DB Systel
Moving the digital future. Together.

"Rail operations of the future" showcase
in the Skydeck Frankfurt am Main

Blockchain - The future of Railway Systems?
The world's first blockchain-based railway

Blockchain may well be the most hotly debated topic in the business community at present. Yet there have been few implementations to date. Blockchain offers a great deal of potential – particularly for a technology company and industry leader like Deutsche Bahn.

A peek under the hood of blockchain: rail operations of the future
The use of blockchain makes sense wherever secure transactions are involved. Most of today's blockchain applications are in the commercial sector and are limited to the virtual world. On a theoretical level, you also have a secure transaction when a train runs on a route section or passes through a station or switches. Deutsche Bahn is therefore currently investigating whether blockchain could also be used to move trains weighing several tons.

The idea is that trains communicate with each other and with other elements, such as signals, switches and train paths via the blockchain. The blockchain provides the necessary transparency in real time, e.g. which section is occupied at what time by which train. As a result, the train itself "knows" whether a train path is currently free or not. That means the train can itself book and run on its train path before releasing it again for the next train.

Certain requirements need to be met for implementation: trains, switches and rails must be mapped digitally in the blockchain. That way, they can interact and negotiate services with each other, as well as securely document processes. This can of course only be done in conjunction with other technologies such as sensors or AI.

Initial tests in the operation simulation facility in Darmstadt have shown that traffic management with blockchain is theoretically possible. The next step is a test with real trains.

Deutsche Bahn's challenges
- Punctuality and quality of the service as well as safety of rail operations
- Customer communication regarding current train plans as well as information consensus across all train operators, particularly in the event of an incident
- Compelling prices compared with the competition as well as reduction of internal process costs

The DB Systel Blockchain Crew shows ways in which Deutsche Bahn could master these challenges in future with the aid of blockchain technology.

The potential of blockchain for Deutsche Bahn

Shared information for a shared infrastructure

Every participant in the rail network would have access to all the shared ledger information – this facilitates direct coordination between everyone involved, speeds up the processes with far better data quality, documents these processes in a tamper-resistant way, while reducing the time and effort involved.

Simplicity of infrastructure usage

Smart contracts allow automated processes to be implemented, such as billing infrastructure usage. If a train books a certain train path, for instance, the switches are set accordingly and the costs and income distributed directly on a pro-rata basis in real time. This kind of solution would also be feasible on the road as an alternative to the toll system, as blockchain technology already includes the out-of-the-box wallet function.

System availability

Decentralisation also supports a greater degree of flexibility and availability. At present, the system is managed centrally. Failure of an interlocking brings all train operations to a standstill. Today, rail companies are also dependent on route opening times and occupancy times of interlockings. Blockchain-based control of the rail operations would enable the rail companies to directly control and bill the infrastructure usage.

Reduction of hardware infrastructure

Using blockchain technology could mean a reduction of costly, railway-specific hardware infrastructure.

Emergence of clear benefits

Simplification of the infrastructure

The blockchain system works essentially as an IoT platform, whereby each infrastructure element communicates directly with the local database to look for instructions. That way, the train "knows" when it should start and stop; the switches "know" which position they need to change to and when specifically. Each IoT device can operate fault-free fully autonomously.

Simplification of infrastructure booking

The process of searching and booking a suitable route becomes a simple procedure for mobility providers - a procedure that can even be completed in a matter of minutes.

Automatic payment distribution in real time

A part of the revenues is already reserved for the infrastructure provider during the booking. When the train approaches the part of the infrastructure - e.g. a station, the relevant amount is automatically transferred using the smart contract.

In a nutshell:
What is blockchain?

Blockchain is an enabling technology for securely exchanging values. It consists of a "chain" of data packets, which cannot be changed subsequently thanks to encryption. The data chain is stored locally on multiple computers.

Each participant receives and processes information, which is constantly synchronised to maintain the history of all transactions. In this way, information can be stored in a tamper-proof, transparent manner in the blockchain.

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