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BLOCKCHAIN INNOVATION

BLOCKCHAIN TECHNOLOGY: BUILDING THE EUROPEAN UNION'S GLOBAL LEADERSHIP

EVA KAILI, EXPLAINS THE IMPORTANCE OF BUILDING THE EUROPEAN UNION'S GLOBAL LEADERSHIP WHERE BLOCKCHAIN TECHNOLOGY IS CONCERNED

IN THIS ISSUE












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INTRODUCTION

Happy New Year and a very warm welcome to the January 2019 Blockchain Innovation publication.

Heading up this edition, we are honoured to have Eva Kaili, MEP, Rapporteur of the European Parliament of the Blockchain Resolution as a prestigious contributor. In her article, she explains the importance of building the European Union's global leadership where blockchain technology is concerned.

In addition, Gunnar Hökmark MEP from the Group of the European People's Party (Christian Democrats) explores the world of financial markets in Europe and asks if it is possible to avoid a crisis. He also tells us about the potential impact of the role of disruptive change to new technologies on the market.

Finally, in a very special in-depth feature, Stefan Junestrand, CEO of Grupo Tecma Red and a member of the European Blockchain Observatory shares his thoughts on what a blockchain-based governance model for smart cities looks like.

As we enter 2019, I hope you find the insights in this edition insightful. Feel free to get in touch with me if you would like to contribute an opinion piece at any time during the future. ■

Jonathan Miles
Editor

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Blockchain technology: Building the European Union's global leadership

Eva Kaili, MEP, Rapporteur of the European Parliament of the Blockchain Resolution explains the importance of building the European Union's global leadership where blockchain technology is concerned

Opening space for a new technology, like blockchain, in the political and regulatory level, is a challenging task. It looks like a political entrepreneurship endeavour. Governmental organisations always have their own priorities and their immediate needs to cover. Short-termism is the "by default" condition. Creating demand for political and regulatory engagement around a forward-looking and potentially disruptive technology is not always easy. Especially when this technology is in the middle of a hype, challenges the existing value chains and is depicted by many legacy institutions as barely legal or even a tool for scammers.

Having obtained the permission to write the Blockchain Resolution of the European Parliament the first priority was to start educating people that blockchain is a general purpose technology. Blockchain in not just about crypto-assets. It is an enabling technology that can be used in a wide range of sectors, including energy, supply chain management, education, creative industries, the financial sector, healthcare, transportation etc. The great achievement of the Blockchain Resolution is that depicts it as an infrastructure based on which we can develop smarter institutions, a more efficient public sector that increases the value to the citizens, and a solid foundation for the Internet of things (IoT) applications.

Of course, crypto-assets is a distinct enabling technology we cannot ignore. The difference between a cryptocurrency and an initial coin offering (ICO) is that the first has not a counterpart, whereas the second has. Regarding cryptocurrencies, Bitcoin, Ethercoin (ETC) and so on and so forth, these provide us with an indicator for the evolution of money. The concept of money has changed many times in the course of history. We are in a time of change once again. Eventually, we will be in need to have money that can be encoded in a smart contract. Cryptocurrencies can help in this direction. A "Crypto-Euro" is a case we should explore soon. On the other hand, ICOs proved that they are instruments that can mobilise idle capital in high-risk start-up projects. We touched on the issue during the negotiations of the Crowdfunding Platforms Regulation and we asked both the European Commission and The European Securities and Markets Authority (ESMA) to propose a framework that enables ICOs within a secure and legally-certain environment.

Another great challenge we stressed in the Blockchain Resolution of the European Parliament is about the development of an ecosystem that will support distributed ledger technology (DLT) in general. This challenge includes the problems of cybersecurity, data protection, energy waste problems, as well as issues about the interoperability of the ledgers, self-sovereignty and digital identity issues, and problems related to the legal enforceability of smart contracts. Especially in the space of smart contracts, the challenges are as great as their potential. Good governance methods and best practices can be explored through the thorough examination of use-cases and the development of blockchain application in the protected environment of regulatory sandboxes.

