



INDEPENDENT SAP TRENDS, ANALYSES, STRATEGIES AND IN-DEPTH REPORTS FROM BUSINESS AND IT



Spotlight: Blockchain

Josef Packowski (l.), Founder and CEO of Camelot Consulting Group, and Steffen Joswig, Managing Partner at Camelot Innovative Technologies Lab, are blockchain pioneers in the SAP Community. In this E-3 Special they explain the megatrend and opportunities for existing SAP customers

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Spotlight: Blockchain

Josef Packowski (left), CEO of Camelot Consulting Group, and Steffen Joswig (right), Managing Partner of Camelot Innovative Technologies Lab, are blockchain pioneers in the SAP community. Here they explain the megatrend and the opportunities for existing SAP customers.

For some people, the blockchain boom is just a case of old wine in new bottles, while others anticipate disruptive applications. What is beyond doubt is that blockchain is able to solve many tasks very elegantly. Moreover, it is generally available thanks to cloud computing and frameworks. Because the blockchain method promises very high security for information exchange, it is ideally suited for B2B scenarios and specifically for ERP environments.

SAP partner Camelot was one of the first companies in the community to engage with blockchain at a deeper level, and today it is a leader in this area. E-3 Editor in Chief Peter M. Faerbinger spoke to Josef Packowski, CEO of Camelot Consulting Group, and Steffen Joswig, Managing Partner of Camelot Innovative Technologies Lab (Camelot ITLab).

In the past few years, blockchain has attracted more attention than almost any other technology. Inspired by the

soaring success of cryptocurrencies, more and more sectors beyond the financial industry are investigating the application possibilities of this highly encrypted, and thus secure, distributed database technology. Blockchain is a database system that is distributed over many nodes in a network. Strong cryptography protects it against manipulation. The “network,” in which the data is present in concatenated and encrypted form, has a further advantage: A data transaction can take

place without an intermediary – and is counterfeit-proof, too! Blockchain could change the way in which market participants in various sectors conduct transactions with each other – turning whole sectors inside out in the process. In industries such as logistics and manufacturing or the energy sector, numerous companies are exploring application possibilities: everything from direct electricity trading between neighbors to transparent, traceable supply chains.

The technology

The possibilities of blockchain technology offer an ideal basis for large networks with many different partners. They work like a shared ledger in which all the transactions that take place inside the network can be recorded in a shared, unalterable manner. In addition, they give duly authorized partners access to the confidential data in real time. With the use of this technology, a completely new system of instructions and authorizations can be introduced into the information flow. It allows the different trading partners to obtain a shared view of the transaction which has been agreed by all the parties – one in which, moreover, confidentiality and data protection are guaranteed.

Is it possible to describe blockchain technology in a nutshell? “An adequate explanation needs a bit more space, I’m afraid,” replies Steffen Joswig. “Blockchain is essentially a concatenated list in which every list entry (block) can comprise one or more data sets. The concatenation is realized through cryptographic fingerprints known as hash entries. Each hash entry is created out of all data sets of a list entry. The hash entry is included in both the previous and the subsequent list entry. Consequently, list entries are unalterably linked together, like a chain.”

Smart contracts

Furthermore, blockchain is a fully redundant data repository. All participants in a network possess all data, which is constantly synchronized. “However, the true essence of blockchain is the programmability of the network via smart contracts,” emphasizes the Managing Partner of Camelot Innovative Technologies Lab. A smart contract is a small program that is installed in the blockchain and kept there – just like other data – in a redundant, unalterable manner. Through the interplay of smart contracts, data and predefined events certain processes can be

modeled in a counterfeit-proof and trustworthy way without the need for the middlemen that have been necessary before.

To give an example: IBM and Maersk, world leaders in container logistics, launched a collaboration in June 2016 to jointly develop new blockchain- and cloud-based technologies. These are designed to help companies track the route their goods take across international borders. This would benefit manufacturers, shipping and transportation companies, ports, terminals, and customs agencies.

Blockchain is not the same thing as Bitcoin

“Bitcoin was the first implementation of a blockchain – and has even caught the attention of the world’s media on account of the speculation hype,” explains Josef Packowski, CEO of the Camelot Consulting Group. “However, this ignores that blockchain is just one of many elements in the Bitcoin architecture. We always stress that blockchain is not the same thing as Bitcoin.” Is blockchain a fashion trend, then, or a megatrend, because confidential communication and data exchange will no longer be possible without blockchain? “Confidential communication and data exchange are possible even without blockchain,” emphasizes Packowski. “That alone does not make blockchain a megatrend. Although concepts such as asymmetric encryption are an inherent part of blockchain, it should not be reduced to them alone. The full potential of the technology will only be realized when a blockchain network is used as a “trust machine” that removes the need for middlemen.” Drawing on his experience in initial projects, Steffen Joswig adds: “To implement something like this, however, all blockchain concepts – the guaranteed authenticity of all participants, decentralization, the immutability of data, and secure program flows (smart contracts) – must be deployed in equal measure. Regarding this field of application, blockchain is indeed a megatrend, and one that will soon be indispensable.” From the perspective of an existing SAP customer: For which applications could the use of blockchain work based on ECC 6.0 and S/4? “In the context of SAP systems going forward, we see side-by-side additions to existing SAP modules as a starting point,” explains Steffen Joswig. “From



case to case, we must now discuss which data from the SAP system can be usefully associated with blockchain.” Without experienced partners such as Camelot, projects like this are scarcely practicable, as they require a lot of business and technical know-how: As a rule, no data is stored redundantly on the blockchain, rather it is registered there via a cryptographic hash. This approach ensures that you cannot alter the associated data in the SAP system unnoticed. In this way, you could implement track & trace scenarios secured by blockchain in the SAP SCM environment or create inter-company transport marketplaces in SAP TM. “But these use cases generally only use individual blockchain features such as immutable history,” notes Steffen Joswig. “More interesting are use cases in which the blockchain functions as a trust machine mediating between several parties. In this case, the SAP system and its database act merely as a so-called off-chain persistence, as the application logic generally has to take place in the abovementioned smart contracts whenever trust is not fully present.”

