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Digitalization: The future of mobility

Dr. László LUDVIG, Mobility division head, Siemens Hungary

Digitalisation Conference and Fair – 18th of October 2017



- **What does digitalization mean?**
- **The digital evolution of mobility**
- **Road to the digital railway**
- **Examples of railway digitalization**
- **Visegrád Group and Hungrail Working Party**
- **Structure of the Working Party**
- **Timetable**

A picture from 2005





...and an other from 2013

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What does digitalization mean?

Our world is becoming more and more **digitalized**. Billions of intelligent devices and machines generate massive amounts of data, creating a bridge between real and virtual worlds. Turning these vast amounts of data into value is a key success factor.

Whether in factories, rail and traffic management systems, or decentralized power distribution systems, the trend is toward networking individual devices with entire systems – a process that is based on the integration of the physical world with the virtual world of data. The result is what Siemens calls the **Web of Systems**.

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Digitalization can be:

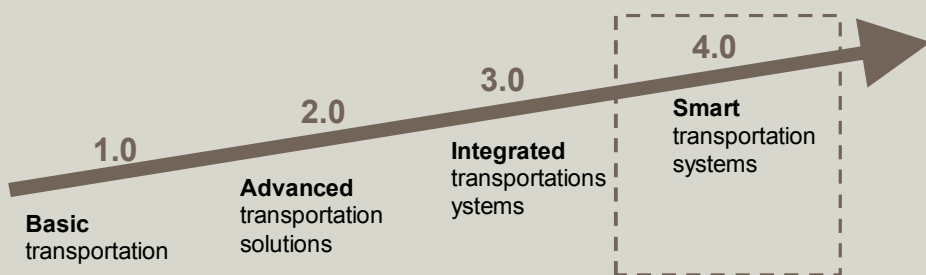
- **Digitized documents**
- **Exchange of data**
- **Automatization**

*Presentation- Digital Single European Railway Area,
Kathrin Obst
European Commission
Directorate General Transport and Mobility,
2015*

Information and Communications Technology (**ICT**) is no longer a specific sector but the foundation of all modern innovative economic systems.

Digital Single Market Strategy, 2015

Development path of mobility



Main objective of Hungary: Developing transport from Mobility 2.0 to 4.0

Key characteristic of mobility development stages

Mobility
1.0

Basic – Conventional way of transportation

- Dominance of cars
- Conventional types of fuels and propulsion
- Low intelligence

Mobility
2.0

Advanced transportation solutions

- Growing ratio of public transport
- Alternative fuels and propulsion in the individual mobility
- Developing passenger and cycle infrastructure of the cities

Mobility
3.0

Integrated transportation systems

- Integration of different ways of transport (end users, operators)
- Ecosystem involvement

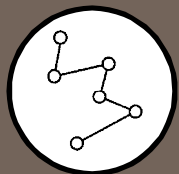
Mobility
4.0

Smart transportation system

- Intelligent mobility based on digital solutions
- Automated mobility processes (order,ing, booking, driving etc.)
- Personalized packages on demand



Road to the digitized railways – Main objectives



Connected railways

Highly reliable connectivity in order to boost the railway's attractiveness



Customer experience

Maximizing the consumer's satisfaction with better services.



Increased capacity

Increasing capacity with enhancing the efficiency and productivity of the sector.



Competitive railways

Raise the competitiveness of railways with optimized usage of traffic information.



European leverage

European supporting background

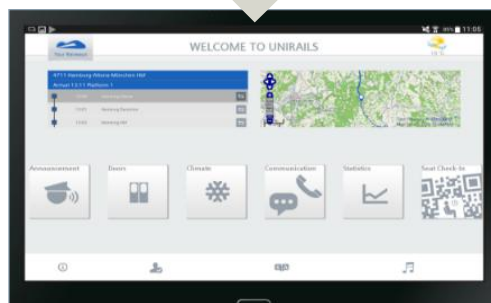
Connectivity for everyone

For the traveler:
Connectivity during the
whole journey



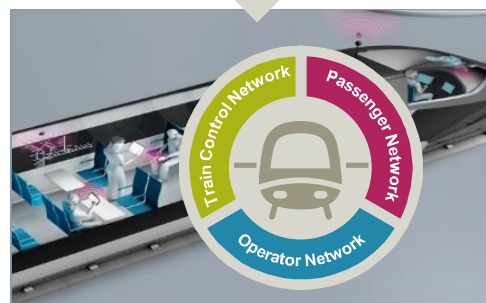
Travelers need online assistance during the journey, anywhere and anytime.

For the operators:
Cost reduction and
digitalization



Operators need real-time based data (current capacity usage) in order to optimize the performance of the system.

For producers:
Innovative solutions



Manufacturers have to reach the highest cost- and energy-efficiency by producing vehicles.

For every service
providers:
Intermodality and
autonomous driving



Travelers require „door to door” solutions in the rail and road traffic as well. Passenger transport and freight will be completely reshaped by autonomous vehicles and digitized traffic systems.

Improvement of consumer satisfaction

Individualist traveler



New consumer attitudes: Diversification of traveler's needs, strengthening role of independent decision making have to taken into account by value creating.

Development of dissemination of information



Consumer based innovation with the assistance of digital platforms. Development of real time schedule applications, improve the punctuality of information with digital solutions.

Internet connection



Ensuring the secure and continuous internet connection during the whole travel chain.
„Always on” conception

Encourage the cooperation among sector-related companies



The integrated mobility solutions could get higher priority with more efficient cooperation of companies in the sector.

Digitalized diagnostic methods



Information collected by on vehicles and along the railroad track placed sensors ease the diagnostic processes.

Predictive maintenance



With predictive processes train operators can remotely identify any relevant dysfunction and cause of failure, they can directly decide on the necessary maintenance or repair activities.

Implementation of ATO (Automatic Train Operation)



Automatic train operation system is more secure, energy efficient and create savings.

IoT - Internet of Things



With each other communicating vehicles increase the productivity and the efficiency of operative activities.