The European Commission has already built impressively on the mandate it took from the European Parliament. There are already four use-cases in place under the supervision of the Commission. There is also a hackathon of blockchain-based applications for social good that interested parties can apply for until

Eva Kaili, MEP (S&D, Greece), Rapporteur of the European Parliament of the Blockchain Resolution

April 2019. Use cases are the elements we need in order to promote blockchain technology and create certainty and confidence around it. Confidence building does not come from the regulation of the technology per se. It comes from the regulation of its uses. This is the regulatory concept of "technology neutrality". The other regulatory concept we used is the "business model neutrality". By this principle, we signify that the regulator does not favour any business model over another. If blockchain applications can disrupt existing value chains and replace them with brand new ones, then let it be so.

The most important thing tough is to signify that blockchain is a technological space that the European Union (EU) can become a global leader in. Perhaps this is the reason why all the political parties of the EU voted in favour of the resolution, something, which is a one-in-the-decade event in the Brussels politics. The European Commission is ready to move things forward fast and propose frameworks and initiatives that will strengthen the EU's global competitive advantage in both standards-setting and ecosystem development. In this vein, we made sure that significant amounts of money will be dedicated to blockchain through the grants of the new Multiannual Financial Framework (MFF). Similarly, the European Investment Bank (EIB) and the European Investment Fund (EIF) will finance blockchain applications and research, either independently or within the framework of the European Fund for Strategic Investments (EFSI) and the InvestEU Programme.

> "The European Commission has already built impressively on the mandate it took from the European Parliament. There are already four use-cases in place under the supervision of the Commission. There is also a hackathon of blockchain-based applications for social good that interested parties can apply for until April 2019. Use cases are the elements we need in order to promote blockchain technology and create certainty and confidence around it."

It is apparent that the EU invests and opens up opportunities. It is now the decision of the European citizens, both start-ups, major firms, universities, research institutions and governmental organisations to start taking the risks of experimentation and develop commercial and non-commercial blockchain empowered solutions. Making the EU a global leader in the field, is essentially a bottom-up function and the success of the blockchain experiment can be copied to other technologies, that are even more complex, like artificial intelligence (AI), neuroscience and quantum computing. ■

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A global biomedical ecosystem to underpin lifetime patient healthcare: Improving the world's supply chains

Genevieve Leveille, Venture Partner of BioLife and Co-Chair of the TechUK DLT Working Group explores how current advances in DLT will improve the world's biomedical supply chains when it comes to life sciences health care

The way health services are delivered is changing and not a moment too soon for the world's ailing healthcare systems. Issues of patient data security, meeting agreed standards of healthcare and ensuring better health outcomes for all people everywhere have brought some of the brightest minds on the planet together at this crucial time, to solve the crisis. The BioLife team is at the forefront of the move toward lowering the costs of intricate care.

As BioLife begins to improve access to high-end biomedical services worldwide, there will be a noticeable shift in the way health is managed and treated. BioLife, through its digital ecosystem, integrates the world's major life science resources to underpin lifetime patient care and ensure global liquidity for the bioscience industry.

Yuelin Liu, Chairman of the Tinjoy Health Group, Executive Director of the China Overseas Chinese Merchants Association and Chairman of Shenzhen One Belt and One Road Investment Development Group started his business in 2007 and has made many advances in the life sciences industry including as the creator of BioLife.

Founded on digital ledger technology (DLT) as a consortium chain of ACChain, BioLife digitises assets and handles private records for patients, investors and owners of global biomedical resources. Patients can create a personal electronic health record (EHR) and access high-end health product and service suppliers. Biomedical resources are digitised, and traceability is maintained throughout the supply chain as trade in digital assets between resource owners and patients takes place. Immutable peer-to-peer transactions occur on the BioLife chain when agreements trigger linked smart contracts.

These new technologies can support people in taking more responsibility for their own health. Waste is reduced within the system as biomedical resources are tracked end-to-end. Overall, the introduction of the BioLife ecosystem creates more productivity within the health systems of the world. Research and the development of new treatments are well supported through open sharing and better treatments without duplication can be produced faster. Treatments are becoming more personalised.

