



COMPUTING POWER FOR SMART TRAINS

High-performance PC for the full range
of train communication



The demands on communication systems in rail transport have increased considerably in recent years. In addition to WLAN for passengers, diagnostic systems for predictive maintenance, applications for video security or real-time travel information are increasingly becoming state-of-the-art. With Colibri, Deutsche Bahn AG offers a modular solution for transport companies that covers all communication tasks, including support. At the heart of Colibri is an intelligent high-performance PC from Kontron, acting as the central computer in the vehicle and controlling all diagnostic, communication and monitoring functions in all areas of public transport.

🎯 TARGETS

- ▶ Central platform for diagnostics, communication and monitoring in public transportation
- ▶ Easy integration even into existing vehicle fleets
- ▶ Future-proof solution in terms of performance and new radio networks or standards

🚀 CHALLENGE

- ▶ High computing performance and at the same time highest reliability and flexibility
- ▶ Fulfillment of all safety requirements and standards in rail vehicles
- ▶ Uniform digital solution for different transport systems with maximum flexibility and scalability

💡 RESULT

- ▶ High-performance PC as central computer with standardized interfaces for all communication, diagnostic and monitoring tasks
- ▶ EN 50155 certified platform with communication options such as WiFi, Gigabit Ethernet, 4G/5G LTE or GPS, up to four 5G modems for external communication and eSIM option for simple and fast provider change

DB Fahrzeuginstandhaltung GmbH
Frankfurt

Project:

Digital in the Regio

Kontron Platform:

High-Performance-PC

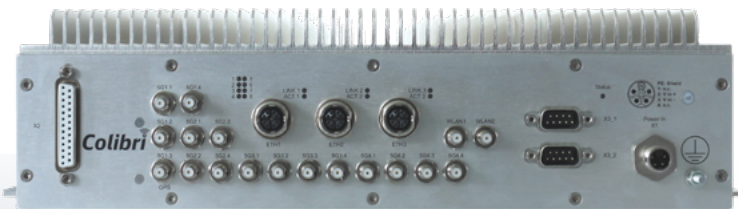
Colibri is a comparatively young organizational unit of DB Fahrzeuginstandhaltung. Almost 40 employees are working on advancing networking technologies while being responsible for engineering, installation and modifications. The solution has the same name and is an abbreviation for Coach Link for Broadband Information Exchange.

www.db-fzi.com



As early as 2015, the installation of WLAN in trains started so that passengers could surf the internet on the move - this quickly became a 'must have'. At that time, Colibri was created to further expand the spectrum in the direction of diagnostics and security.

Catharina Schick, Marketing and Sales Officer for the Colibri IT onboard product range at DB Fahrzeuginstandhaltung GmbH



// High-performance PC for the full range of train communication

WIFI, IOT AND SENSOR TECHNOLOGY HAVE CHANGED RAIL TRANSPORT

Today, passengers expect to be able to use their smartphones, tablets or laptops online throughout their rail journey. Moreover, entertainment systems such as the ICE portal with films and e-journals have become established. In addition, there are now a variety of other communication tasks related to IoT (Internet of Things) on the train. These include, for example, travel information systems or passenger counting systems, which can be used to display the occupancy rate of a train. Furthermore, tracking, real-time diagnostics for train systems and video security are part of it. Colibri is a one-stop solution that transport companies and associations can integrate into their fleets comparatively easily. It offers a 24/7 operating guarantee as well as software support and maintenance. Customers can choose exactly the functions they need from the modular system. By the end of 2021, more than 1700 Colibri systems were already in use in 16 regions, and the 2000 mark is soon to be exceeded. The solution is also increasingly being used in buses.

SOUND HARDWARE SELECTION FOR THE TECHNOLOGICAL CORE

"Colibri transforms a simple train into a Smart Train", says Catharina Schick. Core of this solution for digital intelligence in rail transport today is a central computer from Kontron. In order to be able to offer the most innovative technology possible, various suppliers were scrutinized as part of a Europe-wide tender two years ago.

"Based on our evaluation matrix, Kontron turned out to be the best provider in terms of technology and price. The decisive factor was the performance of the overall system, in terms of CPU, main memory and communication modules," recalls Thomas Derlig, Team Leader Market Development for IT on Vehicles at DB Fahrzeug-instandhaltung. Colibri has now been working with the embedded and IoT technology specialist since 2021. Meanwhile, Colibri offers its customers a choice of three central computer variants. These include a 5G computer, a 4G/LTE computer and a "Rail WLAN only" option: a light variant with three LTE modems.

