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Background Information

Siemens Mobility GmbH

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How digitalization is transforming the future of mobility

Rail and road infrastructures have long since reached their limits in many metropolitan regions. Today, over half of the world's population already lives in cities, and by 2050, an additional 2.5 billion people will live in megacities and urban regions worldwide.

Creating connected mobility of the future

Digitalization will be the principle driving force behind the connected mobility offerings. Internet and smartphone apps have strongly influenced options for personal mobility and have made intermodal travel possibilities available to every traveler. At the same time, new competitors and mobility offerings have increased pressure on traditional transport companies. To remain an attractive part of the transportation chain in the future, operators have to expand and improve their offerings and ensure that they are viable for the future. Their customers expect easy-to-use digital apps, reliable transport at reasonable prices, and practical offerings for the first and last kilometers of their journeys.

To meet these demands, transportation in the future will need trains with improved passenger information systems and entertainment. Personalized information has to be provided to passengers online and punctually in order to make journeys and transfers efficient, convenient and comfortable. At the same time, improved entertainment offerings will change the passengers' perception of public transport: Waits will be leisure time.

The new Velaro Novo trainset is based on the proven distributed traction system used since the ICE 3, can be delivered as a single- or dual-system train (15 kv/25 kV), and has a scalable traction system for top speeds of 250 km/h to 360 km/h. The

Siemens Mobility GmbH
Communications
Head: Frederick Jeske-Schönhoven

Otto-Hahn-Ring
681739 Munich
Germany

corresponding power outputs range from 4,700 to 8,000 kW. In a seven-car configuration, the Velaro Novo is 202 meters long and can be operated with either single or dual systems. A 404-meter long 14-car version is also available.

Outstanding energy efficiency

With the Velaro Novo, Siemens Mobility is writing a new chapter in its Velaro success story – one marked by innovations in energy efficiency. Running at 300 km/h, for example, the new high-speed train uses 30 percent less energy than previous Velaro models, which translates to savings of 1,375 tons of CO_2 emissions a year.

Rigorously improved aerodynamics are essential for achieving higher energy efficiency and thus substantially reduced lifecycle costs. The completely covered and streamlined bogies cut energy consumption by roughly 15 percent and lower noise emissions. The aerodynamics of the end cars, further improved with a more streamlined front surface, and gangway connections that are flush with the train's body shell substantially reduce aerodynamic drag and cut energy consumption by around ten percent. In addition, the high-voltage equipment on the car roof is also completely covered, further improving the aerodynamics.

Furthermore, the Velaro Novo is around 15 percent lighter than previous Velaro generations. New profile and welding technologies for the body shells, mass-optimized inbound bogies, new on-board converters and the use of innovative materials and construction solutions are just a few examples of the advances that have reduced the train's weight by over 70 tons. The design of the inbound bogies, proven in the Desiro City trainsets operating in the United Kingdom, was combined with experience gained with Velaro bogies and further refined for the Velaro Novo. The inbound bearings substantially lighten the running and traction bogies and, as a result of the lower unsprung mass, ensure smoother operation and reduced wear.

Low-wear, cost-efficient operation

Maintenance costs for the new train will also be substantially reduced. Continuously collected status data from the train can be analyzed and provide precise instructions for predictive, condition-oriented maintenance work. The electrical high-performance brakes with brake resistors enable braking largely without wear and tear, considerably reducing maintenance costs for the pneumatic braking system.

A flexible and reliable infrastructure is the backbone of mobility. In the future, IP-based infrastructure communication will require fewer cables and other hardware. This will ensure that system information is accessible everywhere, foster more automated train operations and revolutionize infrastructure management.

Front runners in digital train control

In the past, signals and points were controlled mechanically and by cable from local and regional interlockings. In order to increase throughput on rail systems, Siemens Mobility is focusing on increased automation through Ethernet-based interlocking technology and remote controls from a central control center.

Siemens Mobility has put the digital interlocking system Trackguard Sinet in Switzerland into operation since 2012. In March 2018, the company won its biggest order ever for rail automation systems with the Sinet technology: The entire Norwegian long-distance rail network will be digitalized – and controlled from a single interlocking in Oslo.

