INNOVATION IN DIGITAL COMMERCE

Electronic Invoices
Streamline Processes
and Save Paper

What Can Blockchain Do For You?

What Does Frankfurt Have to Offer?

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Please note: The opinions expressed in Industry Insights published by dotmagazine are the author’s own and do not reflect the view of the publisher, eco – Association of the Internet Industry.
The June issue of eco’s dotmagazine, “Innovation in Digital Commerce”, explores the areas of e-commerce, digital financial technology, and blockchain technology from a range of industry perspectives.

Online payment services have been around for years, but it is taking a surprisingly long time to develop a widely-accepted and applicable e-invoicing standard. Prof. Georg Rainer Hofmann, Leader of the eco Competence Group e-Commerce, and Meike Schumacher from the Aschaffenburg University of Applied Sciences explore the reasons (this issue, pg. 6) for the slow uptake of e-invoicing among SMEs and offer insight into the business and environmental benefits – the sheer masses of paper that can be saved – of adoption.

One of the fundamental forms of value creation on the Internet remains online retail. For small and medium-sized enterprises, getting access to infrastructure, developing shop and payment systems, and finding the partners needed to be successful can be an uphill battle. “While online sales are surging, so too are consumer expectations”: Richard Stevenson from ePages offers advice (this issue, pg. 8) on using Software-as-a-Service platforms to create a successful webshop, and tips and tactics for smaller retailers to develop relevance in a competitive marketplace. Lars Hofacker and Dorothee Frigge from the EHI Retail Institute look at (this issue, pg. 10) shop systems and payment systems for webshops, as well as looking at some of the hurdles for online retailers. Meanwhile, Dr. Thomas Fischer from noris networks explores (this issue, pg. 12) the infrastructure requirements for e-commerce solutions and how to develop a secure and reliable e-commerce strategy.

Blockchain is a potentially game-changing technology which is influencing not only financial services – through the myriad of crypto-currencies now in existence, as explained by Daniel Gross from DWF – but also a whole range of other areas where transparency and the guarantee of authenticity are fundamental. This includes electronic health records, according to Dr. Christina Czeschik from Serapion (this issue, pg. 21), but also smart contracts, which Stephan Zimprich, Leader of the eco Competence Group Blockchain, explains in his easily understandable glossary of the most common concepts in blockchain (this issue, pg. 17). Matteo Cagnazzo and Chris Wojzechowski take a look at some of the security applications of blockchain, and some of the challenges the technology faces (this issue, pg. 26). And Anthony Robinson from Corning Optical Communications offers advice to data center operators on how to develop a blockchain strategy within their infrastructure to keep pace with the needs of their customers (this issue, pg. 24).

Finally, in our Doing Business in Germany section this month, we focus on two cities with specialist focus areas. Mathias Röckel explains why Frankfurt is such an attractive location for financial services (this issue, pg. 28), and Torsten Oletzky from InsurLab Germany looks at the insurance industry in Cologne (this issue, pg. 30).

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Judith Ellis, Béla Herting, Cát Kinsella, Mathias Röckel, Marc C. Schmidt, eco – Association of the Internet Industry

E-COMMERCE, DIGITAL FINANCIAL TECHNOLOGY & BLOCKCHAIN
The slow adoption of electronic invoicing among SMEs belies the financial and environmental advantages of e-invoicing. The eco Association and Aschaffenburg University of Applied Sciences explore the acceptance factors of e-invoicing.

The saving potential of e-invoicing is worth billions per year alone in Germany. The saving potential for printing, sending, postage, and the respective receiving process is worth billions per year alone in Germany. The electronic invoice is establishing itself as a central element of the further move towards digital transformation in industry and retailing in Germany and Europe. Associated processes like electronic payments (e-payments) are also increasing in economic significance. Nevertheless, the share of electronic invoices is currently still within single-digits.

A survey (go.eco.de/e-invoicing-survey) among small and medium-sized enterprises (SMEs) carried out by the Junior Chamber International Germany (Wirtschaftsjunioren Deutschland e.V. - en.wjd.de) shows how much still needs to

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1 See draft legislation from the German Federal Government, 12 October 2016
2 For one A4 page per invoice, at a weight of approx. 5g
be done: only 9 percent of the companies surveyed issue electronic invoices, 37 percent use only the paper form, and 48 percent send invoices partly by e-mail and partly on paper.

**Emerging European standards for e-invoicing**

PDF-based solutions are mostly used for paperless invoices. Larger companies are using the international EDIFACT standard. Industry solutions such as the VDA 4938 standard by the German Association of the Automotive Industry (Verband der Automobilindustrie e.V.) are well-established. An approach for hybrid invoices is the format ZUGFeRD ([go.eco.de/zugferd-en](go.eco.de/zugferd-en)) in which the data is stored separately in two components, one in structured form as XML data and the other one as directly readable iconic PDF data.

In order for the digital transformation in e-invoicing to be successful, it is necessary to define official and thus reliable standards at the European level. On this basis, open systems can be designed in such a fashion that electronic invoices can be universally created, transmitted, received, processed, and archived. In this sense, a unified European system should replace stand-alone solutions of individual sectors and companies as soon as possible.

**Acceptance of electronic invoicing**

To understand why invoices are still mainly sent in paper form, the Information Management Institute (IMI) at the Aschaffenburg University of Applied Sciences started to explore the acceptance of electronic invoicing. Acceptance factors such as trust, liability, and reliability were identified as being crucial for electronic invoices.

The current contexts in which electronic invoices are actively accepted can be broken down into three different scenarios:

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These scenarios are explored in more detail in eco’s recent study on “Acceptance Factors of E-Invoicing” ([go.eco.de/e-invoicing-study](go.eco.de/e-invoicing-study)).

**E-invoicing: recommendations and uncertainties**

*Using systems to create, send, or receive, process, and archive electronic invoices is essential for the further development of the digital economy.*

From the point of view of the Internet industry, using systems to create, send, or receive, process, and archive electronic invoices is essential for the further development of the digital economy and digital transformation as a whole. The further development of electronic invoices in Europe is uncertain. What is certain is that electronic invoices are a significant and central component of the digital transformation of industry and administration.

**Benefits of using electronic invoices:**

1) **Expenses:** electronic invoices reduce the cost of printing, paper, enveloping, and postage compared to paper invoices.

2) **Process advantages:** with paperless invoices, factoring is more secure and faster. Hybrid invoice forms like ZUGFeRD, which combine PDF and XML data, are tailored for SMEs.

3) **Future security:** currently, the CEN TC 434 is being created as an official European format. According to the EU Directive 2015/55 / EU, public EU administrations must be able to accept and process e-invoices from November 2018 onwards.

4) **Environmental contribution:** up to 250,000 tons of writing paper can be saved in the EU, equivalent to the load of more than 80 complete freight trains.

Prof. Georg Rainer Hofmann and Meike Schumacher explore how and when digital invoices are implemented and accepted in a study for eco – Association of the Internet Industry. Download the abridged version of the study “Acceptance Factors of E-Invoicing” ([go.eco.de/e-invoicing-study](go.eco.de/e-invoicing-study)).

Read this article online at [go.eco.de/e-invoicing](go.eco.de/e-invoicing)
WEBSHOPS – TACTICS FOR SMALLER MERCHANTS

Richard Stevenson, Head of Corporate Communications, ePages.com

ePages’ Richard Stevenson looks at the options for smaller merchants who want to sell online.

DOTMAGAZINE: What do you see as the big challenges involved in setting up an online shop?

RICHARD STEVENSON: Well, data shows that participation in retailing is at a record high – millions more SMEs and individuals are launching new e-commerce projects, and dipping in and out of selling online according to their needs. However, it’s also true that while online sales are surging, so too are consumer expectations. The good news is that it has never been easier to create a professional quality online store.

Perhaps the best gauge of success is your ability to deliver both a great shopping experience and also work efficiently and enjoyably as a merchant. A clear challenge is to be relevant and visible for website traffic, and be present on the most popular marketplaces. With the right online tools, it’s achievable for even the smallest sellers to ensure this.