The 5G variant in particular demonstrates the focus on innovation that will offer travellers further advantages in the future – made possible by the features of 5G technology.

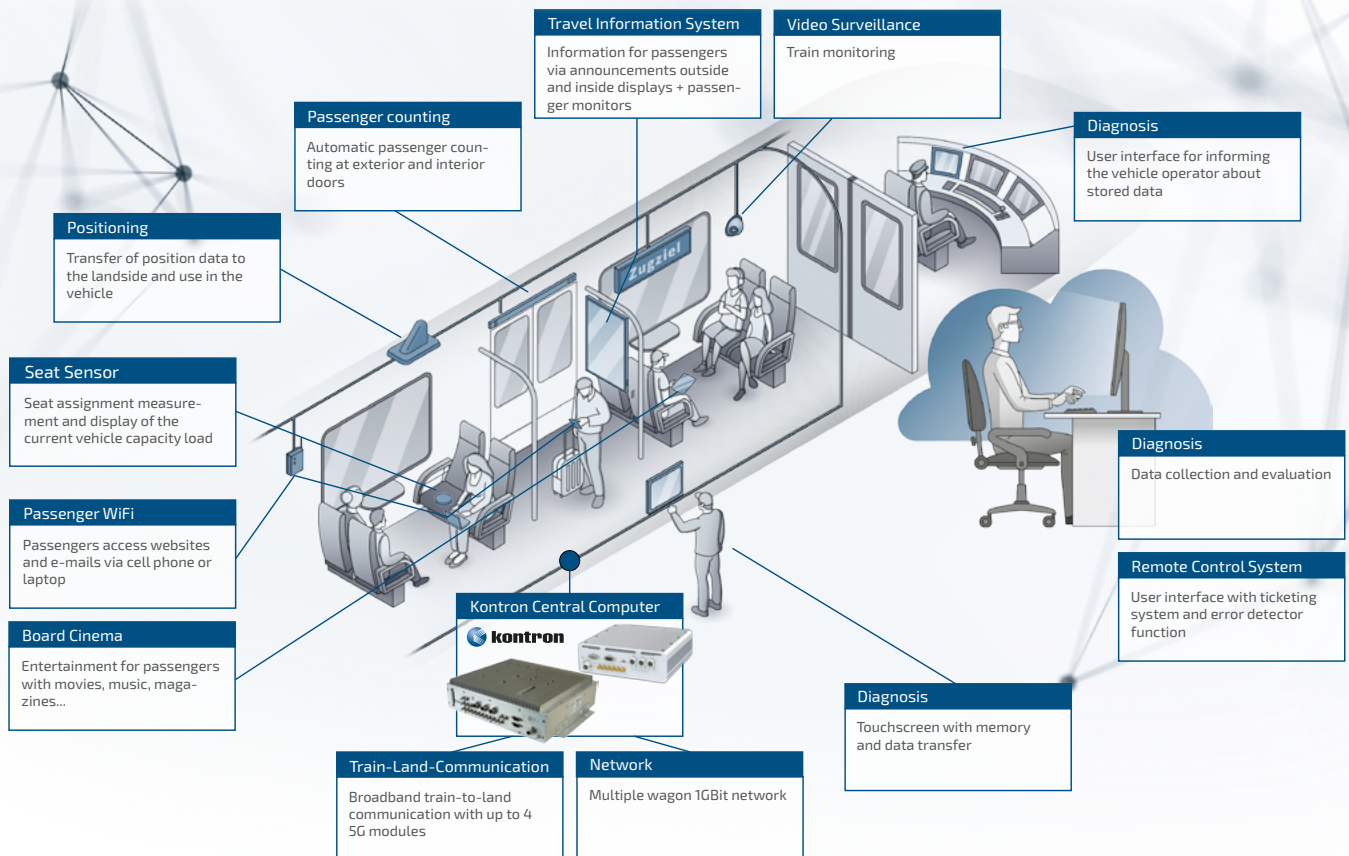
SAFETY AND LONG-TERM AVAILABILITY AS FOCUS IN THE TRANSPORT SECTOR

The safety requirements for hardware in rail vehicles are particularly high, especially with regard to fire protection and robustness. This is why all Kontron central computers comply with the EN 50155 standard. These intelligent high-performance PCs offer communication options such as WiFi, Gigabit Ethernet, 4G/5G LTE or GPS and up to four 5G modems for external communication, as well as an eSIM option for a quick and easy provider change and optionally two exchangeable SSD storage media, for