In addition to the new business processes, another important question for existing SAP customers is naturally the infrastructure and the hardware you need to use blockchain. “That depends on the selected deployment method, which in turn strongly depends on the use case,” reckons Josef Packowski, before handing over to his colleague Steffen Joswig: “Publicly accessible blockchains are the most hardware-intensive, because they use a computing-intensive proof algorithm, such as with Bitcoin and Ethereum. For consortium blockchains with a clearly defined set of participants, however, a small Linux VM per node is sufficient, with manageable resources per blockchain node.”

“We ourselves do not offer any blockchain of our own,” adds Josef Packowski. “There are very many blockchain technologies on the market. But using them generally turns out to be very complex in



practice. We've taken all our accumulated experience with blockchain technologies and put it into our Camelot Hypertrust Platform." Camelot has invested a lot of resources into its work on blockchain technology, and this benefits the SAP community today. "At the beginning of our research in this area, we decided that we would not simply document it, but invest in a reusable framework," explains Joswig. "Using the framework, we can develop individual blockchain use cases for customers in double-quick time. In customer projects, we then supplemented our framework with requirements from real-life use cases." Setting up and operating ordinary blockchains is a complicated business. "Without spending dreary hours inputting commands in command lines, you cannot begin with the development of distributed applications," says Steffen Joswig, who knows the truth of this all too well from his operational environment. But at Camelot, they asked the questions: How can we simplify this process? How can we reduce the implementation costs in blockchain projects? How can we empower customers even without development staff to experiment with blockchains? These questions gave birth to the Camelot Hypertrust Platform. "It is difficult to use a raw blockchain directly for application development," emphasizes Josef Packowski. That would be like a database without an application server, explains his colleague Steffen Joswig: "For us, the middleware serves as a link between the blockchain, a user interface based on SAP-UI5, and further services, such as Web services from the SAP Leonardo portfolio – IoT, AI, etc. – and also as a container for our blockchain applications. These consist partly of smart contracts and of chain code inside the blockchain and server-side Java scripts outside the blockchain." Another question also arises: private or public blockchain? "Depends

on the use case," says Josef Packowski. "But within the context of value chains, we're usually talking about consortium blockchains – a private network with a clearly defined group of participants. Completely private blockchains are generally only needed for development."

Through initiatives such as those pioneered by Camelot and SAP Leonardo, the topic has definitively arrived in the SAP community. "Our customers and partners want to work with us and employ blockchain as a decentralized transaction register to improve cooperation and transparency," says Tanja Rueckert, President IoT & Digital Supply Chain at SAP, who will become President of Bosch Building Technologies on August 1st, 2018. "The goal is a future in which blockchain is an integral part of the digital value chain." At SAP, for example, the Advanced Track and Trace for Pharmaceuticals pilot project was created, which can help pharmaceutical companies comply with the legal requirements for protection against counterfeit drugs.

Through joint innovation with customers and partners, SAP wants to create use cases for blockchain that can be employed in a standardized manner and on a broad basis – in logistics and in SAP Leonardo IoT solutions. "What's interesting is that similar architectures quickly emerged here," says Josef Packowski. The Camelot Hypertrust Platform was unveiled to customers in the first quarter of 2017 (then still called the Camelot Hypertrust Network). "When we saw the first beta version of the SAP Cloud Platform Blockchain Service at the end of the second quarter, we were taken aback by the similarity of the two stacks," recalls Packowski. "Many of the components used are common to both. Through the deployment model, however, the two offers differ quite clearly: SAP Cloud Platform Blockchain Service is only available in the cloud, whereas the Camelot Hypertrust Platform can fill on-premise "blank space" in a SAP context, but in principle can also be operated in the cloud." Steffen Joswig explains further: "At first glance it seems abstruse with blockchain, which is designed to eliminate the need for trustworthy third parties, to rely on trustworthy third parties – cloud providers. But the fact is that these are software and hardware services which also have their justification in the blockchain environment. The provision of ready-made frameworks to simplify

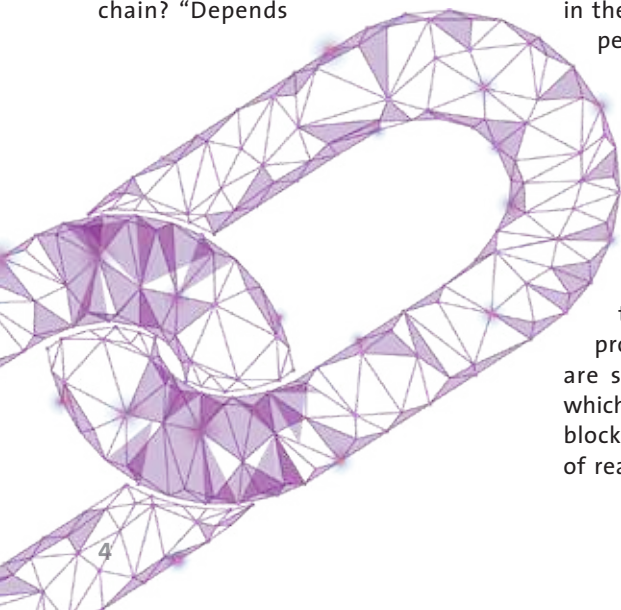


Tanja Rueckert, SAP President IoT & Digital Supply Chain: Blockchain as decentralized transaction register.

the implementation of blockchain networks – whether that be in the cloud or on the customer's premises – is a genuine added value for business." What the community needs is a good mix. SAP customers will value the SAP Cloud Platform Blockchain Service because of its simplicity, but they must take care not to exclude their business partners and any non-SAP customers.