Development of sector's competitiveness

Big Data



The structured utilization of Data produced by companies can help by creating personalized and flexible traffic system.

Data sharing between companies



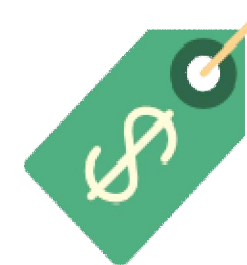
Data sharing between actors contributes to the creation of new traffic solutions, enhance the productivity of Startups and the railways' competitiveness.

Integrated operation

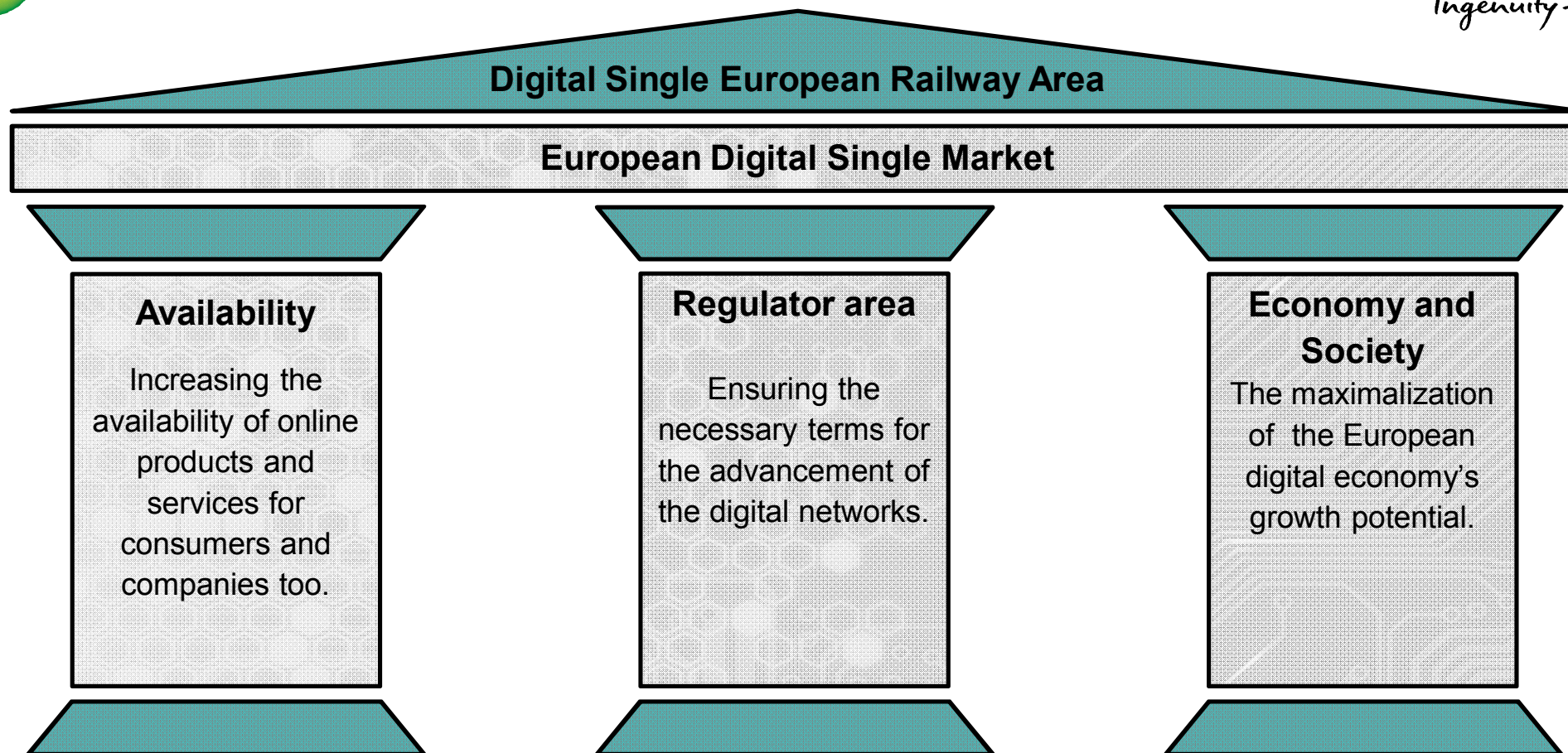


„Coopetition“:
Beside the competition the integrated functioning between different transport alternatives became fundamental in the sector.

Pricing



Demand based pricing – personalized offers, allowances for clients.
By determination of prices will be taken into consideration special factors, too: time of day, speed, capacity usage, and even the carbon dioxide emission.



The European Digital Single Market belongs to the Top10 priorities of the Commission.

Workforce must have the relevant digital skills !

- **Flexibility** – abilities to learn and use multiple platforms, systems and solutions
- **Programming and database fundamentals** – computer science basic knowledge
- **Communication and visualization** – capable of interpreting and translating data into actions and insights
- **Analytical skills** – capability of analyzing datasets and identifying problems
- **Problem solving** – proactive attitude, looking for solutions



- **Digital readiness** - abilities to work with electronic tools, documents and data
- **Security and privacy** – understanding digital threats and risks arising from daily work
- **Digital etiquette** – dealing with values, habits, patterns during data, platform and system usage
- **Digital cooperation** - Organize and collaborate on online platforms and interfaces
- **Curiosity and open mindset for digital change**



HUNGRAIL
MAGYAR VASÚTI EGYESÜLET

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Examples of railway digitalization



PASS2 - Billing and Statistics System for Network Usage

Pályahasználati és Statisztikai Elszámoló Rendszer



- **PASS2** – Opens the opportunity for creating analyses, traffic-, service-, and return statistics.
- The collected data about performances will be managed by PASS2 system. According to the unit prices the system uses a rating algorithm and make invoices.
- The system is capable of handling partners' complaints as well.
- **The system covers:**
 - Railway track system
 - Billing
 - Statistical systems

PASS2 Project Objectives

- Performance evaluation, **quality management** (improvement of schedule punctuality)
- **Optimizing the invoice system** with digitized technologies
- **Replacement of obsolete data gathering processes**
- **Participation in the creation of the single European traffic control system.**

Providing reliable traffic services for railway companies.