example for the evaluation of video data. In addition, the computers operate in an extended temperature range of -40 °C to +85 °C. The absence of moving parts such as fans significantly increases reliability and extends the mean time between failures (MTBF). The challenges in the transport sector are subject to permanent change. The entire hardware system concept is therefore modular and scalable so that it can easily be adapted to new tasks. "It is very important to us to work with a technology partner where we can participate in the further development of the product, as well as constructive cooperation and open communication", emphasizes Thomas Derlig.

COMPLEX RANGE OF TASKS FOR A CENTRAL COMPUTER

The Colibri system not only covers the application in trains, but can also be used in other transport systems such as buses as well as in ticket vending machines and electric charging stations - the goal is in supporting continuous mobility beyond the train. Creating a uniform digital solution for so many different means of transport, ticketing systems, vending machines and terminals is a mammoth task. In addition, customers should be able to configure their system as they wish and thus remain as flexible as possible. System openness and manufacturer independence therefore play a particularly important role for the Colibri experts. This flexible approach



enables the redesign of older vehicles on the one hand and the development of innovative systems for new vehicles on the other. Of course, this mindset has also been applied to the central computer. Here, the system platform concept relies on standardized interfaces. They offer a high degree of flexibility in terms of add-on cards that can be used for various wired and wireless interfaces and processor modules. As far as the supported operating system is concerned, the system solution is absolutely Linux-compliant. The open-source operating system ensures a high degree of openness. However, standards that have been developed for the industry must also be integrated, especially when it comes to the inclusion of technical components in the train.



There are comprehensive standards for WLAN and communication with the terminals, but some use cases remain proprietary. Interfaces and high-performance hardware have to bridge those gaps.