"In addition to our consulting and technology portfolios, our services include many training offers and workshops," stresses Josef Packowski, because he is aware of the knowledge deficit that exists in the SAP community. "From executive briefing workshops to blockchain developer and administrator training courses, we offer the right program for every company level to enable businesses to understand blockchains, evaluate their potential, and be able to use them."

Finally, Josef Packowski emphasizes the close cooperation between Camelot and SAP: "We're partners of SAP in the Blockchain and IoT Co-Innovation Program." Blockchain has definitively arrived in the SAP community! (pmf)



Innovation driver is changing business models in a fundamental way

Blockchain is revolutionizing the value chain

Traditional business models are more than ever being called into question, reappraised and turned on their head. Completely new approaches are emerging. „Blockchain“ is the word increasingly being heard in connection with this digital upheaval.

By Josef Packowski, Camelot Consulting Group

The still fledgling blockchain technology is just emerging out of the shadow of the digital currency bitcoin, guaranteeing as it does secure money transfer without the involvement of third parties such as banks. However, it is no longer only interesting for applications in the financial sector, but increasingly also for use within value chains, especially in cases where data security and data transparency are important.

Camelot Innovative Technologies Lab (Camelot IMLab), a specialist for digitalization of value chains, has been working with this technology for more than three years. Its Digital Experience² now offers,

for the first time, a service and product portfolio for identifying and implementing specific use cases in value chains.

The wider public first became aware of blockchain technology when it started to be used in connection with cryptocurrencies. At a first glance, bridging the gap to the management of value chains seems difficult, mainly because we're talking about completely different applications and processes. After a more detailed analysis of the four cornerstones of the concept - decentralization, safeguarding of authenticity, immutability of the data and guaranteed consistency through reliable program sequences (smart contracts) - it quickly becomes clear that especially in the value chain there is a great deal of hidden potential for blockchain technology.

Removing the middleman through blockchain technology

At the latest when thinking of „trust machines“, which can be achieved through a combination of the four above-mentioned cornerstones and which in many scenarios eliminate costly and data-hungry middlemen, even the most technology-satiated value chain manager becomes alert. Global business networks present numerous problems which are deemed as solved, although they still require the involvement of trustees, clearing houses, legal advisors or other „trustworthy third parties“. These service providers exact a lot for their services, usually in the form of fees or unpopular data collections. In addition, the unavoidable manual intervention has the effect of making the processes increasingly slow and bureaucratic. These processes often involve complicated trade relationships

between several parties between whom there is little or no trust.

In such situations, blockchain solutions promise a remedy through the decentralized installation of smart contract-based, distributed applications. They replace the

What is blockchain?

When we speak of blockchain, we're referring to a technology possessing disruptive features. Blockchain is a concatenated list in which every list entry (block) can comprise one or more data sets. The concatenation is realized by means of cryptographic hash entries, a kind of checksum. Each hash entry is created out of all data sets of a list entry and included in both the previous and the subsequent list entry. Consequently, list entries are unalterably linked together, like a chain.

Furthermore, blockchain is a fully redundant data repository. All participants in a network possess all data, which is constantly synchronized. However, the true quintessence is the programmability of the network via smart contracts. A smart contract is a small program that is installed in the blockchain and kept there – just like other data – in a redundant, unalterable manner. Through the interplay of smart contracts, data and predefined events certain processes can be modeled in a counterfeit-proof and trustworthy way without the need for the middlemen that have been necessary before now.

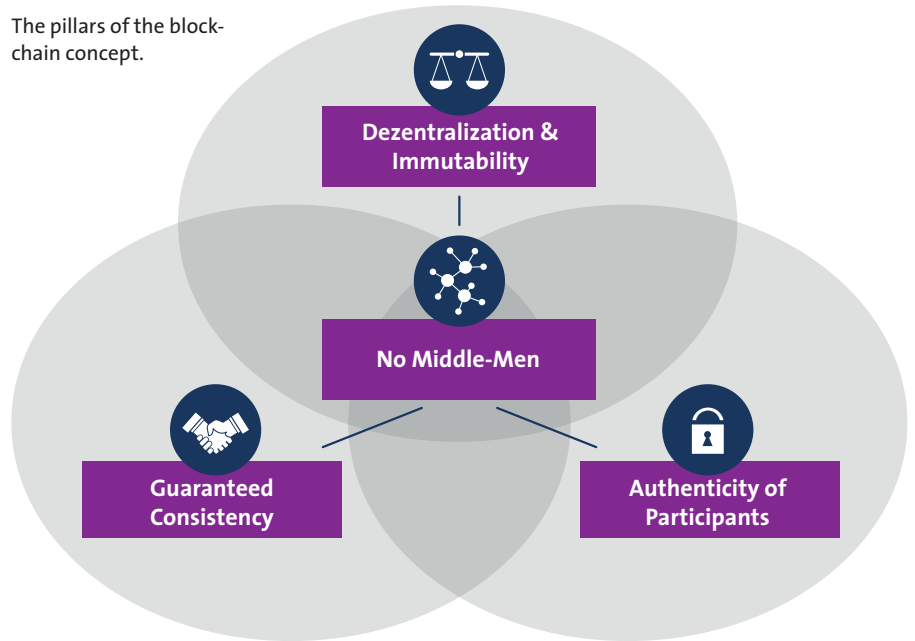


Josef Packowski is the CEO of Camelot Consulting Group.