The BioLife platform serves as a safe, reliable, efficient and economical foundation for a thriving biosciences community. Products, services, personal data and assets relevant to life sciences health care are being digitised. Patients can obtain authenticated pharmaceutical drugs and biomedical services and receive access to a credit ledger from asset owners.

BioLife providers include pharmaceutical companies, health service organisations, equipment manufacturers and research institutions. As patients purchase health services on the BioLife Service Platform, the relevant health data is accessed only through a private key and transmitted peer-to-peer, ensuring privacy and security.

As a decentralised healthcare delivery system, BioLife is poised with advantage in the coming establishment of widespread high-capacity, low-latency 5G networks planned for deployment in 2019. Early investors in the BioLife ecosystem will benefit from these deployments, which will support acceleration in the digitisation of distributed, local health resources worldwide.

The BioLife service platform opens a transparent marketplace for a wealth of customised biomedical treatments and therapies. BIOT, as the internal fuel token of BioLife, enables trade in biomedical resources as digital assets, reducing cross-border payment costs and risks. Contributors and investors are able to acquire, maintain and

access intricate health care within a safe and secure exchange system. BIOT is structured in a way that supports the entire BioLife digital ecosystem and increases liquidity within the biomedical industry.

The BioLife community is occupied by three types of members: clients (patients and their families), providers (health services practitioners, biomedical researchers, health service institutions, government agencies and non-profits), and developers (programmers and software engineers). As bioscience develops biological solutions to sustain, restore and improve quality of life for humans, plants and animals in our world, the BioLife community seeks to establish a service channel of traceability, security, convenience and confidentiality.

BioLife's resource providers include Swiss Serolab® of Leukerbad Wellness Management Group Ltd. The first enterprise to BioLife, Swiss Serolab® provides over 80 types of medicines and own more than 1,000 bioscience patents covering areas from anti-ageing to major illness precaution. Enshi Tinjoy Bio-Technology Co., Ltd., another resource provider on the BioLife chain, is a high-tech enterprise specialising in micro-ecological health. Shenzhen Dongchen Pharmaceutical Holdings Ltd., whose main business includes pharmaceutical precision retail, big data applications, health management, and cross-border e-commerce of big health will integrate the chain pharmacy resources and adopt a model of "direct mining and self-operating + offline experience + health consultants" to provide clients with a number of value-added services. Guangzhou Zhongxin Gene Medical Technology Co., Ltd., a genetic wholly-owned enterprise with a mission to "take genetic technology as the core, with mobile intelligent monitoring of the Internet of things (IoT) platform to support and implement dynamic monitoring" is also among the first resource providers to join BioLife, with benefits to patients and the industry itself.

BioLife's resource providers include Swiss Serolab® of Leukerbad Wellness Management Group Ltd. The first enterprise to BioLife, Swiss Serolab® provide over 80 types of medicines and own more than 1,000 bioscience patents covering areas from anti-ageing to major illness precaution. Resource provider Enshi Tinjoy Bio-Technology Co., Ltd. is a high-tech enterprise specializing in micro-ecological health. Shenzhen Dongchen Pharmaceutical Holdings Ltd., whose main business includes pharmaceutical precision retail, big data applications, health management, and cross-border ecommerce of big health will provide clients with a number of value-added services. Guangzhou Zhongxin Gene Medical Technology Co., Ltd., a genetic wholly-owned enterprise with a mission to "take genetic technology as the core is also among the first resource providers to join BioLife, with benefits to patients and the industry itself.

As BioLife integrates our world's life science resources into one digital ecosystem, investors in BioLife have all the evidence of the value of their investments at their fingertips. It is time to reduce the costs of intricate care for Your Body, Your Health and Your Life.

Social media links

https://www.facebook.com/BioLifeChain/

https://t.me/BioLifecommunity

https://www.youtube.com/channel/UCI3azfNKsqHUyfhyOCSjxGA?view_as=subscriber

https://medium.com/biolife

https://www.reddit.com/r/BioLifeChain/

https://bitcointalk.org/index.php?topic=5065102.msg47675794

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Financial markets in Europe: Is it possible to avoid a crisis?

