Infrastruktur

Simplification and digitization of the customer interface

New data based business models



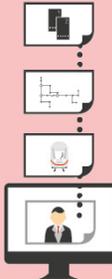
Shopping experience in train stations Passenger information at the train station



OPERATIONS

Optimize and develop production system

Digital workflows



Smart planning and management of tenders and production



Digital workflows



Asset Intelligence

Autonomous driving (Road)

Automation of logistics processes



Production optimization with data analytics



Virtual building design and management (BIM)



Automation of building and train station operations



IP-Network for train operations and digital control and security systems

Digital vehicle solutions - platform for digitization of vehicles



Digital workflows

Digitization of scheduling processes



Produktion



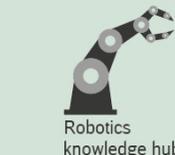
Condition based and predictive maintenance



Autonomotiving (rail)



New communication standards (5G)



Robotics knowledge hub



3-D printing for maintenance

Automation of operation processes



LIVE



ENABLER

Provide comprehensive frameworks and conditions



Arbeitswelt



Leadership and Organizational Models



Job Profiles and Occupation



Ways of Working and Framework



Learning and Competencies



Communication, Collaboration & Innovation



Informationstechnik



Digital work space



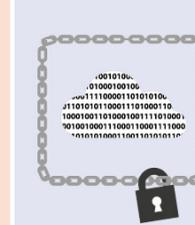
Big Data-Center & open data



Digital platforms and IT toolboxes



Social intranet DB Planet



Cyber security and information security

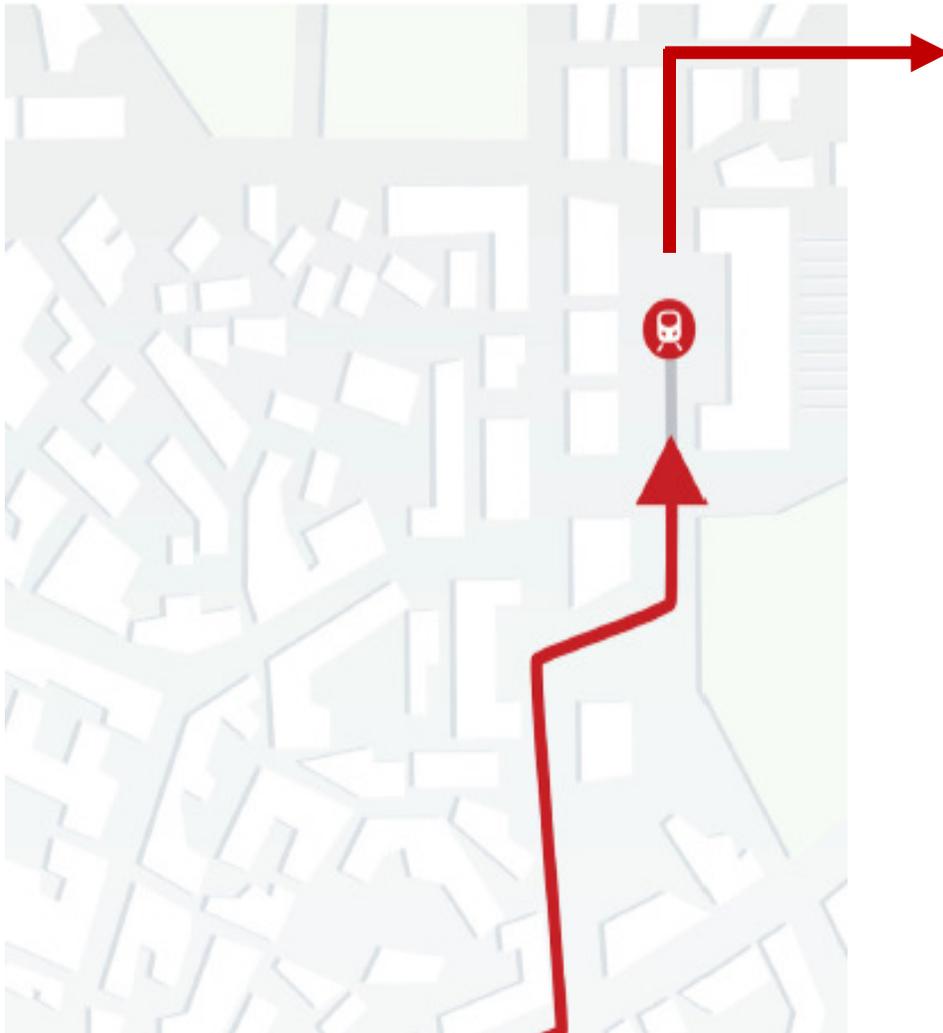
Lab activities



Startup activities



The digitization map shows the main topics of all 4.0 initiatives regarding digital transformation at Deutsche Bahn AG.



Conclusions

■ Why?

- Customer centricity
- Operational excellence

■ Achievements?

- Top awareness, strong visions, change of culture
- Large number of entrepreneurial initiatives and projects

■ Regulatory implications?

- Change of relevant markets
- Digitalization of regulators

■ Open/ long-term challenges?

- Attractiveness of products!!!
- Big data analysis
- Connectivity and cyber-security
- Automisation (infrastructure/ train operations)
- Simplification and digitalisation of documents

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