- **Software developer** for timetables and mobility
- **Creator of Train Planning System (TPS)**
- **TPS Features:**
 - Multi-user system focused on train and capacity planning for railway networks
 - Multi-screen support
 - Oracle database for data management
 - Suite of specialized applications and services

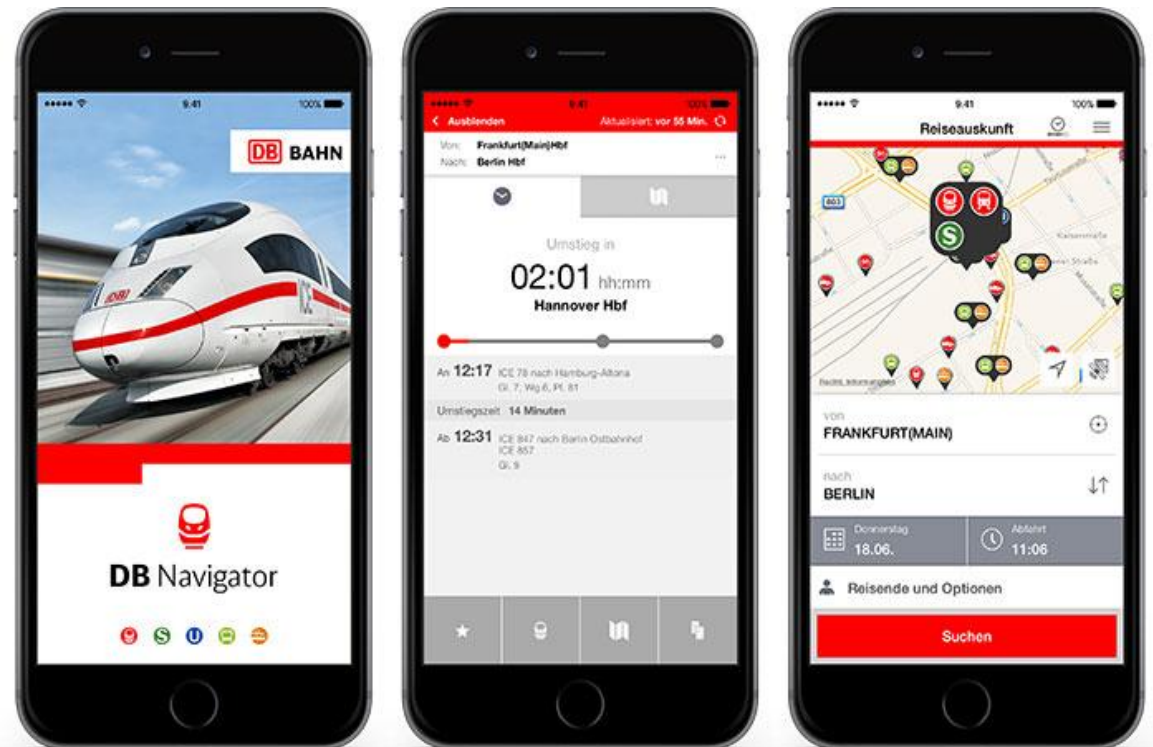
TPS Functional areas:

- Runtime calculation
- Tabular and graphic editing
- Reports and analysis
- Conflict detection and resolution
- Planning parameters
- Simulation



Cooperation with local public transport operators, freight and technology companies.

- **DB Navigator**
 - **30 million downloads**
 - Travel planning and booking including **tram and bus** services
 - **Real-time information** with up-to-date departure and arrival times
 - **Door-to-door route planner** including GPS positioning and footpath mapping
 - Save and **manage mobile phone tickets**
 - Tickets booked using the DB Navigator app **can be saved to Apple Wallet.**



Hacon's mobile ticketing solutions can be incorporated to create an efficient and simple user experience for passengers.

Hacon – Success examples



- **Smart Displays**
 - **Web-based technology** for displays
 - Available for **stops and on-board**
 - **For all modes:** train, bus, metro, car sharing, bike sharing
 - Map and animation can be integrated
 - **Used all over Denmark by all transit operators**
 - **Minimal requirements:** just a frameless web browser

Hacon's HAFAS product suite covers all aspects of Intelligent Transportation Systems (ITS) and creates the ultimate end user experience.