aforementioned middlemen. Companies reap the benefits of optimization, streamlining and accelerated processes resulting from automation. Moreover, fraud and faulty procedures can be eliminated. Establishing these networks is intended to promote trust between the business partners. Responsibilities and obligations are clear and firmly embedded in the unmodifiable software network and operation is decentralized for all involved parties alike. While this may still sound like science fiction, in fact we're already dealing with pending or current projects. It's safe to assume that these solutions will in fact become reality in the course of the next two to five years.

The pillars of the blockchain concept.



Blockchain in supply chain management

Blockchain is attracting particular attention in supply chain management. As the many track and trace initiatives show, often the focus is only on individual blockchain features such as the immutability of the stored data. While the resulting solutions are often conceptually better than existing applications without blockchain, the full potential of the technology has not yet been exploited. Also, in the supply chain management environment there are use cases for blockchain-based „trust machines“ and blockchain networks, al-

though potential imbalances between the partners should be noted. It is a matter of finding out to whose benefit trust can be established here because the dominant players of a supply chain could control the use of the blockchain with clearly defined rules concerning membership and thus undermine the whole idea of blockchain being an equal and voluntary network. Many blockchain solutions for the value chain are still in their infancy, despite stabilization in the quality of

the core blockchain technologies. There are still challenges to be met, such as the scalability of large volumes of data.

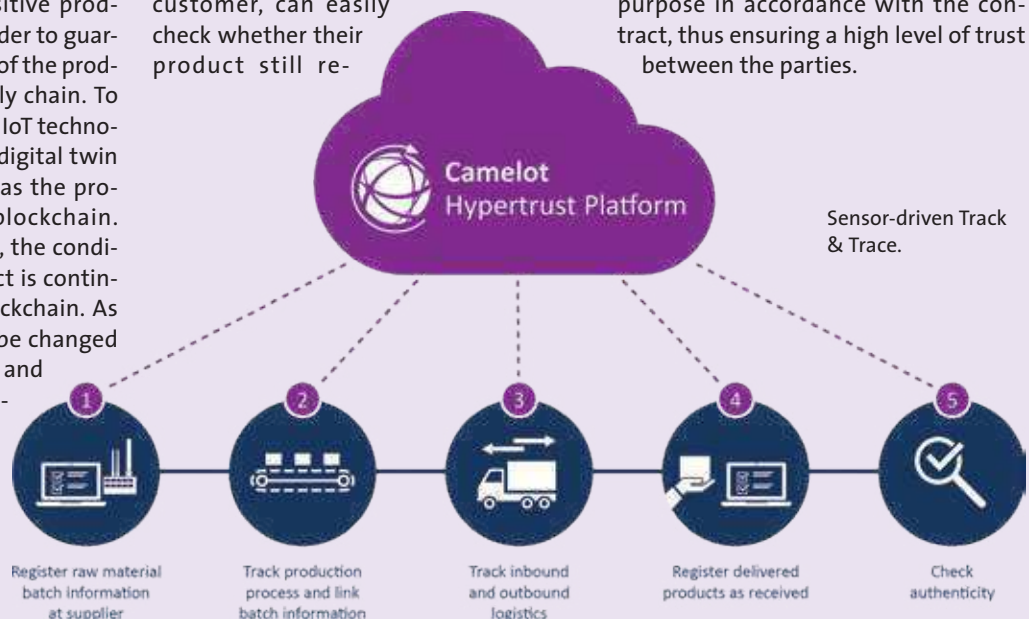
Yet today there are already a large number of applications ready for execution. As to why many solution providers still keep these under wraps, the answer is obvious: The gold in the „blockchain for business“ area is no longer to be mined in the technology itself, but rather in the appropriate innovative use case, as exemplified by Bitcoin in the financial sector.

Use case: sensor-driven Track & Trace ensures complete traceability

The sensor-driven Track & Trace solution developed by Camelot serves to monitor temperature-sensitive products such as medicines in order to guarantee the perfect condition of the products across the entire supply chain. To this end, the blockchain and IoT technologies are connected and a digital twin of the used sensor as well as the product are created in the blockchain. Using real-time monitoring, the condition of the delivered product is continuously written into the blockchain. As information can no longer be changed in the blockchain, a faithful and complete history of the product can be recorded across the entire supply chain. Decentralized storage of the blockchain prevents falsification. Using the information that has been verified through block-

chain technology, the recipients of the goods, whether manufacturer or final customer, can easily check whether their product still re-

tains its original characteristics, has been correctly transported and is fit for purpose in accordance with the contract, thus ensuring a high level of trust between the parties.



From a megatrend to a digital return on investment

What are the benefits for SAP customers?

On the subject of blockchain and other technological trends, the question facing companies is this: Is the technology even relevant for my company? In what areas does its use make the most sense and what added value will I have?