Mobile is a clear requirement for all retailers now – to capture every possible sale, it is essential to use an e-commerce platform that delivers a seamless shopping experience for all devices.

Social selling and story-telling can be powerful tactics for smaller merchants.

Social selling and story-telling can be powerful tactics for smaller merchants. Research shows that consumers are hard-wired to want to support SME retailers who are experts and care about their products – this often means customers are willing to pay a premium for attentive service and brand values. Selling via social channels and social activities can be a highly efficient way to convert this.

DOT: Can you explain the value chain of an e-shop? Who are the important partners that a company needs to sell online?

STEVENSON: E-commerce is indeed a complex and fast-moving sector. The beauty of SaaS e-commerce platforms such as ePages is that merchants can rest assured that they are automatically kept up to speed with the latest retail apps and integrations that shoppers want, as well remaining fully legally compliant and secure at all times.

Behind the scenes, a complex network of features is involved, including payment processing, fulfilment of deliveries and integration with online marketplaces. If your
shop system cooperates with reputable partners from those fields (such as PayPal, DHL, Amazon, and eBay), you will benefit from two clear advantages. Firstly, large-scale partners of this type can help make your entire order fulfilment process run smoothly. Secondly, your customers gain much confidence in your shop from seeing these household names on your site.

DOT: An e-shop that no-one knows about won’t be much of a success. How to you recommend companies approach topics like SEO and online marketing? Should they keep it in-house or outsource it?

Indeed, there’s clearly no value to be had from a beautiful shop that’s invisible to shoppers.

STEVENSON: Indeed, there’s clearly no value to be had from a beautiful shop that’s invisible to shoppers. In order to deliver you with relevant web traffic, modern shop systems include an integrated SEO kit. This is a highly cost effective way to simplify and automate the search engine optimization of your shop, helping new customers to find your store online. Look for a shop system equipped with built-in SEO-friendly URLs and tags to boost your selling success.

Furthermore, SEO services like rankingCoach.com, available to activate as apps within shop platforms like ePages, are an excellent turn-key method to win a competitive edge for retailers. Specialist or niche-product shops, in particular, can derive substantial value from an effective SEO strategy as they tend to have a clearer idea of their competition.

DOT: What do you see as the pros and cons of standardized out-of-the-box and customized e-shops?

STEVENSON: For the majority of merchants with a restricted budget and limited technical knowledge, cloud-driven all-inclusive solutions are, by far, the best all round option. These can provide you with a complete solution at low cost, continually updated with the latest functionalities and merchant services, and allowing you to concentrate fully on your core business.

At the same time, because the platform is always managed and automatically updated, the danger of any security, compliance or performance risks are kept to a minimum. Open-source solutions, in contrast, are primarily suited to larger-scale retailers with access to the resources needed for installing and maintaining the shop software themselves or contracting an agency to do this.

With open-source solutions, the costs of installation, maintenance, and expansion can be difficult to calculate and can often turn out to be higher than with SaaS solutions.

Software-as-a-Service (SaaS) solutions are generally available on a monthly fee basis. In such cases, merchants can usually opt to pay a low rate initially before switching to a higher monthly charge when enhanced capacity, performance levels, or additional features are required. With open-source solutions, the costs of installation, maintenance, and expansion can be difficult to calculate and can often turn out to be higher than with SaaS solutions.

DOT: What do you see as important changes in customer expectations and trends in market development?

STEVENSON: In 2017, we are seeing the further influence of the large marketplaces in brokering sales – in fact, new data suggests the marketplaces will account for 40% of online retail by 2020. This means that merchants should have a strategy for leveraging marketplaces while, just as important, developing their own brands and unique value adds.

Mobile traffic has now over-taken desktop, meaning that many e-commerce projects will now have a mobile-first strategy. Regardless of sector or size of retailer, most consumers want flexibility across multiple channels to search, view, and procure goods. Retailers who can offer a seamless online and in-store experience, and joined-up marketing campaigns have won larger growth than online pure-players in recent years.

Cross-border trading is continuing apace, at around 25% growth per year. To achieve this, however, your site will need to be translated into different languages and, in most cases, set up to work with other currencies. Many modern shop systems provide support for this internationalization process, and it is worth considering at the start of all retail projects, no matter how modest.

Around 75% of UK retailers report that they intend to increase the work they do on social platforms.

Another important area is the use of story-telling and social selling to provide a compelling reason to buy. Mono brands and niche retailers are also incentivizing shoppers to buy direct in order to reverse commoditization. Engaging content
and a celebration for their industry is often a good return on investment. For example, around 75% of UK retailers report that they intend to increase the work they do on social platforms.

Read this interview online at go.eco.de/webshop-tactics

SHOPPING AND PAYING IN GERMAN E-COMMERCE

Dorothee Frigge, Project Lead Online and Mobile Payments, EHI Retail Institute

Online retail has moved quickly beyond desktop online shops. Lars Hofacker and Dorothee Frigge of the EHI Retail Institute spoke to dotmagazine about the systems used by online shops in Germany, the optimal mix of online payment methods, the EHI seal of trust, and the future of online retail, as they see it.

DOTMAGAZINE: Can you start by giving us a brief overview of the range of shop systems?

LARS HOFACKER: There is a wide range of different shop systems in the ranking of the largest 1,000 online shops in Germany. Magento is one of the most commonly used systems with 14.5 percent. OXID Eshop followed with 9.3 percent of the shops and Shopware with 5.7 percent. Hybris is used by 4.4 percent of the providers. The free system osCommerce could be identified in 2.4 percent of the cases.

DOT: There are so many different payment systems to choose from – How can e-shop operators and consumers alike find the best solutions for their needs?

DOROTHEE FRIGGE: There is no recipe for an optimal payment mix in an online shop. Each trader should individually analyze their industry and target group, weigh their financial resources and consider how great their willingness is to offer risk-based payment services. As for the last factor; more and more service providers have entered the market in recent years, which ensure default risks. This is usually more expensive for the merchant than processing the payments themselves, but minimizes the risk. This makes it possible to offer some of the most popular payment methods, for example, by invoice or direct debit.

In order to address the needs of many customers, it is recommended to offer a mixture of classic, card-based, account-based, and alternative payment methods. In particular, credit card payments and Paypal should not be missing in any online shop. If, additionally, invoice and credit transfer service are offered, the dealer is very well placed. Many traders, however, offer significantly more payment
methods or even offer several services of the same methods. The 1,000 leading German online shops (in terms of turnover) offer, on average, seven different payment services. In Germany, most turnover is made by invoice. The payment method which allows the customer to pay after receiving the goods, has a turnover share of more than 30 percent. Payments by direct debit (20.2%), PayPal (17.9%), and credit cards (12.2%) follow. With shares of below five percent, all other payment methods are less important.

Online shops who are internationally active should precisely analyze their target market. In addition to the well-known international payment methods, in many countries there are additional national payment services, which are extremely popular with customers and should not be missing in the local payment mix. In the Netherlands, for example, only 5 percent of all payments are processed via PayPal. The national payment service iDEAL, by contrast, has a market share of 56 percent. Other major national payment services are, for example, eps (Austria), PostFinance (Switzerland), and Przelewy24 (Poland).

Both nationally and internationally dealers can also use the services of so-called payment service providers. These maintain contracts with numerous payment service providers and can thus offer traders the processing of several services from one hand. In addition, the service providers have experience with different industries, target groups and markets, and can help traders to find a suitable payment mix for their shops.

**DOT:** What are the pros and cons of omni-channel retailing vs. purely online retail, and what kinds of companies are best served with each?

**HOFACKER:** Each strategy and branch has its own challenges. There is no recipe for success. I think the pure online players are often faster in realizing approaches. Only the fast and well-positioned omni-channel retailers can be successful. The most obvious criterion is still e-commerce revenue.