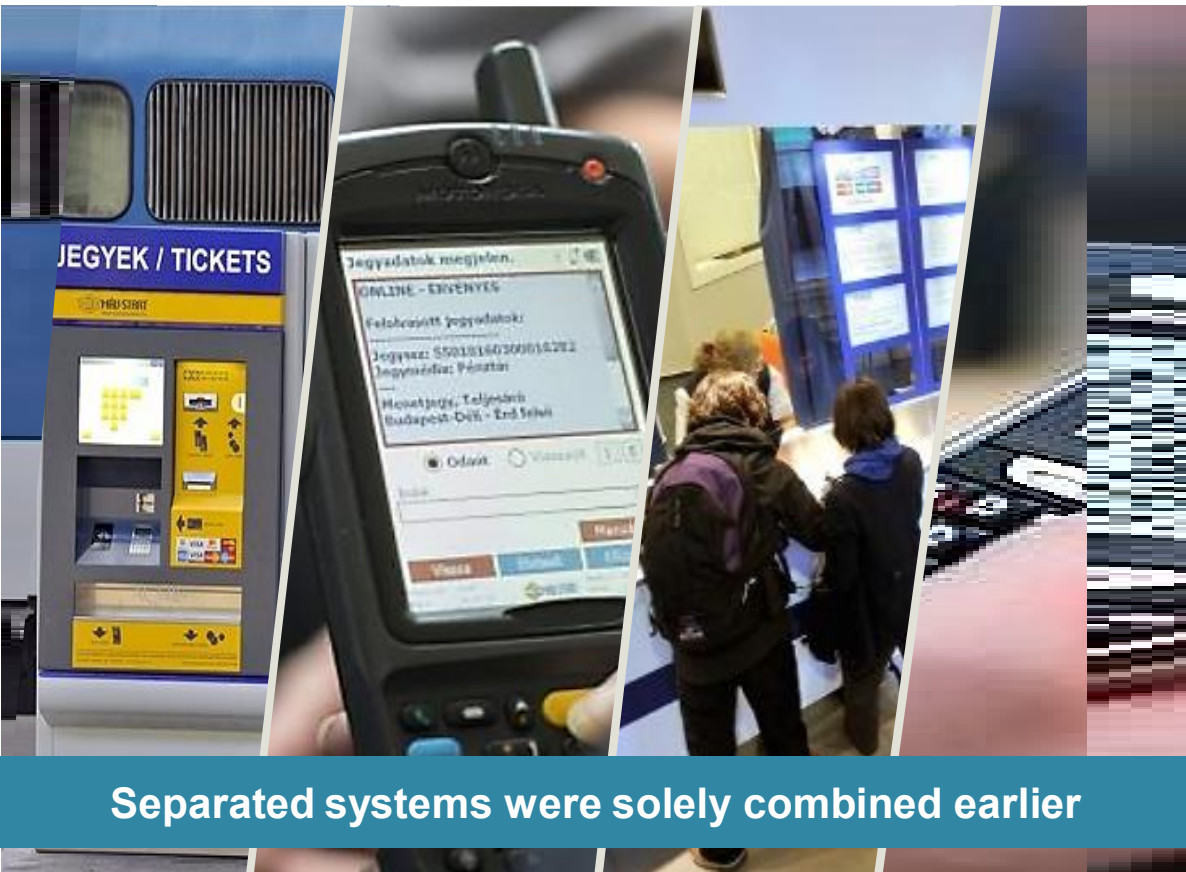
Centralized traffic control system on GYSEV's railroads



- **Integrated traffic management and control system**
- **3 center remotely controls 36 stations**
- **Remotely controlled energy** running through overhead contact line system and 4 subsystem
- **Broad integration** of on-board and trackside systems, fire-fighting systems, and protection of properties
- **Real-time passenger information and assistance** based on KÖFI data

A PROLAN Zrt. supply a unique sized and complex rail line system longer than 400 km

MÁV's e-Ticketing system *Jegyértékesítési Rendszer (JÉ)*



Separated systems were solely combined earlier

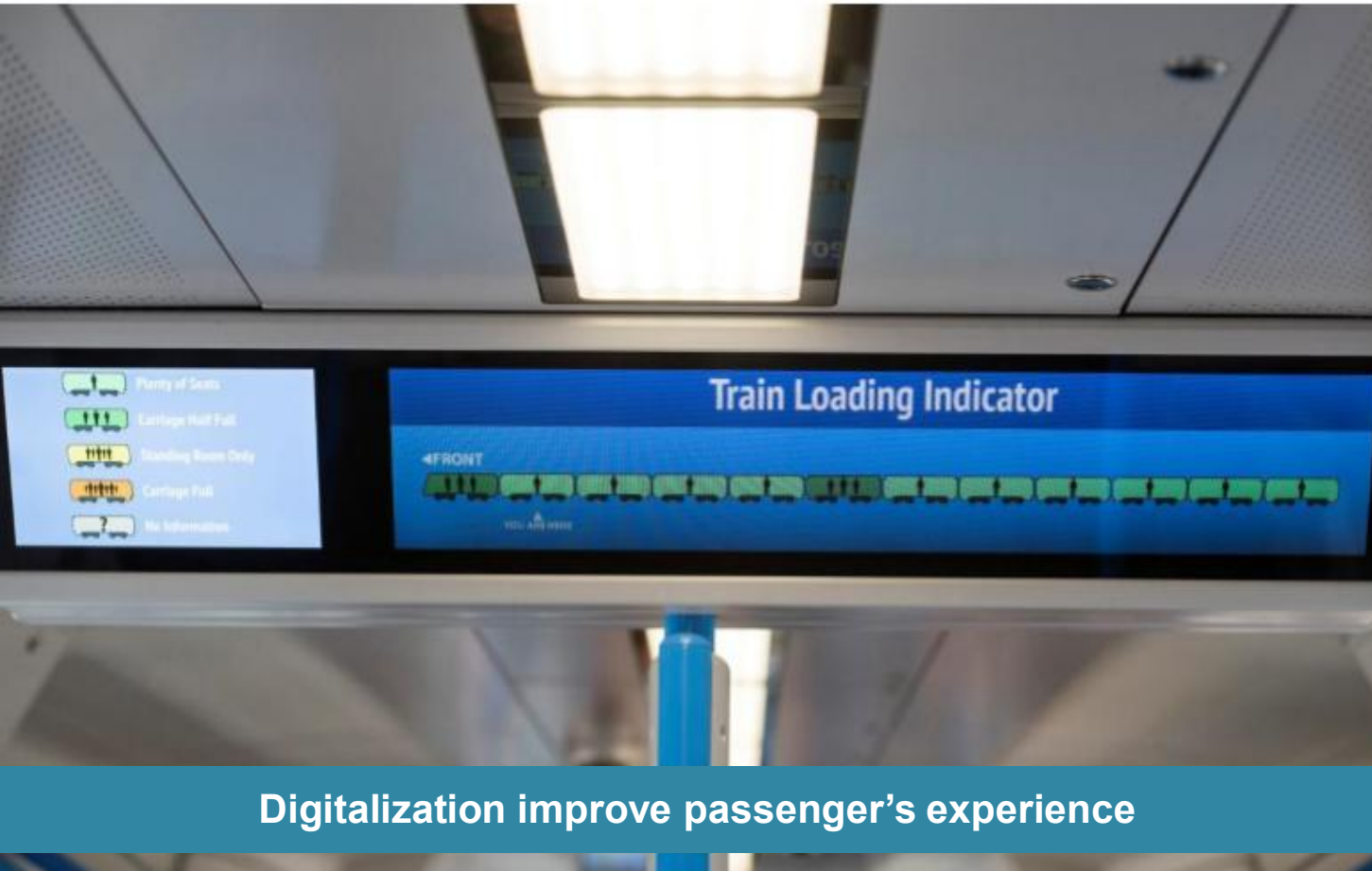
Integrated e-Ticketing, which has:

- **One single sales engine - Omni-channel sales**, modal enhancement capabilities
- **Always-on data link between the central server and the individual system elements** („offline” mode onboard)
- **Unified sales and settlement database** (trackable lifecycle of the tickets)
- **Standardized electronic ticket**, integrated, platform independent content



Integrated, intermodal and connected solutions for passengers

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Digitalization improve passenger's experience

- **Always connected:** Integrated solutions for passenger assistance and entertainment during the journey
- **PIS+:** Passenger information and guidance systems in the train – depending on passengers location and traffic situation
- **SiMobility:** Solutions for information and transactions across transportation modes – incl. hands-free ticketing “Be-in/Be-out“
- **iCCTV:** Automated recognition solutions, incl. detection of empty seats and availability of wheelchair space
- **Train-IT:** Fully integrated IT backbone for flexible and future-proof train applications



S-Bane Copenhagen: automated transportation pioneering in railway

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- All the network's lines are equipped with CBTC (Communication Based Train Control) for fully automated operation
- Train intervals in the inner city zone shortened from 120 seconds to 90 seconds
- Low maintenance costs due to elimination of trackside signals in the network
- Mixed transport with regional trains at the Hillerød terminal station
- Fully automated system operation in test phase

Partially automated transport system provided by Siemens since March 2016

Dr. László Ludvig, Siemens Hungary



Automated driving demonstration project in rail freight transport

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- **Successful tests for:**
 - Sensor-controlled hazard detection
 - Automated coupling to freight train
 - Automated braking and acceleration to adjust to line speed limits
 - Tablet-controlled remote departure and precise stopping of the train
- **Advantages:**
 - Increased transport capacity and flexibility
 - Energy consumption reduced by around 20 percent

DB backed by Siemens made the first automated rail freight system in the World

Dr. László Ludvig, Siemens Hungary



Highest availability of transport systems with the help of continuous data analytics

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Digital services and solutions in maintenance work.

- **Our basis:** Modern rail vehicles transmit over one billion data points a year
- **Our competence:** Analyzing this data with algorithms and deriving measures to prevent downtimes in operation
- **Our goal:** Support our customers by providing highest availability of vehicles and optimal maintenance
- **Our reference:** Data analytics used with the Velaro Spain for predictive maintenance and avoiding costly downtimes

Dr. László Ludvig, Siemens Hungary

INTELLIGENCE ON THE FREIGHT WAGON



DB Cargo is equipping its wagon fleet with networked sensors

(1) TEMPERATURE
SENSOR

(2) HUMIDITY SENSOR

(3) SHOCK SENSOR

(4) GPS

(5) LOAD SENSOR

Acquire data

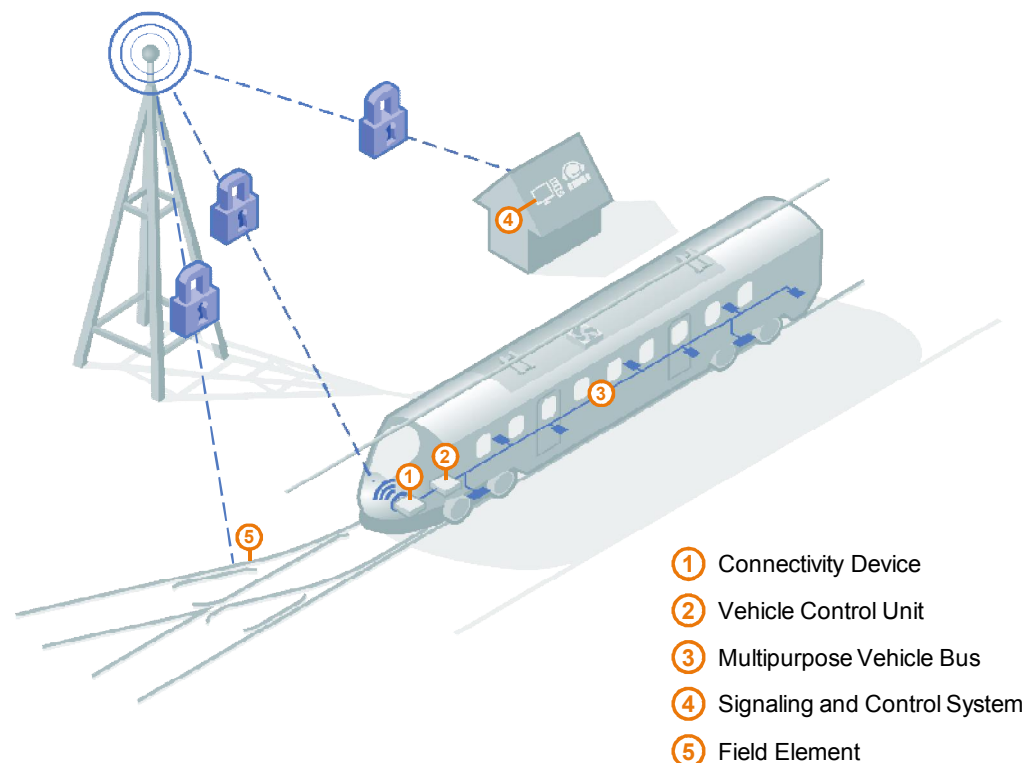
- Collection server with safety approval
- Data preprocessing at customer side
- Secure data transmission with cRSP