Gunnar Hökmark MEP from the Group of the European People's Party (Christian Democrats) explores the world of financial markets in Europe and asks if it is possible to avoid a crisis. He also explains the potential impact of the role of disruptive change to new technologies on the market

Is there a way to avoid a financial crisis? The answer is no. Financial crises will come, often as a result of high growth and rapid development. A disruptive change to new technologies may change the logic on the market and the game of competition or crises may suddenly emerge from financial instability, trade wars or conflicts. They can also come from misjudgements on the role of new or old business structures.

Bad investments have bad consequences and good investments will be followed by tougher times. When it happens, it influences financial markets, as financial markets measure the value and the development of the economy. That is how one can attract capital for investments, allocate it to the best investments and disinvest when needed. Financial capital decreases by losses and increases by profits.

The financial market is like a thermometer of the economy that sometimes goes better than expected and sometimes worse. Where there are growing economies and uncertainty about the future, there can be a crisis. Uncertainties in the short-run secure growth and prosperity in the long-run. Only failed economies avoid financial crises, because of constant stagnation without hope for new achievements. We cannot avoid crises, but we can reduce the magnitude and the consequences.

First, we need financial markets in competition, which can serve different technologies and business models. That is why it is important with a European financial market, to have a Capital Markets Union and competition. With the plurality of business ideas, different technologies, companies to invest in and private investors, we get tremendous risk sharing. There will still be defaults and insolvencies, but most of them will not influence other parts of the economy.

Financial markets are about analysing risks, taking risks and distributing them. Better opportunities to analyse risks means better risks will be taken. The more different the risks are, the better they are distributed.

Second, we need different investors. Capital markets union is of interest for anyone who wants to stimulate investments together with stable financial markets. The more capital for investments outside the banking sector, the less exposure for the banking sector to risks of the economy. We need to stimulate private shareholding, private equity, different forms of venture capital and private savings. When private households have better buffers for losses, they have better room for new investments, and stability.

Third, financial markets must be characterised by transparency and efforts directed to the best of the investors, savers or customers. Customers and investors need to know the risks. Investment companies need to serve the interests of the customers to facilitate profits to the company and the leadership. We have made progress in this context via the legislation on Mifid, IDD and Emir.

Fourth, banks need to be as stable as possible. They are the core of financial markets, necessary for payments, saving, investment making, liquidity making and financing investments. In Europe, they are financing the dominating part of small and medium-sized companies. We must ensure that they are not over-burdened, unable to finance necessary investments, which would lead to financial instability when companies fail to grow.

It is good if banks can be based on different legs, like investment making, market maker trading, or their customers but not on their own interest, retail and

Gunnar Hökmark MEP, Group of the European People's Party (Christian Democrats)

deposit. Diversified banks normally seem bigger, but also more stable. That is why I opposed the proposed legislation on separating banks in two parts: retail and the rest. It would have hindered development to a better capital market, but also competitiveness on the global market, and reduced investment and market making where it is needed.

Now we are strengthening the credibility of dealing with banks in crises through the banking recovery and resolution directive (BRRD), which is the base of the banking union. We are introducing requirements on subordinated capital that will facilitate bail-in without rocking the financial system or public finances. With higher levels of own capital and sufficient debt for bail, we clarify that banks are exposed to risks just as every other company, meaning that risks in banks will be analysed and distributed the same as financial markets in other parts of the economy. Those who invest in the bank will pay for losses and deficits and will refrain from investing more than they can lose.

Fifth, public finances must be stable and on EU-level. We need a backstop in the form of European Stability Mechanism (ESM) that can stabilise banks when a bail-in is not enough and can lead to deeper crises. The ESM is important to make the bail-in instrument in the BRRD credible, meaning that markets know that bail-in will be used because governments have other alternatives if the situation becomes worse.