**DOT:** What do you see as the most exciting recent innovations in online retail, and what will be the next big transformation?

**HOFACKER:** The omni-channel transformation is still on going. New innovations will follow with this infrastructure.
I am curious about how e-commerce is spreading more and more throughout the home. With artificial intelligence applications, voice control, and automated orders are becoming increasingly standard. Previously, desktop online shops and mobile online shops were indispensable.

FRIGGE: An exciting development, which not only influences the way how we shop online, but also the way how we pay, are voice assistants. Then, when Alexa and Co. make our orders on call, the payment is increasingly invisible and disappears from the perceived shopping process. As soon as the customer has deposited his payment data once, the payment will automatically run in the background. Unlike today, where the customer is usually met with a conscious decision for or against a method of payment at each check-out, payment methods and their brands will move into the background in the future. There are also fewer opportunities for traders to direct the customer’s choice of payment in their own interest.

By the way, Voice Commerce is just one example of the fact that the payment process becomes invisible. Other prominent examples include the use of Amazon Dash Buttons or riding with Uber.

Read this interview online at go.eco.de/ehi-shopping-online

TOP 3 TIPS FOR COPING WITH THE EVER-CHANGING REQUIREMENTS OF MODERN E-COMMERCE

Dr. Thomas Fischer, Principal IT Architect, noris network AG

Keeping your online business afloat and your customers happy requires constant availability, fast load times, and the flexibility to handle surges in demand. A scalable and flexible infrastructure is essential to survive in the competitive world of e-commerce. dotmagazine spoke to Dr. Thomas Fischer, Principal IT Architect at noris network, to find out what companies should keep in mind when taking their business online.

DOTMAGAZINE: What are the most important infrastructure requirements for e-commerce?

THOMAS FISHER: Today’s e-commerce requires flexibility and short feature lead times. This means that the infrastructure must provide the possibility to cope with changing requirements and short release cycles.

A modern infrastructure should therefore allow for API (application program interface) access to provision and change network, storage and computational resources.

A modern infrastructure should therefore allow for API (application program interface) access to provision and change network, storage and computational resources. Cloud platforms in their different shapes, ranging from dedicated private clouds to the major public clouds, provide this kind of programmable access. Based on such infrastructure, a continuous delivery based release management that automates all steps required during a release process allows the business to eliminate or at least reduce the pain of each release. The key buzzwords in this context are “Infrastructure as Code” – all configuration is managed like source code using tools like Puppet, Ansible or Salt and “Immutable Infrastructure” – deployment units; often containers that are immutable and a change leads to a redeployment, rather than a change of the system. Such an infrastructure supports Agile and DevOps processes and can cope with the ever-changing requirements of modern e-commerce.
DOT: How do the infrastructure requirements differ for different aspects of e-commerce – for example, website, web shop, customer relationship, logistics, and payment systems?

FISCHER: The different infrastructure requirements are mainly driven by the software employed. And the readiness of currently available software for modern fast-paced infrastructure designs ranges from “old-school” deployments, where systems must be treated as unique “snowflakes” with only rudimentary failover mechanisms, up to cluster architectures with production-ready containers.

The key for a future-ready infrastructure is to keep operability and “cloud readiness” in mind when decisions about software products are made.

The key for a future-ready infrastructure is to keep operability and “cloud readiness” in mind when decisions about software products are made. You should always have failure scenarios – and how the software can cope with such scenarios – in mind. In a “cloud world”, compute nodes will fail – and with short release cycles, the software should be responsible for any failure mitigations.

One of the challenges in such architectures is security and data location. Both challenges can be addressed with a hybrid strategy, keeping critical data and core applications in a secure dedicated cloud platform, while MVPs (Minimal Viable Products – anything from a mobile app to a fully-fledged customer interface) and satellite applications like customer interfaces can be hosted in a public cloud.

DOT: Can you describe the basic IT infrastructure set-up required for an online shop?

FISCHER: From a cloud-centric view this question is easy: Just subscribe to one cloud platform and use the provided features to build your setup. The components required would be load balancing, firewalls, redundant application servers, and one or more databases of your choice. But, as I said before, the basic infrastructure set-up depends heavily on the design and requirements of the online shop software. However, it is advisable to keep the application servers stateless in order to easily scale horizontally (in times of high-demand or as the platform grows) and move session state like the shopping cart into an (in memory) database.

DOT: Is geo-redundancy advisable for hosting e-commerce solutions?

FISCHER: The requirement of geo-redundancy depends heavily on the size of the e-commerce solution and the disaster recovery scenarios the platform requires. Geo-redundancy in terms of stretching the setup over different data centers is one way, however, in some scenarios a
distribution of the setup over two fire compartments in one data center is totally sufficient. A cloud platform mirrors these two disaster recovery scenarios by providing different regions and availability zones.

DOT: What are your top three tips for companies thinking about starting e-commerce activities?

FISCHER: First, start small and build an e-commerce platform that easily scales with the demands of the platform.

Second, design your e-commerce software for failure of the underlying infrastructure. This allows you to use cloud platforms and reduces the requirements for the infrastructure.

Third, find an infrastructure partner that can accompany you along your way and is able to realize hybrid architectures, if the core components of your e-commerce platform must be dedicated systems. In order to be future-proof, that partner should be able to provide the complete stack, ranging from colocation up to cloud services.

Read this interview online at go.eco.de/thomas-fischer-interview
"The Internet never forgets!" Although untrue, this statement reminds people to think twice before putting information online – and out of their control. The advent of blockchain changes everything. Blockchain forgets nothing – and it brings back content control. Mathias Röckel looks at the potential of this new technology for innovative commercial enterprise, as well as for Internet infrastructure providers.

The Internet as we know it is difficult to control. Once a text, image, video, or piece of content is posted online, it is hard to manage what happens to it. Think of malware, for instance. Malware is "in the wild," meaning it can show up anywhere at any time and is difficult to contain, control, or even track. Songs, movies, software – just about anything can be replicated and distributed by nearly anyone at almost zero marginal cost.

At the same time, data can be manipulated. Code can be altered, pictures can be photoshopped, video and audio can be modified to give false impressions of the behavior of individuals and companies. It is becoming increasingly difficult to prove that something never happened, pics or no pics.

Blockchain can’t and won’t solve all of these issues. Some things we’d rather forget will still be remembered online, some things we’d never want to lose will still be lost, and some things we know for certain happened differently will still be falsely portrayed.

Blockchain provides opportunities for new business models that bring back control and trust.

But blockchain provides opportunities for new business models that bring back control and trust. In many such cases, customers and end users will need to look very closely to notice any differences, as the changes mainly will occur in the back ends.

Promising business cases

Digital Rights Management can be changed profoundly by the use of blockchain technology. Blockchain can drastically reduce the spread of illegal copies of software, potentially saving companies billions of dollars. This is achieved by keeping a blockchain-based inventory of licenses bought, used, shared, expired or decommissioned, completed by an automated billing process. This inventory, as with any blockchain-based use situation, is distributed across several networks and encrypted, and it is theoretically impossible for anyone to manipulate (see “Blockchain – What’s What?”, this issue, pg. 17).

The same principle can be applied to any digital asset or process. Whatever becomes part of a blockchain stays in that blockchain. A blockchain never forgets. Whoever owns the asset will have much greater control, which is something end users will notice. Unlike with content published on the Internet, the use of content kept in a blockchain can be restricted. Think, for example, of that picture you posted on Facebook and wish you hadn’t: If your social network was
blockchain-based, you wouldn’t be able to delete the picture (which you can do now). However, you could prevent anyone from sharing or even viewing it after you changed your mind.

While security and privacy can be enhanced by blockchain technology, its distributed nature does not lend to anonymity. As Matteo Cagnazzo and Chris Wojzechowski put it: “Blockchain technology will not be the holy grail of cyber-security, but it is a powerful tool which can help to harden systems.” (see “Security and Privacy in Blockchain Environments”, this issue, pg. 26)

We do not know yet which applications are going to be killer applications, game changers or disruptive.