Prepare data

- Process data at customer side to reduce transmission volume
- Store data temporarily to be considered for lower bandwidth or communication breakdowns

Transmit data

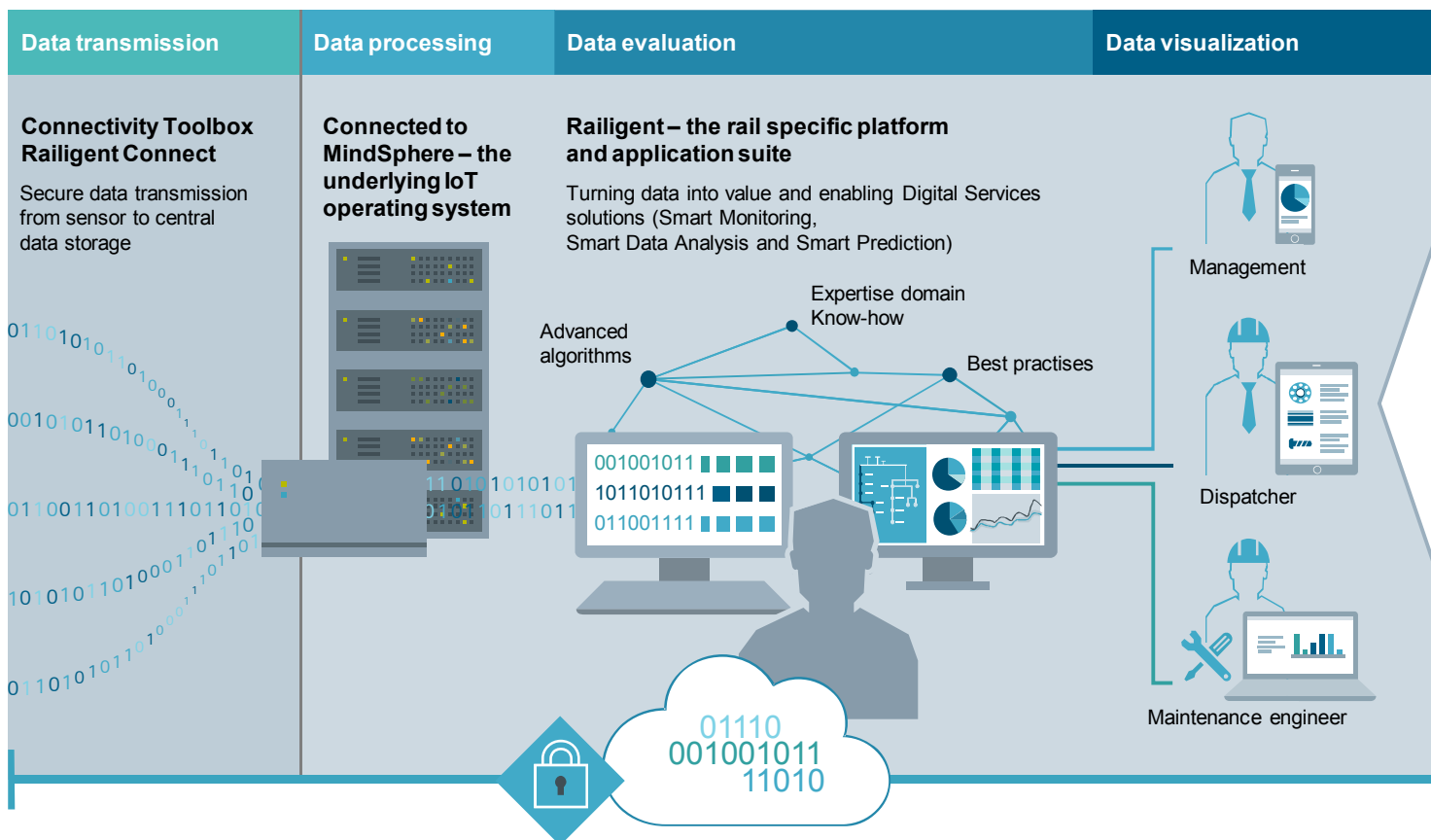
- Transmit operational and process data continuously as far as possible
- Transmit data in a highly safety and secure manner with focus on confidentiality, integrity, availability



Providing valuable system and diagnostic data



Railigent® covers the entire value chain – from data transmission to analytics and provision of proposals



Smart Monitoring

Automatic data visualization offering full transparency and fast troubleshooting

Smart Data Analysis

Efficient root cause investigations

Smart Prediction

Algorithms for preventive fault analysis



Siemens support DB's predictive maintenance



- DB has a **data system named TechLOK**, which **collects and processes diagnostic data** from locomotives across Europe, **helping DB Cargo to improve its operations and backing the condition-based predictive maintenance**
- **Development of data analysis models based on Siemens' Railigent platform and MindSphere IoT operating system**, specialist work together with DB's Asset & Maintenance Digital Lab

Siemens helps DB Cargo in achieving its 2020 goal of fitting 2 000 trains with diagnostic technology.



- Trains equipped with **remotely programmable electronics** – connecting sensors and actuators
- Traxens technology collects **real-time data**: position and condition of the cargo can be known and controlled in real-time
- Costumers **can see where transported goods are at any time** and they are alerted when goods have arrived
- Railway **undertakers can organize transport efficiently** by remotely **automated measurements and tests, controlling door and tank domes closure**
- **Fleet managers can access data** on mileage, axle wear for each wagon – **maintenance based on usage**

SNCF Logistics partnership with Traxens to create digital solutions for freight transport.



French train driver automation project



The Safe Autonomous Land Transport (TAS) project aim to automate functions as:

- distinguishing between lineside signs and signals
- spotting passengers on a station platform
- monitoring defects on passing trains
- recognizing objects on the track

The objective is to carry out these functions to very high levels of safety.

An environmental perception system will be designed based on sensors to provide advanced functionalities and on artificial intelligence.