These five points make risks in the financial markets better analysed, taken by those who can take risks and distributed to avoid deep shock. This way we can reduce the impact of a crisis and prepare for new opportunities. ■

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Bridging the gap between traditional banking and crypto

The Founder and CEO of HEdpAY reveals his ultimate vision to be the leading company in FinTech by bridging the gap between the traditional financial services and the crypto ecosystem in today's global market

Whilst some people still 'trust' traditional banks and financial institutions, many are looking to a new world – and this includes cryptocurrencies and crypto banking. Vicken Kaprelian, Founder and CEO of HEdpAY, a pioneering company in connecting traditional banking and the crypto universe, talks about his ultimate vision to be the leading company in FinTech bridging the gap between the traditional financial services and the crypto ecosystem in the global market.

"Unlike traditional money, crypto is decentralised, meaning it is outside the control of banks," explains Vicken. "The banks have, therefore, largely shunned crypto, particularly as it is also coming under increasing scrutiny from regulators. For crypto to be used by the masses, it currently must be integrated with fiat currency (euros, pounds, dollars, etc). Both traditional banks and crypto banks have their place, and, with the current mood of distrust, they need each other. There is a bridge that needs to be built to align both." Future banking operators like HEdpAY are building a platform that connects crypto with fiat currencies and supports decentralised control. Overcoming these challenges will finally bring crypto use to the mass market.

"Traditional banks are seeing the potential value of crypto but bringing them together requires restructuring of legacy systems, adaption to the desires of the new consumer generation and changes to rules and regulations," continues Vicken. "Banks and bankers' worst clients are high-risk customers and non-stable residents, but the red-tape around compliance and KYC procedures are really due to human constraints, however, cryptocurrencies and blockchain solutions embrace a self-centralised process in a smart contract manner. I believe we will see more of a correlation between fiat and crypto, with banks and ICOs creating their own blockchain platforms and bespoke tokens, which will, in turn, become the new bank currencies. Consumers will then use these widely more for payments but in a decentralised way, just managed by the bank on their behalf.

HEdpAY is one of the first projects connecting traditional bank and the crypto universe, and one of the first to be creating investment funds in crypto, in order to maximise profits and minimise losses," explains Vicken. It has been created to be the first and most authoritative financial institution enabling users to transfer their fiat currency in crypto quickly, safely and compliantly, using the following services: current account, debit card and exchange. HEdpAY also gives investors exclusive opportunities: creating their own blockchain, helping entrepreneurs developing new projects (ICO) following detailed protocols, selecting only the best projects in order to preserve investors, and evaluating currencies already included in the market.

> "Overcoming these challenges will finally bring crypto to the mass market".

The company's goal is to showcase how its futuristic solution, "bridges the gap between crypto and traditional banking to revolutionise a financial system that is still anchored to old banking standards," in the words of Vicken. He believes that the real opportunity is the benefits blockchain can bring to the financial services industry. "While ICO marketing has witnessed saturation over the past few months, the real opportunity is more about the benefits that blockchain can bring to financial services to bridge the gap between traditional and crypto banks. The insurance industry is primed for the integration of blockchain technologies. Other opportunities can be seen in voting, forecasting, government, crowdfunding, retail and real estate. I think the possibilities are endless.

Despite the perceived negativity around cryptocurrencies in regard to the puzzle of jurisdictional risk and regulation, Vicken is positive about the future of crypto, whilst establishing and cultivating compliant relationships

with the regulatory bodies, global financial institutions and businesses. "HEdpAY's purpose is to provide the services of the modern traditional bank whilst implementing the prospects of a bank for cryptocurrencies, and at the same time ensuring better regulation of the cryptocurrency market, says Vicken."

> "...revolutionise a financial system that is still anchored to old banking standards."

In the past year, HEdpAY has reached some significant milestones, most recently the company received the Most Outstanding Payments Solution Company of the Year 2018 in the Global Business Insight Awards and has been listed on four major crypto exchanges including ChainCreator. The company offers two kinds of HEdpAy (Hdp.dp) ERC223 tokens:

- Equity token, based on the company equity, hedged to the registrar of its c-class shares, which will be presented in Q1 2019 and;
- Utility token, based on the community operations and transaction activities, which will be available until the end of Q4 2018.

"Both tokens will be used within the HEdpAY ecosystem to ensure our team of highly skilled developers to complete development work on our revolutionary platform, adds Vicken."