Some say blockchain has disruptive potential. Any company whose business depends on handling large numbers of payments or contracts might find that blockchain will change their industry. Take, for instance, Car eWallet, a German-based blockchain project that aims to convert vehicles into smart vehicles that function as electronic wallets. The vehicles would pay toll fees directly and electronically. Granted, this may not sound particularly cutting edge, considering that most countries that charge for use of their roads already have easy-to-use payment systems in place. But blockchain’s disruptive potential becomes evident when automated micro payments are combined with the ability to charge your soon-to-be electric vehicle while you wait at a red light. That brief time spent waiting could be used to charge your battery and pay for the service at the same time, no matter how brief your stop.

Most blockchain experts agree that applications like Car eWallet are currently still in the experimental phase. The first blockchain-based crypto-currencies are already legal tender in Tunisia and Senegal and Sweden will soon join their ranks (see “Crypto-currencies – High Prospects Despite Low Reputation?”, this issue, pg. 19). We have many concepts of what blockchain can do theoretically (the most prominent examples come from the financial and insurance industries; see “Blockchains: A Cure for the e-Health Record Problem?”, this issue, pg. 21). But we do not know yet which ones are going to be killer applications, game changers, or disruptive.

Blockchain requires an ecosystem

What is known, however, is that any blockchain service will be successful only if the underlying technology provides security and scalability. Mining is a key success factor, and for it to play out, we need to fulfill the same infrastructure requirements that we already know from operating the Internet.

An entire ecosystem is needed to bring blockchain to life, and many companies are already throwing their weight behind the movement. As Anthony Robinson from Corning Optical Communications explains, “Not only must data centers evolve to meet the demand of higher traffic and more devices, but they must also prioritize securely storing users’ sensitive data. By transforming their architecture and adopting a blockchain strategy, they can take the next step forward to a completely connected society.” (see “Blockchain & The Cloud: Transforming Data Center Architecture for Tomorrow”, this issue, pg. 24)

The Linux Foundation’s Hyperledger Initiative is supported by names such as Accenture, Deutsche Börse Group, Cisco, Fujitsu Limited, Hitachi, Intel, IBM, Red Hat and VMware. IBM, Microsoft (BaaS) and Amazon (AWS) are working on their own software and service ecosystems surrounding blockchain.

The eco Competence Group Blockchain is your first stop for learning more about how eco can help you.

eco – Association of the Internet Industry has its own Competence Group Blockchain, https://blockchain.eco.de led by Stephan Zimprich (see “Blockchain – What’s What?”, this issue, pg. 17). Together with other industry experts, the group hosts different events on all topics related to the blockchain.

A survey conducted by the Competence Group (go.eco.de/blockchain-survey) with the help of YouGov of blockchain in the German market found that 32 percent of managers in Germany believe “blockchain will fundamentally change the German economy within the next 10 years.”

The Competence Group is your first stop for learning more about how eco can help you identify the advantages of the blockchain. Get in touch! (blockchain.eco.de/kontakt.html)

Read this article online at go.eco.de/what-can-blockchain-do
**BLOCKCHAIN – WHAT’S WHAT?**

*Stephan Zimprich, Attorney at Law, Fieldfisher, and Leader of the Competence Group Blockchain in eco – Association of the Internet Industry*

How does a blockchain actually work? Stephan Zimprich, Leader of the Competence Group Blockchain in eco – Association of the Internet Industry and Lawyer at Fieldfisher, explains the key concepts and terms behind blockchain technology.

Blockchain is currently a hype topic as a technical platform for digital innovations. It is a distributed technology for transparent and tamper-proof transactions without the need for a centralized authority. Below is a brief explanation of the most important blockchain terminology, in alphabetical order:

**Blockchain**

A blockchain is a database that is distributed throughout a network. As a result, all transactions are simultaneously saved in many different locations. Its integrity is ensured through the saving of the hash-value of each previous data set. It was created as the technical foundation for crypto-currencies like Bitcoin. In the meantime, numerous advancements have further developed the original blockchain technology. These enable a whole range of other applications aside from crypto-currencies, such as in the areas of license management, insurance, logistics, and ID management. For many experts, the strength of blockchain lies in simple transactions that validate the blockchain network – for example, in computationally intensive processes using proof of work (POW). The majority of computing resources decides which version of the blockchain is correct. This protects the blockchain against manipulation, and trusted intermediaries are no longer needed for the processing of transactions.

**Distributed Ledger**

The basis of a blockchain is a database of records distributed across all nodes of the network. This means that all data is shared between participants in a peer-to-peer network. All participants of this network have the same rights and the same information, and thus the same preconditions to be able to participate in the system and enter new information. Every node stores the entire database. This exhaustive redundancy protects the system against unilateral power, outage, and manipulation. The system is self-administering, and as a result could simplify processes for banks and stock exchanges, as well as in many other sectors.

**Consensus Process**

The consensus process is the decisive component for protecting a blockchain against manipulation. It prevents one participant from using a value more than once – for example, that a sum of money is transferred multiple times, even though it only exists as a single sum. The consensus process solves this "double-spending problem": Only when the majority of the connected nodes are in agreement about the generation of a particular new block will this be validated and the previously generated blocks will be "chained" to it.

**Mining**

All transactions are stored in blocks that are "chained" to one another – like a constantly-growing pile of sticky Post-it notes. The miners, the participants in the network, generate new blocks, by using computationally intensive process steps to aggregate and validate multiple transactions. During mining, a hash value – a kind of electronic fingerprint – is calculated for every new block on the basis of the previous block, and then the new block is chained to the previous one through the hash value. The blocks also contain a timestamp and a nonce, a randomly-generated string or set of characters. In order to calculate the current block's hash values for the next block, blockchain systems use, for example, computationally intensive proof-of-work processes. Given that every newly-created block is chained to the previous one by means of the hash value of the previous one, a linear, chronological chain is created.

**Nodes**

Any computer can become a node, and thus a fully-fledged part of a blockchain network. This is because the database itself, in other words the blockchain, is distributed across many so-called nodes (or clients), and each of them stores...
the entire blockchain. Using specialized software, the nodes receive and examine every transaction and send it on. The software also contacts other nodes, in order to get or submit information and is itself a component of the network. Anyone can operate a node, because the different nodes do not need to trust one another in order to guarantee the consistency of the data.

**Proof of Work (POW)**

Instead of trusting in a central authority, a computationally-intensive proof of work (POW), for example, is required within the blockchain. In this process, new blocks are generated in computationally intensive process steps, the correctness of which is easy to ascertain for the other participants. Here, speed is essential: The first to generate the new block is rewarded. The new block will only be accepted by the rest of the network, if the majority of the computing resources in the network confirm the result. This is, at the same time, a trust mechanism, because no individual within the network can calculate faster than the complete network. A rogue participant would need to be faster than all the others combined and control more than 50 percent of the processing power, which is impossible, since the individual participants or nodes do not have basic mutual trust. Alongside the proof of work process, there are further processes, such as proof of stake and proof of burn.

**Smart Contracts**

Alongside simple transactions, blockchain also enables what are known as smart contracts to be generated. A smart contract is a program that emulates a contract or technically supports the settlement of a contract. Smart contracts are not actually intelligent, but they can automatically carry out specific actions if pre-defined conditions come into effect, making the settlement of the contract possible without human intervention. In this way, contract partners can determine in advance that, in the case of rain on a particular day in a particular location, a defined sum of money will be paid out – this would be an application in the form of a bad-weather insurance policy for filming. The smart contract can, for example, obtain the required weather information from an Internet-capable weather station without human intervention, and the payment of the insured sum would be done using a blockchain-based crypto-currency like Bitcoin – in this way, the contract can be settled completely without the need of a trusted central authority.