SystemX have expertise in artificial intelligence and methodologies for processing images applied to transport, as well as expertise in virtualization and simulation to validate and certify the security of these systems

Institute of Technological Research (IRT) SystemX, French National Railways (SNCF) and Alstom has launched a two-year project to automate the observation functions of train drivers.



2017: DB's destination boards infected by WannaCry

Rail systems vulnerable to cyber attacks



- **Traffic management systems:** sometimes have security weaknesses, like the ability to control the device without authentication, and the use of known protocols such as XML over HTTP, which makes it possible to create tools for controlling the device
- **Computer-based interlocking (CBI):** If an attacker can gain access to these systems, they can cause physical damage by changing a switch or by setting up conflicting routes
- **GSM-R SIM cards:** a malicious actor could attempt to disconnect the train and the control center hence can stop operating trains
- **Badly managed passwords:** passwords are sometimes displayed on post-its that anyone can see, GSM-R PIN default 1234 isn't overwritten
- **Modems of the Over the air (OTA) management systems:** can be comprised, e.g. by malicious firmware update, therefore the host connected to the modem could also be hacked

*Security Week,
Researchers: Trains Vulnerable to Hacker Attacks
29 December 2015*

Railway need enhanced protection as a Critical Infrastructure



Applications and directives of Kürt Co.

- **Proper recording and processing** for large-volume **log files** generated in IT systems, with an **appropriate log analysis application (LogDrill)**
- **Testing of systems vulnerability** (legal hacking, penetration testing)
- **Increasing the security of systems** by environment-dependent configuration changes (**hardening**)
- **Applying appropriate security tools**
- **Providing adequate risk and operational continuity management** supported with software (**SeCube**)

logdrill
MAKE YOUR DATA WORK

 **secube**

Integrated solutions for security



- **Siplus Rail Trackside and Rolling Stock Devices:** Integrated security such as protection against cyberattacks, as well as network security, system security, and know-how protection

Main attributions:

Systematically Addressing Vulnerabilities

The top priority for security is to be faster than hackers and uncover security gaps yourself.

Scanning Data for Anomalies

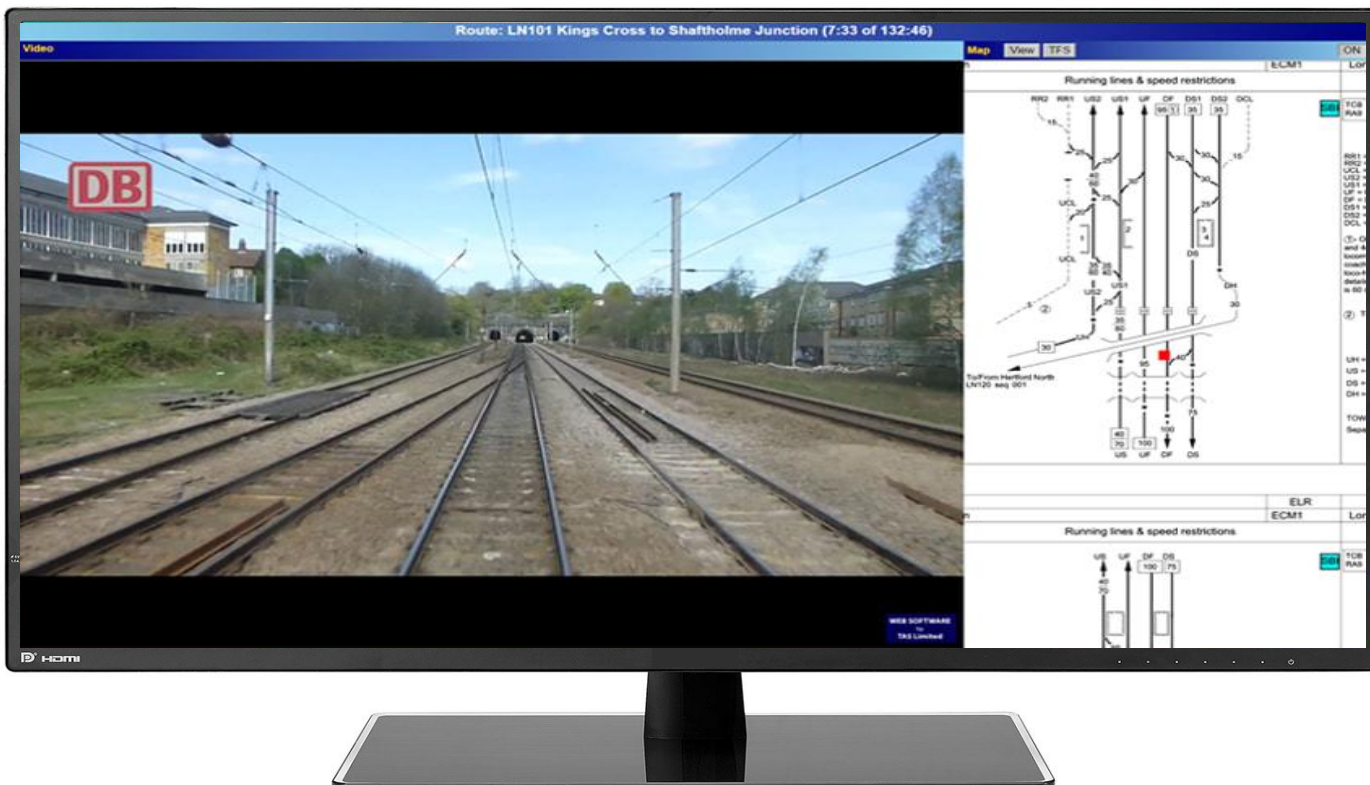
Every IT system has its own typical patterns, the search for clues has to be adapted to that. If the monitoring system detects anomalies, it automatically notifies the appropriate security center.

SIPLUS RAIL – Trackside and Rolling Stock Devices



- **Recognizing Attack Patterns in Time**
An important IT security component is the ability to monitor operating environments to detect attacks
- **ID Check for Machines**
Machines have to "identify" themselves before they can exchange data with one another or transmit it to databases.
- **PKI (Public Key Infrastructures)** digital certificates. The PKI certificates are issued by a “**Trust Center**” that operates according to very high standards of security and thereby establishes trust in the PKI certificates.