HEdpAY's ambitions of the future

Going forward, the company's ambition remains undimmed. "HEdpAY has an exciting year ahead in terms of the completion of our ICO, the future launch of the HEdpAY Exchange and our full set of banking services," says Kaprelian. "In a year's time, I would like to see the gap between traditional and crypto banking reduced thanks to the wider benefits that can be realised through blockchain technology."

HEdpAY – The future banking solution. Explore the possibilities'?

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Decentralising security for mobile devices: Is blockchain the viable solution?

Steven Sprague, Cofounder and CEO of Rivetz reveals a viable solution when it comes to decentralising security. He argues that there is great promise for creating mobile device security with blockchain technology

The world was introduced to the first commercial mobile phone in 1983 with the launch of the Motorola DynaTAC 800x, which stood at a height of 13 inches, weighed 1.75 pounds and took 10 hours to recharge. In the early days of the mobile phone industry, it was incredibly simple for attackers to clone a phone's identity and run up all sorts of charges on your account.

Over the last few decades, mobile has experienced quite a metamorphosis from the "brick" of the 1980s to the compact, feature-packed smartphone of today. Now, mobile is king – people across the globe use their mobile devices not only to communicate but also to read the news, get directions, stream music, check bank accounts, store assets and so much more.

As we increasingly rely on our mobile devices, new avenues of attack continue to emerge. So much of our sensitive personal information and digital assets – such as corporate data and bank account and credit card numbers – are accessible via our mobile devices. They have become treasure troves for attackers.

Blockchain and mobile device security

There is great promise for creating mobile device security by combining secure enclaves – also known as 'roots of trust' – with blockchain technology. Blockchain is a distributed ledger technology that protects a digital transaction through complex mathematical algorithms. Because of the strength of this math, the transaction can only be created by those who hold a valid private key.

Private keys were developed as a means of protecting our digital transactions. A private key is a piece of cryptographic code that allows a user to prove who he or she is – in other words, it's a digital signature that says the user is, in fact, the one who is executing a digital transaction.

Private keys are used to secure a variety of transactions on mobile, including messaging, cryptocurrency and more. Here's the downside: if an attacker steals your private key, they can impersonate you, and then access and abuse your data and digital assets. The prevalence of mobile devices has made them some of the largest repositories for private keys.

The biggest challenge in decentralised cybersecurity is that we cannot prove the transaction was intended. If an attacker steals your private key and transfers $5,000 to a third person, there is no way to prove that the attacker – and not you – performed the transaction. Rivetz ensures an intended transaction by establishing that it occurs from a known device, in a known condition, with an authorised user, under the required conditions. Rivetz performs "device attestation" to ensure a user's devices are in a "known" condition by executing regular health checks to ensure the device integrity. Each device's integrity is recorded on the blockchain so future health checks can be compared with the baseline, establishing that those devices are in a condition the user intended.

As the rise of the internet brought digital fraud and attacks on identity, innovative industry leaders banded together to fight that fraud and formed organisations such as the Trusted Computing Group (TCG). TCG developed specifications that have become standard for securing devices, as well as the data and identity on those devices, such as personal computers and laptops.

Trusted computing uses hardware to protect users. It ensures a device will consistently behave in the expected ways, protected by a secure enclave or a 'root of trust' embedded within the device's hardware. A root of trust is isolated from the device's software operating system (OS), allowing it to execute code that cannot be seen by the OS. One such root of trust developed by Global Platform is the Trusted Execution Environment (TEE), which

enables trusted computing technology for mobile devices. The TEE already is built into the hardware of more than 1 billion mobile devices. Today, most private keys are generated within software, which is much more susceptible to attack than hardware. The TEE is capable of protecting a user's private key within the device hardware, a method that is far more secure than performing these operations in standard software.

A single system of security may not be enough to protect against the variety of cyber-attacks possible today. It is more pressing than ever to provide multi-layered protection of digital assets across two or more security domains. That way, even if an attacker were to breach one point of security, the other(s) still would need to be compromised, offering an extra layer of protection for important digital assets – whether that's your personal information or your hard-earned money.