Smart contracts also serve as the basis for more complex applications that no longer need human intervention. An example is decentralized autonomous organizations (DAO); autonomously acting and completely digital companies based on blockchain. Here also, activities are monitored and implemented completely without human judgement, but rather simply on the basis of algorithms. Such applications can be designed, for example, using the platform Ethereum. This blockchain with integrated programing language makes tools available to developers in an open platform, in order to develop their own smart contracts and to use them in a blockchain.

More information on the activities of the eco Competence Group Blockchain can be found here: blockchain.eco.de/ (in German) and here go.eco.de/blockchain-en (in English).

Read this glossary online at go.eco.de/blockchain-glossary
New methods of conducting payments and bank business have been developed since the early days of the Internet; Credit cards, direct debit cards, and e-money transactions are widely accepted and increasingly popular. However, all these payment methods require two things: banks and a regulated currency. With the emergence of blockchain technology, new payment methods have evolved, which claim to make banks and regulation unnecessary. What are these crypto-currencies, what are their benefits, and do they really have an impact on the banking and financial world? Daniel Groß, Attorney at Law, DWF Germany, Cologne, explains.

The most widely known crypto-currencies are Bitcoin and Ether, but they are by far not the only crypto-currencies. At present, more than six hundred crypto-currencies exist, and each follows its own rules. What they have in common is that they are exclusively digital, hence they are cashless, and make use of blockchain technology. This means they use cryptographic processes to ensure security within the payment system and store all processed transactions in a tamper-proof decentralized database, which every user can access. The decentralized database is usually referred to as the “ledger”.

Both Tunisia (2015) and Senegal (2016) have introduced digital currencies based on blockchain technology.

Currently, crypto-currencies are not commonly issued by a state or regulatory authority (both Tunisia (2015) and Senegal (2016) have introduced digital currencies based on blockchain technology). Thus, their creation has to follow certain methodological guidelines from within the currency’s network. From the approaches available, the most common method is so-called “mining”. In a nutshell, mining is part of the validation process required for each transaction within a crypto-currency. The validation process follows a complex mathematical procedure and therefore requires special hardware consumers usually cannot afford. Hence, consumers usually acquire their first units of a crypto-currency by exchanging their state-regulated money, so-called “fiat currency”, for the chosen crypto-currency on specialized exchange platforms.

Legal nature of crypto-currencies

The legal nature of crypto-currencies is highly disputed in international expert groups and many jurisdictions come to different legal classifications, ranging from declaring them illicit to accepting them as legitimate means of payment. In Germany, crypto-currencies are not official currency, but can serve as means of payment under private-law contracts.

Advantages over fiat currencies?

In comparison with fiat-currency-based transactions, crypto-currencies offer one major advantage: they are fast. Where a transaction with fiat money takes up to three bank days to complete within the European Union, or even more than a week for international transactions, a crypto-currency based transaction is usually completed within a few minutes. This is due to the fact that within a crypto-currency transaction, only a given data set is exchanged and stored within the currency’s ledger. No banks are involved and no conversion has to take place on cross-border transactions.

Programmers see the further advantage that wide areas of crypto-currencies are based on open source software. The entire blockchain technology does not use proprietary soft-
E-COMMERCE, DIGITAL FINANCIAL TECHNOLOGY & BLOCKCHAIN

ware and neither do many crypto-currencies. This gives software developers the unique opportunity to develop their own payment solutions and freely place them in the market.

Reactions from fiat currencies?

Also within the EU, banks are currently speeding up their processes. By the end of 2017, the second Payment Services Directive of the European Parliament (PSD2) will have entered into force. It tackles the aforementioned issues: a major aspect of PSD2 are intraday payments. In the future, payments within the EU shall not take longer than a bank day to complete. This is a significant increase in transaction speed and might just be enough to make crypto-currencies negligible for daily business in the eyes of consumers, as they are still not a widely accepted payment method.

Also, with PSD2, the obligation of “Access to Account”, or XS2A, is introduced. XS2A means that banks must provide software developers and FinTechs with the Application Programming Interfaces (APIs) necessary to grant a software-solution access to bank accounts of a given user, if permitted by that user. XS2A’s purpose is to enable third parties to offer new solutions and services for payment and banking. Thus, XS2A is theoretically capable of opening the banking and finance world to new FinTech innovations on a large scale.

High-speed = high flexibility?

**Crypto-currencies may have an advantage in speed, but they lack the flexibility and convenience of fiat money.**

Even though crypto-currencies claim to enable rapid transactions worldwide, this alleged truth has one major drawback: crypto-currencies only provide high-speed transactions within their very own ledger. When it comes to cryptocurrency conversion, things change drastically. Where banks have established convenient conversion procedures for fiat currencies, users of crypto-currencies have to find their own ways of converting one crypto-currency to another or even back into fiat money. Therefore, crypto-currencies may have an advantage in speed, but they lack the flexibility and convenience of fiat money.

Interledger and other current developments, a merger of two ideologies? An attempt at an outlook.

Of course, the problems regarding the conversion of crypto-currencies have not gone unnoticed by the FinTech community. A current and promising approach is the so-called “Interledger protocol”. This protocol is inspired by network protocols. In simple terms, Interledger regards every crypto-currency’s ledger as a node of a network that is capable of spanning through most of the existing crypto-currencies. It allows the routing of payments through different ledgers, automatically converting them and thus making a payment with a crypto-currency the recipient does not even use. At least in theory, the protocol could also be used with fiat currencies, which could bring the ideologies of fiat currencies and crypto-currencies closer together.

**Crypto-currencies’ impact on the banking world cannot be denied and the community of crypto-currency users is growing steadily.**

Such mergers sound far-fetched? Not necessarily. Outside of the EU, in Tunisia, such a merger has already begun. With the replacement of the eDinar with the blockchain-based Monetas currency in 2015, Tunisia has become the world’s first nation to offer its national currency through cryptographic technology. Senegal followed in 2016. Also within the EU, crypto-currencies have clearly left their mark: in late 2016, the central bank of Sweden, the Sveriges Riksbank, announced plans to issue the e-Krona. And even though plans are still in an early phase, it is quite likely that the e-Krona will be blockchain-driven as well. Furthermore, European regulatory authorities are beginning to rethink their approach to the classification of crypto-currencies. With the implementation of the EU Anti-Money-Laundering regulations in national law in January of this year, the BaFin also seems to be reconsidering their position on crypto-currencies.

Whatever the outcome of these processes will be, crypto-currencies have become a serious alternative to fiat-money-based FinTech approaches. Their impact on the banking world cannot be denied and the community of crypto-currency users is growing steadily. Almost every day, new ideas for blockchain-based payment methods arise. As the idea of a crypto-currency is rather young, there are still many legal questions to be solved. From a legal point of view, developments could not be more exciting.

Read this article online at [go.eco.de/crypto-currencies](go.eco.de/crypto-currencies)
BLOCKCHAINS: A CURE FOR THE E-HEALTH RECORD PROBLEM?

Electronic health records (EHRs) have been a long time coming. Is blockchain technology a solution for the difficult issues of data privacy and patient autonomy? Dr. Christina Czeschik of Serapion explores the potential and shortcomings of using a blockchain for EHRs.

A never-ending story, or so it seems: According to German law, citizens with statutory health insurance were supposed to receive a functional electronic health card (elektronische Gesundheitskarte, eGK) in 2006. However, the eGK did not replace the now obsolete Krankenversicherungskarte (KV; health insurance card) until 2015. Fast forward to 2017: Here we are, still waiting for the first useful applications of the eGK and its accompanying telematic infrastructure (Telematik-Infrastruktur or TI).

One application, in particular, will be paramount in realizing the potential for increased quality and efficiency in healthcare: the inter-institutional electronic health record (EHR).

Electronic health records (EHRs) have been a long time coming. Is blockchain technology a solution for the difficult issues of data privacy and patient autonomy? Dr. Christina Czeschik of Serapion explores the potential and shortcomings of using a blockchain for EHRs.