There is hardly any time left to answer basic questions on blockchain, as the IT and business world is spinning faster and faster. How can companies still manage to make viable decisions in the shortest possible time and not miss out on megatrends? In response to this question, Camelot Innovative Technologies (Camelot ITLab) developed the Digital Experience² product and service portfolio. In an interview, Steffen Joswig, Managing Partner of Camelot ITLab, explains what it's all about.

Mr. Joswig, what was the motivation behind Camelot Digital Experience²?

Steffen Joswig: Companies are often overwhelmed when faced with the wide range of technological possibilities and the speed at which new megatrends appear. They are confronted with a host of already existing digital business cases but find themselves unable to apply these to their own company. The problem cannot be solved merely with digital consulting concepts that take the shape of PowerPoint slides. Companies need some hands-on experience with new technologies and their digital return on investment so as to be in a position to make sensible decisions in the shortest time possible on whether or not to use a particular technology. We developed Digital Experience² for this very reason.

What is Digital Experience² all about?

Joswig: As the name suggests, it's about technological megatrends, for example blockchain. The focus is on faster digital value creation for innovative customer applications that can be individually experienced. Digital Experience² is a complete package consisting of various pre-configured software modules with easily configurable templates and harmonized methods for developing digital innovations. Tested team approaches favoring innovation and agile, fast development

methods provide specific results as proof of digital ROI in less than four weeks - which signifies a unique client offer to date in terms of scope and speed.

You mentioned software modules and configurable templates. What is actually meant here? And what role do SAP solutions play in this context?

Joswig: The centerpiece of Digital Experience² is the so-called „Digital Workbench“, which combines the various software modules and templates. These in turn are based on new technologies like blockchain, artificial intelligence, digital voice, IoT connectivity and cloud technology. In particular, the Digital Workbench includes the Twinification Bridge, a Camelot IoT service and a connectivity template for generating „digital twins“, the Camelot Hypertrust Platform, a blockchain-based model for developing distributed applications, and what is known as the AI Composer for the rapid development of AI and digital voice applications. The Digital Workbench is largely based on the basic technology portfolio of SAP Leonardo, the new platform of SAP for digital innovation, and will be developed from this in future.

How does Digital Experience² work in practice?

Joswig: Digital Experience² includes a clearly defined, 3-phase process: During the first phase, „Ideate and Innovate“, ideas for innovative digital use cases are developed together with the client with the help of Design Thinking methods. In phase two, „Compose and Construct“, Camelot Group's own Centers of Digital Innovation develop specific applications using the Digital Workbench. Modern, agile methods that enable application development in short sprints are used during this phase. Phase three, „Discover and Drive“, includes the „touch & zoom“ experience and validation of the application and its

value proposition for the customer. Following this, an initial action plan for the client-specific realization is drafted.

What are the actual benefits for customers?

Joswig: The main advantages for customers are: They get company-specific use cases for digital technologies within just four weeks. Through the physical experience of technological megatrends and their digital return on investment, they are in a position to make viable decisions. And last but not least: the good feeling of finally seeing their way clearly through the mist of digital possibilities.



Steffen Joswig is
Managing Partner at
Camelot ITLab.



Evaluating and developing use cases

Success factor for digital transformation with blockchain

To help companies cope with challenges such as data privacy, data ownership or complex intransparent processes across value chains, the digitalization specialist Camelot Innovative Technologies Lab (ITLab) has developed the Hypertrust Platform.

By *Andreas Goebel, Camelot ITLab*

The Camelot Hypertrust Platform contains configurable IT solution modules for developing and evaluating specific blockchain use cases, for instance to optimize logistics processes. Our experience goes back several years. Long before SAP announced (in May 2017) that a cloud-based blockchain platform would become part of its SAP Leonardo portfolio, Camelot teams had already begun to amass extensive experience in using the technology which they then combined in a framework with newly created tools.

Customers are meanwhile clearly benefiting from this. The Camelot Hypertrust Platform enables the creation of a prototype within just a few weeks. The platform is a key component of Digital Experience², Camelot's product and service portfolio for faster digital transfor-

mation of companies. The Hypertrust Platform also enables companies to realize fully individualized application cases.

Technological basis

Camelot's first development projects with the blockchain technology Ethereum was aimed at optimizing blockchain network administration and the development of distributed applications. Features such as rapid network bootstrapping, smart contract deployment, service provisioning and integration, application development or DALM (Distributed Application Lifecycle Management) were on the roadmap from the outset. Today, the Camelot Hypertrust Platform framework consists of an intuitive user interface based on SAP-UI5 and node.js middleware as a link between blockchain, smart contracts,

user interfaces and external services - for instance those of the SAP Leonardo IoT platform. At the same time, the middleware functions as a server for running distributed applications. Essentially, Camelot today not only supports Ethereum but also other blockchain technologies like Hyperledger Fabric and Multichain.