Trackguard Sinet not only requires considerably fewer cables and hardware components, but offers a decisive advantage: a simple upgrade to the cloud. In the future, it will be possible to process certain functions of the interlocking and the control center in the cloud – in a highly available, central computer center – and make these functions available to the railway operator as a service.

Distributed Smart Safe System

Siemens Mobility has developed a new, software-based platform for its portfolio that makes proprietary hardware redundant. With it, future interlockings will operate completely on standard servers or in the cloud. Keeping spare parts and a pool of specialized workers as done by many customers to maintain their various generations of long-lived interlocking technologies will be history. In the future, adaptions and replacements can be done with software updates, speeding up project planning and execution.

IT security in the age of digitalization

In all the discussions about the potential and impact of digitalization, one shouldn’t forget our main objective: guaranteeing the safe and secure transport of people and

goods. In the past, safety-critical traffic networks were always operated in closed, local systems to secure them against criminal intrusion. But to further optimize operations and increase the availability of infrastructure, huge volumes of data must be accessed from existing systems to undergo statistical analysis. Siemens Mobility has developed a solution for accessing this data – both from the installed base as well as from new systems – and which meets the highest safety and security standards in the rail industry.

Data Capture Unit (DCU) & MindSphere IoT operating system

The DCU, certified by Germany's Federal Railways Authority, is a unidirectional gateway which ensures that data can flow only in one direction and that safety-critical networks are always protected from possible cyber-attacks. This enables connectivity, compliant with the highest safety and security standards, with MindSphere – the open IoT operating system from Siemens. The data collected from railway systems is then analyzed with artificial intelligence to optimize operations and availability.

Higher capacity through ETCS Level 3

In traditional train control systems with permanently installed signals, trains follow one another from fixed block to fixed block. If a block is occupied by a train, the following train must stop. Since the blocks vary in length from a few hundred meters to a number of kilometers, trains must always wait until the next block is free. As a result, throughput is low and operations are inflexible. The European Train Control System (ETCS) operates in Level 3 without wayside signals and track vacancy detection devices. Instead, a train's actual position is transmitted by radio to the Radio Block Center. ETCS L3 thus enables safer and more flexible headway without the need for fixed blocks. This increases line capacity and lowers infrastructure costs, since signals no longer need to be installed and monitored. An ETCS L3 emulation based on actual hardware and software will be presented at the InnoTrans 2018.

Automatic Train Operation over ETCS

Line capacity can be further boosted by increasing the degree of automation. The Siemens Mobility solution Trainguard for ETCS with Automatic Train Operation (ATO) can be used for all ETCS levels. It shortens headway on busy lines and

increases transport capacity. In addition, energy savings can be achieved through optimized driving.

The digital station

Railway stations are the central hub for local and long-distance transport. They help shape the travel experience of passengers and play a key role in efficient rail operations. The Controlguide Digital Station Manager (DSM) from Siemens Mobility seamlessly combines modular solutions for the monitoring and control of technical processes (SCADA), passenger information systems (PIS), public address and voice alarms (PAVA) and security systems like surveillance cameras and access controls with signaling and power supply systems. The goal is to optimize the capacity of railway stations and local rail transport systems by quickly guiding travelers through the station, escalators and train platforms. In addition, passengers can be shown where seats are available in each coach, which speeds up entries and exits and reduces the dwell times of the trains.

Keeping focused on the passenger

To ensure that public transport systems remain a viable alternative to personal transport modes in the future, operators must provide travelers integrated mobility offerings. The key to intermodal travel lies in the seamless combination of various transport modes, a reliable infrastructure and the active involvement of passengers in the operations. With our subsidiary HaCon and its diverse travel apps, we have created such an interface to the passenger and we will continue to work with our customers and business partners to shape the future of mobility.

Contact for journalists

Kara Evanko
Phone: +1 202 285 3072; E-Mail: kara.evanko@siemens.com

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