The electronic health record problem

As these examples illustrate, there are two distinct concepts in EHR: Electronic case records are restricted to storage and sharing of data of a single case, ending with the patient’s convalescence and thus beneficial from a privacy point of view. Other kinds of electronic patient records and electronic health records – terminology is variable here – store health data over a patient’s life time. Furthermore, there are solutions that address the problem of data exchange between providers without aspiring to implement a complete EHR, such as Hamburg-based LifeTime (lifetime.eu/).

One application, in particular, will be paramount in realizing the potential for increased quality and efficiency in healthcare: the inter-institutional electronic health record (EHR).

The EHR problem is not merely a problem of data sharing logistics: Every solution that deserves serious consideration in a national healthcare system needs to put patient privacy and informational freedom of choice first in its list of priorities. Traditionally, starting with a landmark court ruling of 1983 (the national census judgment) or even earlier, German citizens have been more sensitive to privacy issues than other nationalities (go.eco.de/dot-data-protection) – even more so today when their personal health data is at stake. Physicians’ concerns regarding their patients’ privacy – voiced time and again at the annual general meetings of the Federal Medical Chamber – was one of the main
When the new German e-health law was issued in 2015 (effective in 2016), great care was taken to allow for a high degree of patient autonomy in choosing which applications to use and which data to share with providers. However, the law was vague as far as actual implementation issues are concerned.

Can blockchains be employed in a useful manner to facilitate data sharing in healthcare and at the same time preserve patient privacy and empower patients?

This current landscape of EHR begs the question: Can blockchains be employed in a useful manner to facilitate data sharing in healthcare and at the same time preserve patient privacy and empower patients to autonomously decide who will have access to which kind of data? The Estonian government has answered “yes” to this question; here, the startup Guardtime is working on a new patient record infrastructure.

Gideon Greenspan: “If your requirements are fulfilled by today’s relational databases, you’d be insane to use a blockchain.”

But in order to answer this question for ourselves, let’s first look at the circumstances in which blockchains are not the technology of choice. To quote Gideon Greenspan of MultiChain in his essay “Avoiding the pointless blockchain project” (go.eco.de/gideon-greenspan): “If your requirements are fulfilled by today’s relational databases, you’d be insane to use a blockchain.” Common database technologies such as SQL have been tested and refined for decades, after all.

However, there are some conditions in which a conventional database has its shortcomings: Whenever a shared database has not only multiple readers, but multiple writers, when these writers don’t necessarily trust each other, and when one would like to forgo having a so-called trusted intermediary that is responsible for permissions to write to the database, and for the correctness of that which is written. A common example for the trusted intermediary is a notary; in healthcare, it might be more appropriate to think of it as a central organ that is responsible for integrity and privacy of EHR – maybe a large hospital or a third-party institution like the Gesellschaft für Telematik im Gesundheitswesen mbh (gematik) that was formed to take charge of the implementation of TI in Germany.

Why blockchain?

Why would one want to forgo such a trusted intermediary and use a blockchain instead? The first reason is, of course, economy. Trusted intermediaries are usually quite expensive to run. Especially in healthcare, unnecessary expenses in one place lead to scarcity and a lower quality of care in other places. Another reason is that having a central intermediary means having a central vulnerability to outside threats, be it malware and other IT-related dangers, or real-life adversaries, human and otherwise (fire, water, earthquakes, et al.). Finally, the trustworthiness of a trusted intermediary may be disputed by some of the parties. This is a salient point in healthcare: There are few other industries in which so many different viewpoints and agendas need to be reconciliated to achieve a common goal (good patient care, presumably).

Interdependent transactions and blockchain

Another strength of the blockchain is that it is designed to handle transactions that are dependent upon another. In Bitcoin, you can only spend money that you have received previously. In healthcare, you may only be booked for surgery when the results of your blood tests have come in and coagulation is within normal parameters. In Bitcoin, “proof of work” makes sure that no conflicting transactions are included in a block, and that no transaction in a new block is contradictory to transactions in a previous block. For this quite labor-intensive work, so-called miners are rewarded with the coinbase and some transaction fees. In healthcare, physicians and researchers might be willing to do the validation work for a “fee” in form of anonymized patient data, for instance, derived from the blockchain that they may then use for scientific purposes (see, for example, go.eco.de/blockchain-in-healthcare-study).

Blockchains generally do not confer anonymity. Quite the contrary: The original blockchain as proposed by Sakamoto is designed to be transparent for each participant as far as transaction IDs are concerned.
These are the advantages of a blockchain-based EHR system. But isn’t the blockchain also the tool of choice to improve a system’s privacy? This is something that is often misunderstood in popular media: Blockchains generally do not confer anonymity. Quite the contrary: The original blockchain as proposed by Sakamoto is designed to be transparent for each participant as far as transaction IDs are concerned (see also “Security and Privacy in Blockchain Environments”, this issue, pg. 26). While transaction IDs are not linked to personal names, the tracking of transaction patterns can enable identification of single participants. The need for improved privacy has been identified by entities from the financial and cryptocurrency communities and has, for example, led to the development of truly anonymous currencies such as ZCash (z.cash), using zero-knowledge cryptography. In healthcare, however, complete anonymity is neither necessary nor desirable. Instead, solutions should be sought in which patients themselves control whom to divulge their identity, where to remain pseudonymous, and which pieces of data to share. Such solutions have been developed, for instance, in the field of online identity management (see, for example, blog.meeco.me/immutable-me/).

**Bottom line:** The blockchain is no secret weapon of privacy and security. In specific circumstances it can, however, confer considerable economical and organizational advantages over conventional database technologies – and these circumstances are remarkably similar to the present day conditions of the healthcare sector. Pilot projects of blockchains in healthcare are underway in the US (see go.eco.de/blockchain-pilot-projects-ehealth); German healthcare professionals will have to turn to similar projects to see whether or not blockchains will transfer successfully to applications in the medical field.

Read this article online at go.eco.de/blockchain-in-healthcare
To pave the way for technologies like this, large data centers are evolving their digital infrastructures for the next generation of cloud services. But they need the right infrastructure in place to ensure the rapid, seamless, and secure transmission of data, voice, and video to an increasing number of users. For these reasons, many data centers are transitioning from current 3-level tree network architectures to a spine-and-leaf network architecture, which can accommodate blockchain systems and increasing data processing demands.

Transforming data center infrastructures

**Internet data centers require higher bandwidth and a much more efficient network architecture to support spikes in heavy traffic from their large number of users.**

In contrast to the traditional enterprise, where data center traffic is dominated by local client-to-server interactions (north to south), the network traffic of the large Internet data center is dominated by the server-to-server traffic (east to west) required for cloud computing applications. The number of users accessing data via applications is not only huge; they also have diversified and fragmented demands and require an uninterrupted user experience. Internet data centers require higher bandwidth and a much more efficient network architecture to support spikes in heavy traffic from their large number of users.

The current mainstream 3-level tree network architecture, which is based on the traditional north-to-south transmission model, is not effective for the applications as it consumes a large amount of system bandwidth and creates
latency concerns. To address these challenges, the world’s large Internet data centers are increasingly adopting a spine-and-leaf network architecture, which is more effective for transferring data between servers (east to west) and allows data centers to expand according to business needs with lower initial investment costs (see Figure 1).

But data center managers encounter new issues when deploying a data center with a spine-and-leaf 2-level architecture. Since a leaf switch is required to connect each spine switch, managing a massive quantity of cabling becomes a major challenge. Corning’s mesh interconnection module (Table 1) solves this difficult problem by enabling a fully meshed, 10G fabric connection between the QSFP spine switch ports and the leaf switch ports without ever having to break out to LC connections at the main distribution area (MDA) (see Figure 2).

The traditional structure (Figure 3, left) has not been widely used because the cabling system is very complex, the cost is relatively high, and it requires a lot of rack space at the MDA.