SAP Leonardo: SAP Cloud Blockchain Service

Camelot also integrates the web services of the SAP Cloud Platform Blockchain Service which, in turn, supports various blockchain solutions. One could ask what added value the Hypertrust Platform provides, if SAP's Cloud Platform Blockchain Service portfolio is similar. Camelot's solution targets a clearly defined area that SAP purposely left out: SAP strongly

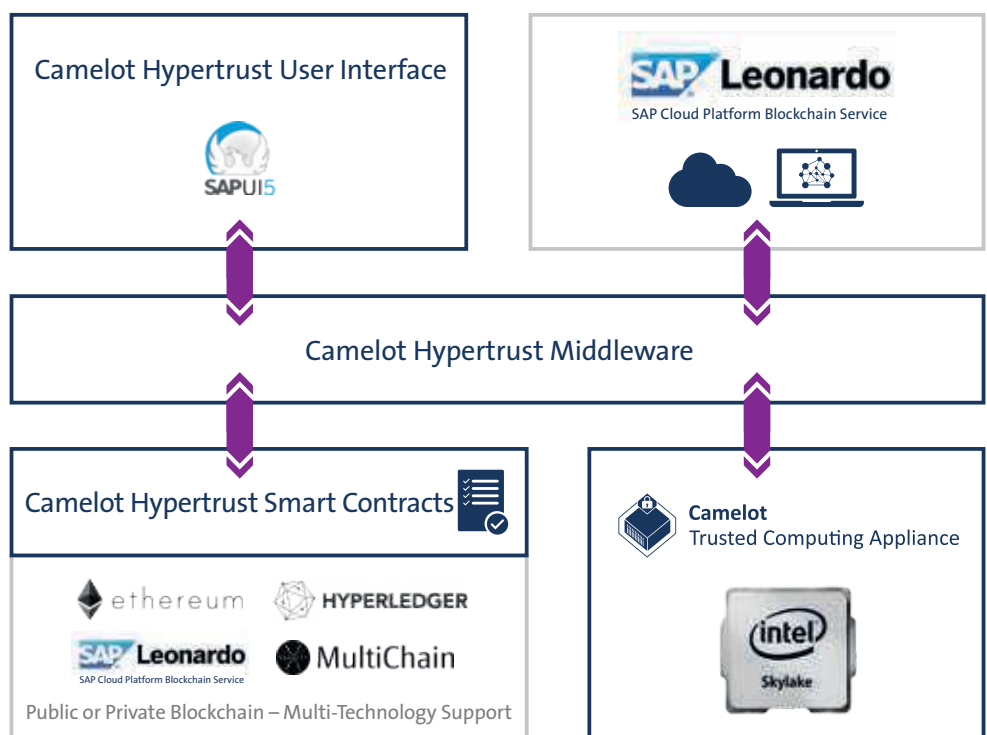
User-friendly UI.

Flexible and seamless IoT-service integration.

Secure high-availability middleware for managing smart contracts and chain code.

Public and private blockchains as data storage and process engine.

The Camelot Hypertrust Platform offers multi-blockchain-support and enables efficient application development for blockchain technology.



emphasizes the distributed operation of blockchain networks and thus also the connection of on-premise nodes to SAP Cloud Platform Blockchain Service instances but without offering the platform contained in Leonardo and its advantages on-premise. This is where Camelot comes into play: The Hypertrust Platform has similar features for smooth blockchain node operation and related development tools and is thus a perfect supplement to SAP's Cloud Platform Blockchain Service offering - irrespective of whether it is operated on-premise or in a managed cloud such as in the SAP Cloud Platform, SAP Cloud Foundry or AWS.

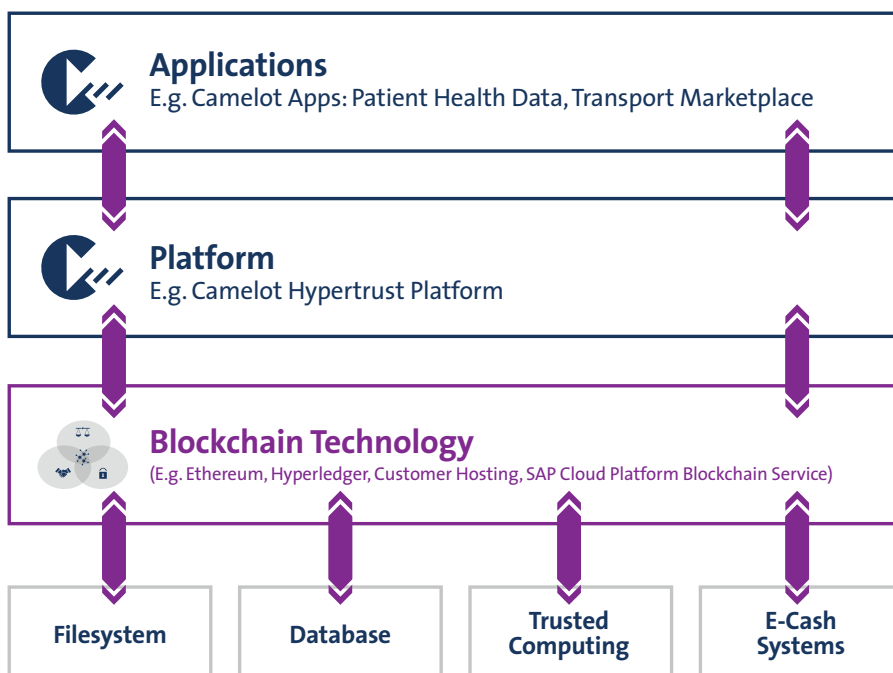
Intelligent dovetailing

In our experience, there is hardly any application case that can be relegated only to the field of blockchain. There are no stand-alone solutions when it comes to digitalization. Blockchain, IoT, AI, cloud, mobility – all these topics are closely interwoven, which was yet another reason for developing the Camelot Hypertrust Platform. Thanks to the latest concepts, it integrates all the current megatrends which customers are even now benefiting from. Camelot is already producing prototypes within its Camelot Digital Experience² service and product portfolio using only this omnipotent tool. The Hypertrust Platform also allows to see beyond current development trends. New blockchain technologies or related technologies can be analyzed and evaluated



Andreas Goebel is Head of Center of Digital Innovation at Camelot IITLab.

at a rapid pace when realizing proof of concepts. At the same time, it is often noted that blockchain is not a universal remedy. For one thing, many use cases require the integration of other innovative technologies. Also, a blockchain often needs additional components, for example distributed file systems or databases for the high-performance archiving of mass data and “trusted computing” for reliable processing of completely confidential data. Thus, Camelot is continuing to develop the Hypertrust Platform in these areas, too.