Siemens can rapidly roll out new security technologies for its high security products.



- Familiarize drivers with the physical characteristics of the routes
- High-quality footage of routes filmed by DB Cargo UK with a moving track diagram and route characteristics
- Using it enables drivers to review a route or sections of it as many times as they wish
- Removes the need to operate trains specifically for route learning
- Provides a more efficient and effective method for route learning and retention of route knowledge
- Accessed via tablet, phone or computer

*Railway Gazette,
Digital route learning at DB Cargo UK,
26 May 2017*

DB Cargo UK has introduced an internet-based route learning program.



Hungrail Working Group for Visegrád 4



Priorities of the V4 Presidency



- Hungary is holding the Presidency of the Visegrad Group for the **fifth time**.
- Period of the Presidency: **from July 2017 to June 2018**
- **Main objectives:**
 - European Visegrád
 - Regional Visegrád
 - **Digital Visegrád**
 - Global Visegrád

*Ministry of Foreign Affairs and Trade of Hungary (2017):
#V4Connects – Presidency Programme, Programme of the
Hungarian Presidency of the Visegrad Group 2017/2018*

Dr. László Ludvig, Siemens Hungary

Digital Visegrád



- **Vision:**
 - Enhancing competitiveness of the V4 countries
 - Creating a regional dimension, which can supplement national and EU-level strategies
- **Digitization objectives:**
 - Besides strengthening the role played in European automotive industry, creating a 'Visegrad Good Practices Platform' dealing with autonomous vehicle manufacturing is a key objective
 - Digitalization of mobility, improving interoperability
 - Developing a startup ecosystem, nurturing talents

*Ministry of Foreign Affairs and Trade of Hungary (2017):
#V4Connects – Presidency Programme, Programme of the
Hungarian Presidency of the Visegrad Group 2017/2018*

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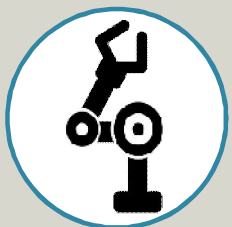
Structure of the Working Party



- Authorities
- Policy makers



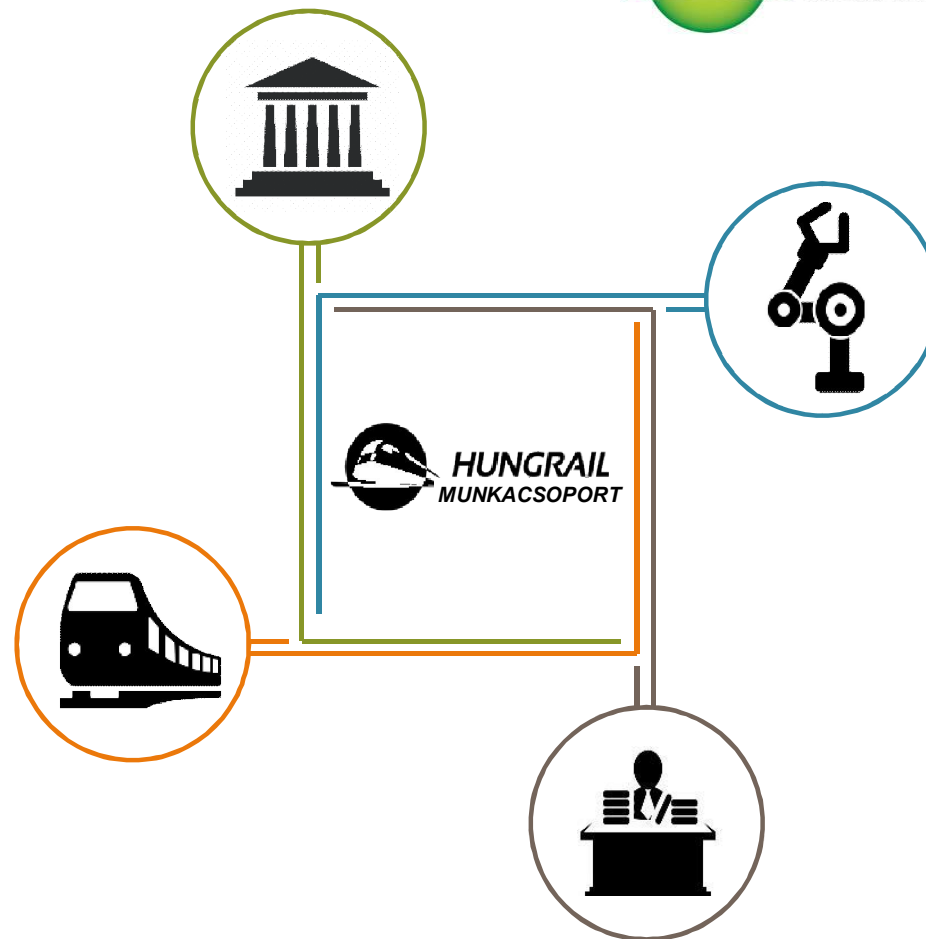
- Railway undertakers
- Rail carriers
- Service providers



- Industry
- Manufacturers
- IT companies, Startups



- Back Office



Timetable



**3rd of October
Hungrail Hungarian
Railway Conference**



**October – January
„Digitalization in Railway”
– preparing for the V4
conference**

**18th of October
VPE Digitalization
Conference**

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
27	28	29	1 St David's Day (Wales)	2	3	4
5	6	7	8	9		
12	13	14	15	16		
		21	22			
		28	29			
		4	5 Maundy Thursday	6 Good Friday	7	8 Easter Sunday

**At the end of October
Working Party's meeting,
Forming a Railway Digital
Forum**

**February
V4 Conference**



To be continued...

Digitalisation Conference and Fair – 18th of October 2017

Thank you for your attention!