Joshua Donath, Product Management IT at the vehicle team



// DB employee checks the diagnosis

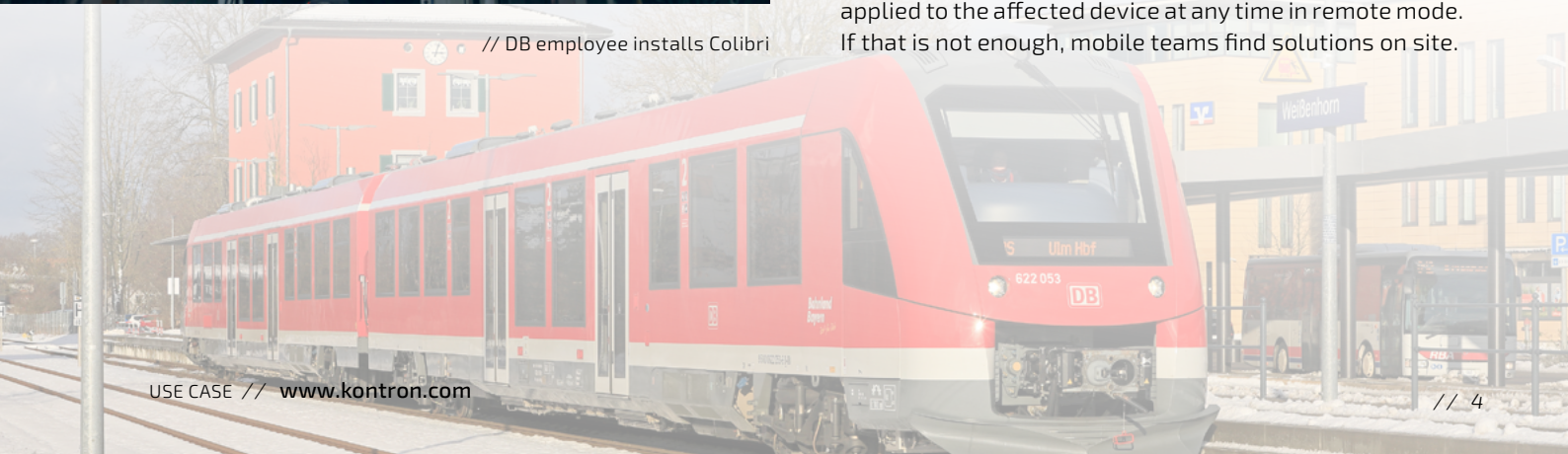
PREDICTIVE MAINTENANCE IS ON THE RISE

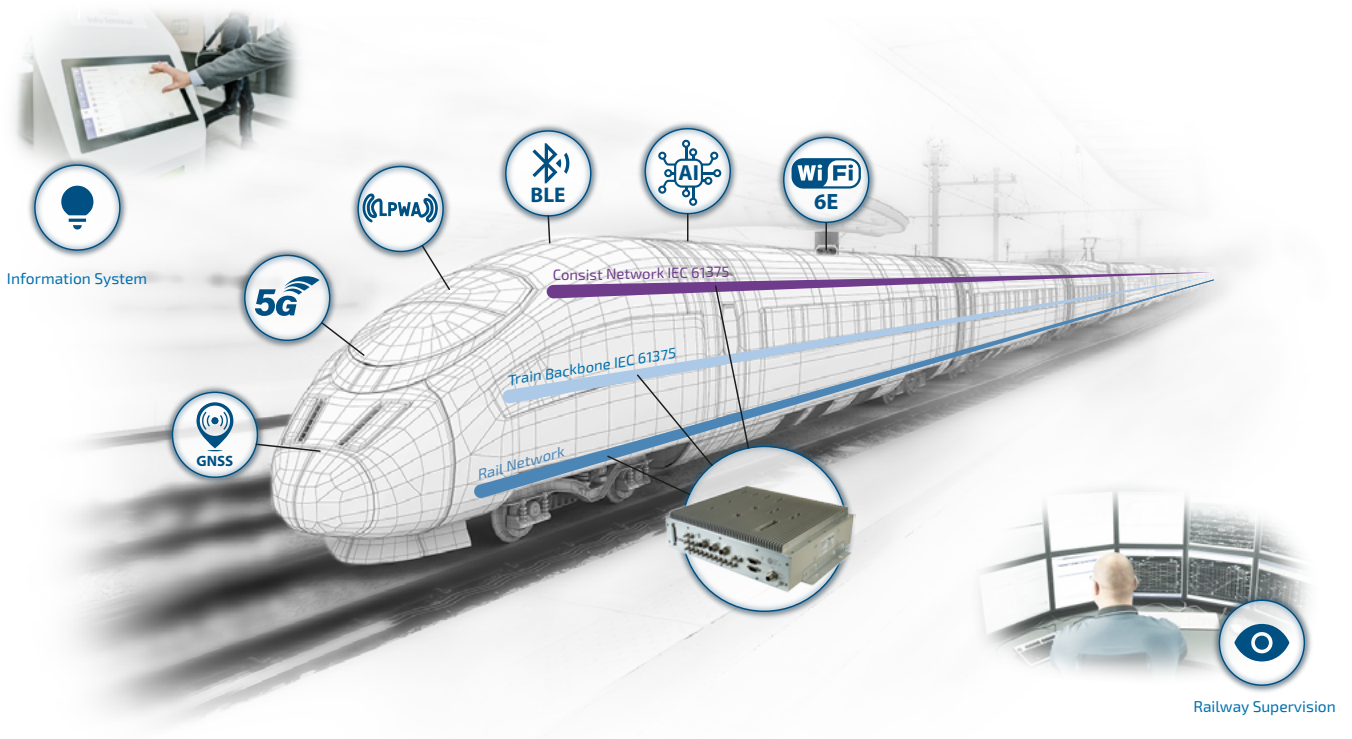
"Diagnostic technologies are becoming increasingly important for rail vehicle operators. Wherever the transmission and analysis of sensor or system data is used, maintenance benefits considerably," explains Catharina Schick. "A wide variety of data from operational management is collected and transferred to the land side for Big Data analyses in data centres in order to implement predictive maintenance on this basis." Every hardware component connected to the vehicle and to Colibri is monitored, including switches, access points or video cameras. But also systems that can be diagnosed, such as doors, energy supply, heating, drive or WC, air conditioning, WLAN or travel information are continuously checked. In the vehicle itself, operating states are being analyzed. As soon as process values leave predefined ranges, the system investigates whether a fault is to be expected. "With Colibri, defects can be diagnosed early and accurately and, if necessary, repaired remotely or reported to the workshops in advance. This significantly increases the availability of the connected systems", says Thomas Derlig, citing an important advantage.