The split stack: Blockchain is only a part of a decentralized system landscape for the remodeling of entire business processes.

Use Case: Managing Patient Data



In the analog healthcare system, patients usually do not keep their own data and records. Instead, the data is kept by medical institutions or doctors directly, thereby severely limiting data access by the patient. Blockchain technology is one of the key technologies to change this situation. In theory, every patient – by analogy with Bitcoin – could have their own record account on command. Only explicit approval through a smart contract would allow for anyone else to access the record. In practice, this enables a completely paperless healthcare system. Additionally, blockchain enables the creation of a large healthcare network that would allow individual patients to freely give science permission to access their records – something that is a far reach with conventional solutions.

Use Case: Uber-like Transport Management



This use case is nothing less than an adaptation of the Uber business model to logistics, specifically to transport management. A cooperation marketplace on a blockchain foundation enables flexible and secure ad-hoc business relations between unfamiliar business entities. Every participant is easily identifiable and verifiable through a mandatory blockchain account. Orders can be fed into the marketplace through smart contracts. The resulting contracts between business entities are immutable and securely documented in the blockchain. This concept enables large companies to flexibly enter business relations with transport providers without going through time-consuming bidding processes. This solution also opens the market for smaller service providers that previously have been unable to participate because of size or lack of reputation.

Blockchain versus protection of private data: a conflict of interests?

The privacy problem

Blockchains are generally incompatible with trustworthy processing of private data. While „trustworthy“ is one of blockchain’s central features, as far as the attribute „private“ is concerned, the technology must by definition surrender.

By *Andreas Goebel, Camelot IITLab*

Data in a blockchain network is first of all never private but can be read by other members of the network. This fundamental problem can, however, be overcome with Trusted Computing Appliances.

There are use cases where trustworthy processing of private data is not possible with current blockchains. This is very problematic especially when intellectual property needs to be protected at the same time as accelerating existing manual processes involving experts and legal advisors. Examples of such processes are the communication of regulated food additives in the consumer goods industry or substance control within the framework of drug approval. But why can blockchains not be used for trustworthy processing of private data today? After all, „trustworthiness“ tops the list of this technology’s advantages. The crux of the matter concerns the nature of „private“ in the data to be processed.

In a classical sense, data in a blockchain is never private, i.e. it can always

be read by other members in the network. If data is encrypted before being transmitted to a blockchain, it cannot then be processed by means of smart contracts unless the smart contract in turn decoded it.

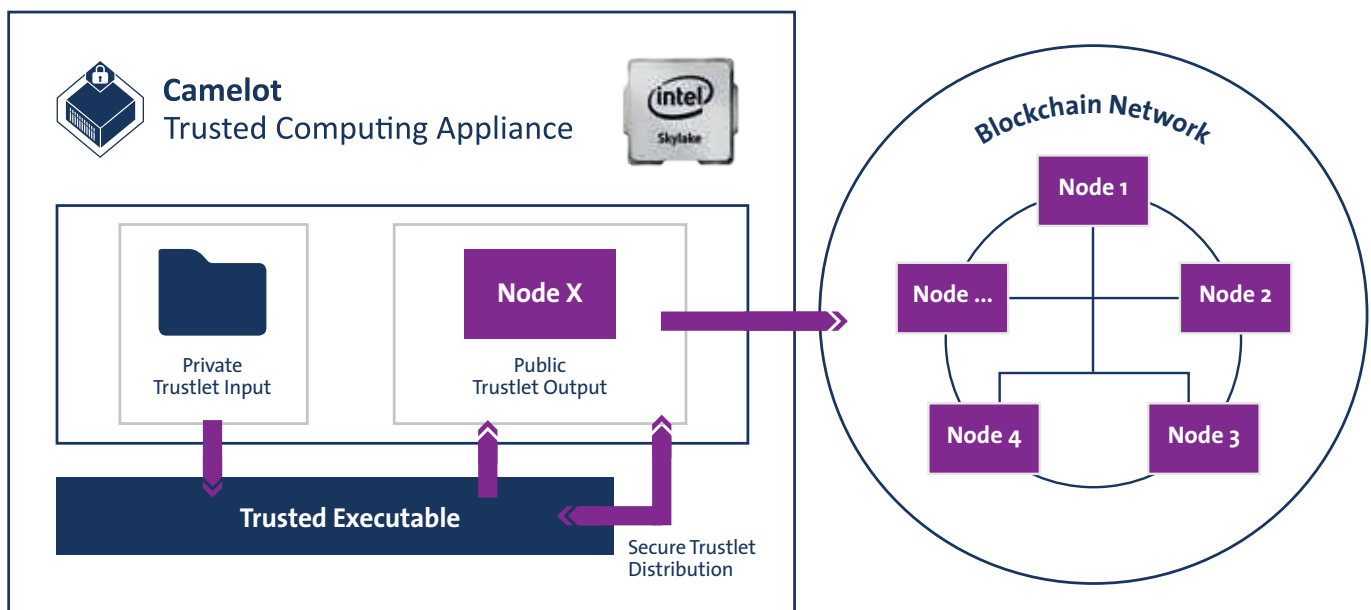
But then of course the necessary decoding key would be visible to all members. The Hyperledger technology is attempting to solve the visibility problem using so-called „channels“ that certain members of a blockchain network can share. Depending on the complexity of the network of relationships, this approach can, however, very quickly become unmanageable and uneconomical. And it is precisely in manufacturing industries that very heavily protected intellectual property is to be found that may never leave the corporate network - and certainly not towards a decentralized system over which the owner doesn’t have complete control. Camelot IITLab’s Trusted Computing Appliances offers one possible solution to the privacy problem.