In this scenario, the use of a mesh module can be a good solution to resolve these problems. In the case of a network module used in MDA (Figure 3, right), the full mesh of the leaf switches is achieved without having to break out the 40G port of the spine switch into 10G channels via an MTP-to-LC module. This greatly improves the MDA cabling structure by eliminating massive LC-to-LC patch fields and can be of great value for the user (see Table 2).

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>Save NGA distribution space by 75%</td>
</tr>
<tr>
<td>MTP connectors</td>
<td>Reduce number of jumpers in NGA by 75%</td>
</tr>
<tr>
<td>Link-loss</td>
<td>Decrease link-loss by 20%</td>
</tr>
<tr>
<td>Cost</td>
<td>Reduces installation cost by 45%</td>
</tr>
</tbody>
</table>

Table 2: Advantages of a Mesh Module in the MDA.

Data centers that implement blockchain technology can provide clients with an even more secure storage method for users’ sensitive information.

Once the proper infrastructure is in place to support the growing amount of data traffic, data centers can better secure that data. Blockchains have become popular solutions through recent examples like Bitcoin, but they are not limited to the financial sector. The technology, sort of external ledger, uses a cryptographic method to distribute data across multiple computers, making it more difficult to hack. Data centers that implement the technology can provide clients with an even more secure storage method for users’ sensitive information.

Catering for future demands on data center services

Data center network infrastructures are going through major transformations to meet the demand of continuously growing data traffic and the need to securely store sensitive information. At the same time, they must support the Internet of Things, 5G networks, and billions of new devices, while continuing to supply the increasing speed and scale required for this interconnection.

Utilizing the mesh module to achieve a full fabric mesh of the spine-and-leaf network supports the current 40G network while ensuring the seamless transition to future 100G network capabilities as user demand grows.
As network bandwidth requirements for the data center rise, the backbone of the data center network has been gradually upgraded from 10G to 40G, and will reach 100G in the near future. The spine-and-leaf network architecture will deliver an economical and efficient network structure for the management of large data distribution. Utilizing the mesh module to achieve a full fabric mesh of the spine-and-leaf network supports the current 40G network while ensuring the seamless transition to future 100G network capabilities as user demand grows.

Not only must data centers evolve to meet the demand of higher traffic and more devices, but they must also prioritize securely storing users’ sensitive data. By transforming their architecture and adopting a more secure blockchain strategy, data centers can take the next step forward to a completely connected society.

Download the full paper “Blockchain & the Cloud: Transforming Data Centre Architecture for Tomorrow” (go.eco.de/corning-blockchain-paper)

Read this article online at go.eco.de/blockchain-and-the-cloud

SECURITY AND PRIVACY IN BLOCKCHAIN ENVIRONMENTS

Matteo Cagnazzo, Researcher, M.Sc., Institute for Internet Security

Chris Wojzechowski, Researcher, B.Sc., Institute for Internet Security

Matteo Cagnazzo and Chris Wojzechowski, both researchers at the Institute for Internet Security, explore how security and privacy can be enhanced by blockchain technology.

Blockchain is currently one of the most-hyped technologies. In this short article we will try to show where current downsides in blockchain security and privacy are. We will explore how security and privacy can be enhanced by blockchain technology and outline the challenges ahead.

Problems of Blockchain Security/Privacy

Transactions are globally published and are not encrypted in most applications. If this data is personal data, for example “medical or financial data”, this leads to regulatory and legal problems, especially in Germany. One solution is to store only encrypted data in the blockchain, which leads to another problem: If the key to decrypt specific information is lost, the data may not be recovered accurately. Furthermore, if a key is stolen and published, all the data is forever decrypted in the blockchain since the data cannot be altered. However, blockchain can also help to improve defensive cybersecurity strategies, especially in terms of identity and access:

MITM Attacks

One attack scheme for man-in-the-middle (MITM) attacks is to get the Certificate Authority (CA) to provide the user with forged public keys (Public-Key Substitution MITM attack). This can lead to the decryption of sensitive information. In a blockchain approach whereby users put their public keys in published blocks, the information is distributed over the participating nodes with links to previous and following blocks. This makes the public key immutable and it becomes harder for attackers to publish fake keys. Furthermore, the single point of failure, the CA, is also distributed, meaning it...
is harder to bring this service down. Projects that try to solve this problem are: okTurtles.

### Data Tampering

Since every transaction is signed and distributed over all blockchain nodes, it is practically impossible to manipulate data without the network knowing about it. How do you prove that Germany won the World Cup 2014? You do not have to prove it, since it is general knowledge that distributed across the people. In health care, the blockchain could be used to create immutable audit trails, maintain the integrity of health trials, and ensure the integrity of patient data shared across different medical environments.

### DDoS Attacks

If DNS systems were based on blockchain technology, attacks like the one from Mirai botnet ([go.eco.de/dot-gridlock-ddos](http://go.eco.de/dot-gridlock-ddos)) would be harder to successfully complete. Such a system would provide transparency and security. The DNS infrastructure could not be targeted if it was a distributed system, since the data is distributed and the data entries cannot be tampered with, due to the append-only nature of the blockchain. The project okTurtle is also realizing a blockchain-based DNS service.

### Privacy

The blockchain technology is a great example for the unrelatedness of security (at least in terms of immutability) and privacy. Whilst it is possible to design an immutable, tamper-resistant transaction, this transaction can be seen throughout all of the nodes on the network. The most promising research on privacy (or private transactions) for blockchain technology is currently zkSNARKs, which are implemented by zCash and Ethereum (zCash on Ethereum).

### Challenges

Even though privacy-enhancing technologies are deployed, they still produce metadata. Statistical analysis will reveal "some" information, even if the data itself is encrypted, making, e.g., pattern recognition possible. Furthermore, scalability is an emerging challenge, since the consensus process is currently too expensive. If currency or any other value is traded on a blockchain-based application, a much higher transaction speed is needed. Ethereum is currently capable of 2.8 transactions per second, while bitcoin is capable of approximately 3.2 transactions per second. It takes so long because of the complex consensus process for each transaction (currently proof of work or proof of stake). Another attack to keep in mind is the 51%-attack or "Majority Hash Rate Attack". If an organization or individual has 51% of the hash power, the attacker can reverse transactions he sent, prevent transactions from gaining confirmations, and prevent other miners from mining.

### Conclusion

Cybersecurity threats emerge every day, while older threats still linger around and wait to be exploited once again. Blockchain technology will not be the holy grail of cybersecurity, but it is a powerful tool which can help to harden systems. Blockchain plays its strengths very well; if the system which it is disrupting is a centralized system with a single point of failure. If higher transaction speeds are possible, blockchain is a technology with use cases ranging from smart grids over the Internet of Things to a globally deployed and used currency system and smart contracts.

Read this article online at [go.eco.de/blockchain-environments](http://go.eco.de/blockchain-environments)
If your company is part of the financial ecosystem and you are considering expanding your business in Germany, you are probably thinking: Frankfurt. But why? Take a look at the reasons—and the potential Frankfurt has to offer. Mathias Röckel explains.

Whether you are travelling to Frankfurt by plane, train or car, the city will make sure you notice its importance long before you reach your destination. Frankfurt’s skyline is unique in Germany. Nowhere else in the country will you find a greater cluster of skyscrapers. Among the towers are Deutsche Bank, Commerzbank, and the European Central Bank. The Deutsche Bundesbank is also headquartered in Frankfurt, as is the KfW. More than 200 banks can be found in Frankfurt. And then, of course, there is Deutsche Börse, the country’s most important stock exchange.

“The banks all gather in Frankfurt because that’s where all the banks are. Circular reasoning with a valid conclusion.”

Ask any German why all the banks gather in Frankfurt, and there is a fair chance the answer you hear is, “Because that’s where all the banks are.” This kind of argument is called a “Zirkelschluss,” or circular reasoning. The definition of this kind of logic is that there is no logic to it.

But what if, in the case of Frankfurt and its banking sector, the argument is valid? After all, if you are part of the financial sector, there is no way to avoid Frankfurt.

