Blockchain

Company Core Technology

Background

Blockchain is a technology for distributed databases and a digital protocol for transactions between business partners – involving no intermediary such as a bank or a payment system such as PayPal. Wherever data or values are transferred, and records need to be kept of such transactions, blockchain-based smart contracts can be used to make simpler and more secure processes. Blockchains combine three mathematical disciplines in a new and elegant way: cryptography, distributed systems and game theory. A blockchain records transactions in a linear chronological order that is open and traceable at all times. One of the best-known blockchain applications is the Bitcoin digital currency.

Importance for Siemens

The current focus is on financial and legal transactions that exploit the advantages of decentralized databases with a peer-to-peer approach across corporate boundaries. This is very significant for Siemens in many respects – when it comes to trading electricity in complex markets, for instance, or providing services on a digital basis. Blockchain is therefore a company core technology at Siemens. In the energy sector, for example, the US start-up LO3 is partnering with Siemens to create microgrid applications that make it easier for operators of photovoltaic systems to sell their surplus electricity.

Other possible applications areas:

Distributed audit trails:
From design right through to decommissioning, industrial facilities must comply with a large number of rules and regulations, and prove their compliance. They must be able to demonstrate their conformity to external bodies such as technical standards agencies, supervisory authorities or insurance companies. Even in building projects where Siemens acts as general contractor, a large part of this conformity documentation is created outside the company itself. Up to now, creating and checking this documentation has involved mountains of paper being sent back and forth between the bodies involved. This is where blockchain technology comes in: it can be used to create a secure database for a digital workflow.

Distributed ledger:
How does an autonomous vehicle pay for its parking space? Using blockchain technology, autonomous machines can have a "wallet" that enables them to process transactions themselves. Tracking assets – such as vehicles in an autonomous mobility system – and their billing across an entire life cycle is beyond the scope of any one company's asset management system. A common distributed

database (ledger) used by all the partners brings advantages (such as lower costs) for all those involved.

Smart contracts:
The automation of complex, multi-level, conditional transactions and processes can be applied in the coordination and regulation of a large number of industrial activities, ranging from commercial transactions and business management (such as financing or decision-making) right through to operations management (such as monitoring). A well-known example is the trading and purchasing of "green" solar power among neighbors by means of an automated blockchain-based process between the smart meters in the participants' homes.

Success stories and research focus
We expect blockchain technology to be mature enough for commercial use in an industrial context in around five years' time. In order to adhere to this schedule, we still need to overcome several complex technical challenges. CCT Blockchain is developing a roadmap of how these tasks can be approached in a structured fashion.

Scaling and performance:
Response times for real-time applications and throughput rates for industrial-scale IoT structures

Authenticated data flows:
Confidential data that originates, for example, from sensors, automation systems or external web services

Confidentiality:
A suitable balance between the necessary transparency with regard to consensus and the required confidentiality with regard to content

Security and compliance:
New types of protocols for monitoring and intervention in blockchains – to report cases of fraud, for example

Correctness of design and implementation:
Automated creation of secure blockchain software