Andreas Goebel is Head of Center of Digital Innovation at Camelot IITLab.

Additional services Trusted Computing Appliances

The concept works as follows: An owner’s private data is saved only locally but registered via hash value on the blockchain. This eliminates the possibility of the owner ever manipulating the data in his own favor at any time. All the parties agree on an algorithm (program) that is allowed to process the private data, for example a simple cross-check between two lists as well as the return of the intersection. Ideally, the distribution of the program between the parties connected to the net-



Trustworthy processing of private data in conjunction with a blockchain network.

work is also done via blockchain mechanisms. After executing the program, the returning value (intersection) may be distributed via the blockchain to the corresponding remote nodes. But this approach has the following drawback: Since the program runs on the infrastructure - the PC or server - of the data owner, this person could manipulate the data himself and thus falsify or distort in his own favor the returning value reaching the blockchain. This is where Trusted Computing comes into play. Using measures firmly anchored in the processor, it prevents manipulation of local programs as well as any interference in the running processes of this program. The Trusted Computing Appliance thus facilitates the operation of „Off-Chain Smart Contracts“ which although local, still run in a trustworthy environment. Camelot calls these above-mentioned programs, which all members of the network agree on, „trustlets“; the trustworthy environment in the current service version is Intel SGX (Software Guard Extension). The biggest challenge when developing the Trusted Computing Services was to render secure the unsecured area between the blockchain and the trustlets. This was achieved with the aid of a coherent concept that describes onboarding mechanisms which function using voting machines and data integrity achieved through digital signatures, the blockchain to be used being in principle freely selectable. Camelot's reference implementation uses Hyperledger Fabric in the SAP Cloud Platform Blockchain Service.

Besides processing protected data, the technical use cases also comprise for example what is known as the inter-blockchain transfer of data, i.e. safe transfer of transactions from one blockchain technology to another as well as inserting data from secure data sources into a blockchain network. Trustlets relate exclusively to code compiled by Camelot. However, also script language interpreters are planned for the next version of Trusted Computing so that the algorithms can be distributed in real time. This shows that this field still has a high optimization and development potential badly needed in the marketplace.

Where the blockchain journey is heading and what role SAP will play

A tough piece of work

The use of blockchain technology beyond the financial sector is picking up the pace. Yet there is still a lot of homework to be done.

By Aseem Gaur, Camelot ITLab

To meet the current challenge, competencies and resources need to be combined in order to develop solutions for the various sectors and standard customer situations. SAP has recognized this need, prompting development of the „Blockchain and IoT Co-Innovation Program“ for customers and SAP partners launched in 2017. This program gives customers the opportunity to identify, discover and implement applications to capture various events in blockchain - from the design and development of products to production and logistics up to product tracking. Program participants can share their specific requirements and thus play an influential role in the project and the solution design. Camelot ITLab is supporting SAP's initiative with many proven use cases such as the sensor-driven Track & Trace, data ownership in health-care or a transport marketplace. A more than two-decades-long partnership between SAP and Camelot is expanding with the blockchain megatrend. Camelot relies on SAP as its platform partner in the development of blockchain customer solutions. SAP expertise in Cloud Platform services and company-wide support are important elements to deliver successful innovation projects, as they create a secure environment for customers to experiment with blockchain.

Hyperledger Fabric and Multichain

The SAP Cloud Platform Blockchain Service is currently at early release stage but is intended to have general availability to all customers as a finished product in the second half of 2018 and will support the Hyperledger Fabric and Multichain blockchain technologies. The SAP Leonardo BaaS service (Blockchain as a Service) will enter the business solution environments of large customers. Their core technologies are also a part of the Camelot Hypertrust Platform that can be used to develop and evaluate specific blockchain applications. Andreas Goebel, Head of Center of Digital Innovati-



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on at Camelot, states: „The field of blockchain technology is very volatile and still needs further development in many aspects. SAP and Camelot are learning something new every day in joint customer projects: What forms should blockchains take in order to support certain use cases? How can the decentralized concept be integrated into existing business processes in the most efficient way? What services are required to get all the needed participants into a common network? We ask ourselves these questions every day, often together with SAP“. Real customer requirements play an important role in the enhancement of the Camelot Hypertrust Platform. This is why the roadmap lists functions asked for by customers directly, such as the integration of blockchains with existing enterprise authorization concepts or the smooth integration of existing databases as „off-chain storage“. Notwithstanding these requirements, Camelot's blockchain experts always also think outside the box. They analyze market trends and new developments in the field of blockchain, so in future they can be integrated, where appropriate, into the Hypertrust Platform.