“Banking is necessary, banks are not.” Bill Gates

What if you are into banking, but not into banks? Why put up with high rents and the sun being blocked by all those skyscrapers if your business does not require residency in Germany’s banking capital? Why is it that so many fintechs are located in Frankfurt?

…for the time being, banks and fintechs don’t compete as much as is often said.

One reason may be that, for the time being, banks and fintechs don’t compete as much as is often said. Both are into banking, and both have assets the other could benefit from. Fintechs are often technologically advanced and agile, while banks have strong brands and profound experience in dealing with customers. They are also very knowledgeable in regulatory matters and have the required licenses. Also, both draw from the same workforce.

Security, Connectivity, and Latency Matter

The banking sector relies heavily on technology and, because of regulatory and customer requirements, needs the highest levels of security, connectivity, and latency. This is true for those who run their business from the city’s skyscrapers and is at least as important for their tech-based challengers.

In Frankfurt, these service levels are fulfilled by a number of data center providers. All the important providers are there; many have more than just one data center in the Frankfurt
area; and all of them are expanding their capacities year after year to keep up with growing customer demand. The city’s data centers have recently surpassed Frankfurt’s airport in terms of energy consumption.

According to Dr. Béla Waldhauser (see go.eco.de/green-it), CEO of Telehouse Deutschland and Leader of the Competence Group Datacenter Infrastructure in the eco Association, all of the larger, well-established data centers will be massively expanding their capacities in 2017, with figures of 5-10 MW of additional capacity per provider (go.eco.de/dc-demand-growing).

As a result, Frankfurt is not only one of the world’s most important locations for banking, but also one of the most important data hubs.

**It has come to the point where networks go to Frankfurt – because everybody goes there.**

DE-CIX (de-cix.net), the Internet Exchange run in Frankfurt, is among the world’s largest of its kind. In Europe, only Amsterdam and London are similarly important data hubs. More than 700 national and international networks meet here to peer their Internet traffic. The amount of data handled by DE-CIX has been growing year after year, most recently peaking at 5.6 Terabit per second (go.de-cix.net/de-cix-frankfurt). It has got to the point where networks go to Frankfurt – because everybody goes there.

**BREXIT: Less for London, More for Everybody Else**

Recently, another factor has emerged when opting for Frankfurt: BREXIT. Much has been written and speculated about BREXIT’s consequences for the UK and its economy as well as for London and its financial sector. Reuters estimates that as many as 9,000 jobs in the industry could move from the UK (go.eco.de/reuters-brexit-banks) to other European countries as a direct consequence of BREXIT. Other estimates of job losses are higher (go.eco.de/ft-brexit-banks); others are much higher (go.eco.de/dfb-brexit-banks).

Impact assessments like these tend to agree that London’s significance as the financial industry’s location will decrease, and that others will benefit. It is not a question of if, but of how much and when. The European Banking Authority (EBA), currently in London, is sure to leave the UK as a direct consequence of BREXIT. Politicians have already started talking about the ideal location for a future EBA office, and an application process is in place. Among the top candidates: Frankfurt.

Read this article online at go.eco.de/frankfurt-financial-hub
BUILDING AN INSURTECH STARTUP ECOSYSTEM IN GERMANY

The new InsurLab Germany initiative intends to support innovation in the insurance industry and facilitate startup growth. It will connect insurers directly with startups of different maturity levels, Torsten Oletzky, Member of the InsurLab Germany Task Force, explains.

“Revolution or Evolution”: This question is at the heart of the digitalization discussion in the insurance industry. Unquestionably, digitalization offers great potential, but also poses threats to the insurance industry. While media attention is on big revolutionary ideas changing entire industries, most real-life InsurTech startups are developing solutions for specific challenges within the business model of insurance companies. Hence, an early connection of startups and the insurance industry is key to enable sustainable growth and value creation for the majority of startups in this sector.

InsurLab Germany – part of the German de:hub network

The German economy – unlike the French or British – is highly decentralized with certain regions specializing in core competencies. The Digital Hub Initiative “de:hub” (go.eco.de/digital-hub-initiative) by the German Federal Ministry for Economic Affairs and Energy therefore aims to establish digital hubs for specific industries in different cities across Germany. In the first round, four de:hubs (Internet of Things, Mobility, FinTech, and Logistics) were successfully established in five cities. In the second round, another seven industries were selected, including the InsurTech de:hub in Cologne in the state of North-Rhine Westphalia, a region where several German insurers have their headquarters. InsurLab Germany (go.eco.de/insurlab) has the mandate to establish the InsurTech hub in Cologne. It will be connected with the hubs from other industries, which helps to foster growth through joint problem solving.

Strong support from the insurance industry

Insurers need to work closely with startups providing new perspectives on their business models and offering new solutions to old problems.

A core question at a recent major insurance conference was: Should the insurance industry set up new entities separate from the current business or should new solutions be developed by teams within the company. The conclusion was that new solutions should ultimately be an integral part of the insurers’ business model itself. But how do we get there? Insurers need to work closely with startups who can provide them with new perspectives on their business models and offer new solutions to old problems. Most insurance executives do obviously understand this, and therefore it came as no surprise that InsurLab Germany enjoyed strong support from the German insurance industry from day one. At the founding ceremony of InsurLab Germany, eight insurers joined as founding members, with about a dozen more committed to joining in the coming weeks. Having this strong backing from the insurance industry, InsurLab
Germany should be able to establish the planned InsurTech startup eco-system.

**Excellent conditions for startups**

*Insurance companies will have the opportunity to introduce their day-to-day challenges in areas like blockchain or e-commerce and collaborate with startups at InsurLab in finding solutions.*

InsurLab Germany will enable both national and international startups to work in close collaboration with the German insurance industry and universities. An important aspect for InsurLab Germany is the strong involvement of the insurance top management. Interested startups will find a broad customer base – insurance companies, as well as other clients – to support their product development. In addition, insurance companies will have the opportunity to introduce their day-to-day challenges in areas like blockchain or e-commerce and collaborate with startups at InsurLab in finding solutions. With two universities from Cologne as founding members and further universities joining in due course, there are multiple possibilities for students to pick up ideas and elaborate innovative solutions. The development process is facilitated by a living environment with smart mentors & peers, guiding seminars & workshops, as well as essential tools & hardware at everyone’s disposal. InsurLab Germany therefore provides a firm basis to establish and grow a startup.

**More than just another accelerator**

In a globally ever more saturated market of specialized startup accelerators, incubators, pre-seed venture capitalists, and business angels, the need for another hub can reasonably be questioned. Startups do already have a wide variety of choices to get excellent mentorship and financial support.

Most established accelerators/incubators have experience in the B2C sector and can provide advice in setting up a growth plan, successfully conquering a niche or even competing head-to-head with established industry players. InsurLab wants to do more: it aims to enable startups to establish B2C as well as B2B relationships, seeing insurance companies as partners or customers. In order to crack long-standing business processes/relationships and convince the sometimes conservative insurance industry managers to change established processes, the open environment of InsurLab, where trust and confidence can be built up, is essential.

**An interesting platform for venture capital**

*Venture capitalists have the chance to find and invest in startups with entrepreneurial spirit and at the same time deep industry/customer expertise provided by the InsurLab.*

InsurTech is an attractive area for venture capital funds, but so far it has been difficult for them to find suitable investment opportunities in Germany. An ecosystem where they can meet with both startups and with insurers will benefit these players as well. Venture capitalists have the chance to find and invest in startups with entrepreneurial spirit and at the same time deep industry/customer expertise provided by the InsurLab. For the startups themselves, the possibility for an early proof-of-concept enables them to increase their business perspective significantly – giving them the chance to speed up growth and acquire further funds from venture capitalists, while keeping overall business independence.

**Reshaping the insurance industry**

Startups will play a major role in the reshaping of the insurance industry. Both providing evolutionary improvements as well as revolutionary new operating principles. The InsurLab initiative supports startups to find the right solutions, get the best feedback and ensure rapid and sustainable growth with a solid customer base.

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