// DB employee installs Colibri

In this way, spare parts can be scheduled in good time and the necessary maintenance or repair processes as well as the deployment of personnel can be planned in advance with a view to the required skills. "The rail transport companies have a great interest in all services and systems being available again quickly", reports the team leader. Colibri offers a choice of support variants from first to third level. The central computer allows secure remote maintenance. For example, updates can be applied to the affected device at any time in remote mode. If that is not enough, mobile teams find solutions on site.





HIGH PERFORMANCE IS THE FOCUS

The demand for bandwidth is immense, especially for WLAN and entertainment. For example, if 200 video streams are to be supported simultaneously, a high-performance network connection is required. The necessary performance is provided by Intel® Core™ i7 processors, which are exceptionally powerful on the one hand and offer optimized power consumption on the other. This is important for cooling the fanless computer, especially at high ambient temperatures. The central computer establishes the connection to the back-end systems on the land side and the passengers first dial into the WIFI@DB via access points. The central computers are equipped with several wireless modules, for example for WLAN, LTE or 5G, and up to eight SIM cards. They each access different providers to ensure an optimal connection. This is because in the event of bandwidth restrictions, such as in tunnels, or gaps in mobile network coverage, wireless communication repeatedly comes up against limits.

Therefore, in order to achieve the required availability and to manage incidents, not only one single radio transmission method is being used: an intelligent algorithm continuously monitors whether better network coverage is available from another provider in order to successively log the modules into another network, ensuring a stable and uninterrupted radio connection. Currently, 4G is the main network used. In the future, it will be the faster 5G with better bandwidth. The Kontron computers also ensure that all WLAN clients in the system are completely decoupled from the rest of the train network for security reasons. After confirming the terms and conditions and logging in, the login on the land side and the routing into the public network takes place.

FAST IMPLEMENTATION ON THE TRAIN

Colibri processes enormous amounts of data. The video data from 72 hours of recording alone adds up to many gigabytes. They then get transmitted in encrypted form to a network storage facility. The central computer manages the entire network and ensures that the connection remains permanently stable.

The implementation time of the system per vehicle is manageable: the installation of the central computer with the cabling between train and land side takes an average of half an hour. Including the installation of the cables, the workload adds up to two to three hours. Sensors in the seats or a sensor for counting passengers above the door can also be added. Displays with touch screens for staff and drivers serve as human-machine interfaces on which diagnoses can be carried out.

For the near future, the focus will be primarily on the area-wide expansion with the 5G computer variant. "We are looking forward to the innovations we can implement together with Kontron when the next even more powerful chip generations come onto the market. Within the framework of our development partnership, our ideas are always appreciated here", team leader Thomas Derlig sums up the plans for the future.

CENTRAL COMPUTER / EN 50155

Rail-certified Box PC

- ▶ Powerful Intel® Core™ i7-8665UE processor
- ▶ 2x hot-swappable 2.5" SSD with security key (RAID option available)
- ▶ 4x 5G modem modules each with 4x 4MIMO and eSIM functionality, WiFi, GNSS
- ▶ Fanless operation at extended temperature range -40...+70 °C, +85 °C for 10 minutes
- ▶ Full wide range railway certified PSU (24 - 110 V DC nominal) Class S2
- ▶ Digital In/Outputs, Odometer, Relay-functionality



About Kontron

Kontron is a global leader in IoT/Embedded Computing Technology (ECT) and offers individual solutions in the areas of Internet of Things (IoT) and Industry 4.0 through a combined portfolio of hardware, software and services. With its standard and customized products based on highly reliable state-of-the-art technologies, Kontron provides secure and innovative applications for a wide variety of industries. As a result, customers benefit from accelerated time-to-market, lower total cost of ownership, extended product lifecycles and the best fully integrated applications.

For more information, please visit: www.kontron.com

About the Intel® Partner Alliance

From modular components to market-ready systems, Intel and the over 1,000 global member companies of the Intel® Partner Alliance provide scalable, interoperable solutions that accelerate deployment of intelligent devices and end-to-end analytics. Close collaboration with Intel and each other enables Alliance members to innovate with the latest IoT technologies, helping developers deliver first-in-market solutions.

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