One of the most ubiquitous roots of trust is the subscriber identity module, or SIM card. The SIM is a protected hardware environment and was created to combat mobile fraud and to protect the device identity. With the pervasiveness of both the TEE and the SIM, Rivetz saw an innovative opportunity to use these isolated roots of trust to work together to protect mobile users. In conjunction with ElevenPaths, the cybersecurity unit of Telefónica, the world's third-largest mobile carrier with more than 300 million subscribers, Rivetz uses both the TEE and SIM to protect our private keys – introducing the Dual Roots of Trust.

The solution leverages the TEE along with the SIMs deployed by Telefónica. With Dual Roots of Trust, Rivetz-enabled apps generate private keys in hardware, then cryptographically distribute those private keys between the TEE and the SIM. This delivers built-in security from both the mobile carrier and the device manufacturers, to create decentralised key protection.

By distributing a private key across these two roots of trust, attackers would have to breach both secure systems in order to steal a single private key. As an added security feature, two different entities – or independent control planes – aid the user in controlling their private keys. Through a special application authorised to perform activities inside the TEE, the user remains in control of the secrets stored in the TEE. If your mobile device is lost or stolen, a simple interaction with your mobile carrier can disable the SIM, permanently or temporarily until the device is found. So even if a thief has your device, you remain in control and your private keys are still safe.

The Rivetz solution has an unlimited number of use cases, such as sensitive work apps, mobile wallets, social media accounts and mobile banking. One of the most unique applications of Dual Roots of Trust is the ability to provably control specific applications on a device. This feature is especially useful for enterprises. Let's say a company has its own proprietary Rivetz-enabled app that employees use for work on their personal devices. If an employee is terminated or leaves, the company has the ability to revoke access to that app on the former employee's personal device with Dual Roots of Trust.

As our mobile devices have become more important to our everyday lives and contain so much of our personal and private data, we need better ways to protect ourselves. The solution lies in the roots of trust that already exist on millions of mobile platforms: the SIM and the TEE are two of the most common secure enclaves. Dual Roots of Trust is the next step in ensuring our assets stay safe.

rivetz

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A blockchain-based governance model for public services in smart cities

Stefan Junestrand, CEO of Grupo Tecma Red and a member of the European Blockchain Observatory shares his thoughts on what a blockchain-based governance model for smart cities looks like

Blockchain is a technology that has revolutionised the world of finance through cryptocurrencies. Now, the turn has come for blockchain to transform other fundamental aspects of our society, such as the organisation of businesses, the ownership of assets and even the way in which we govern our societies.

This opportunity for blockchain arises in an era where the management and services of our cities are being digitalised and are developing towards what is called "smart cities". It also comes at a time when public administrations all over the world are facing a growing demand to fight corruption; to improve the efficiency, transparency and security of their systems; and to develop a more participative, interactive and democratic citizenship.

Existing organisational models and technology platforms have not been able to provide all of the abovementioned needs. Blockchain technology, though, could offer solutions for the improvement of many of these aspects since one of its main features is that it provides a transparent, neutral, non-hierarchical, accessible, non-manipulable and secure information platform. Blockchain is also especially suitable for environments where there is low trust established between the actors, which is the case of the governance of our cities.

As a proof of the increasing interest in the use of blockchain for public services, many cities around the world have started to experiment with the development of blockchain applications. That work is of great importance since it generates experience and knowledge. But almost all blockchain applications currently developed, are isolated and hardly any city has a clear strategy on how to integrate them within a complete blockchain-based governance model for public services.

Stefan Junestrand, PhD Architect

The aim of this article is to help cities around the world to understand the framework, as well as the different components and their functionalities in a fully developed blockchain-based governance model for public services in smart cities. In this way, it will be easier to avoid unnecessary mistakes and get on the right track from the beginning.

This article starts with an introduction of the blockchain technology itself, as well as the phenomenon of smart cities. After that, it analyses how these two concepts can work together and presents a blockchain-based governance model for public services in smart cities. It concludes with some practical recommendations for cities in their approach to blockchain projects, along with a discussion of potential future research.

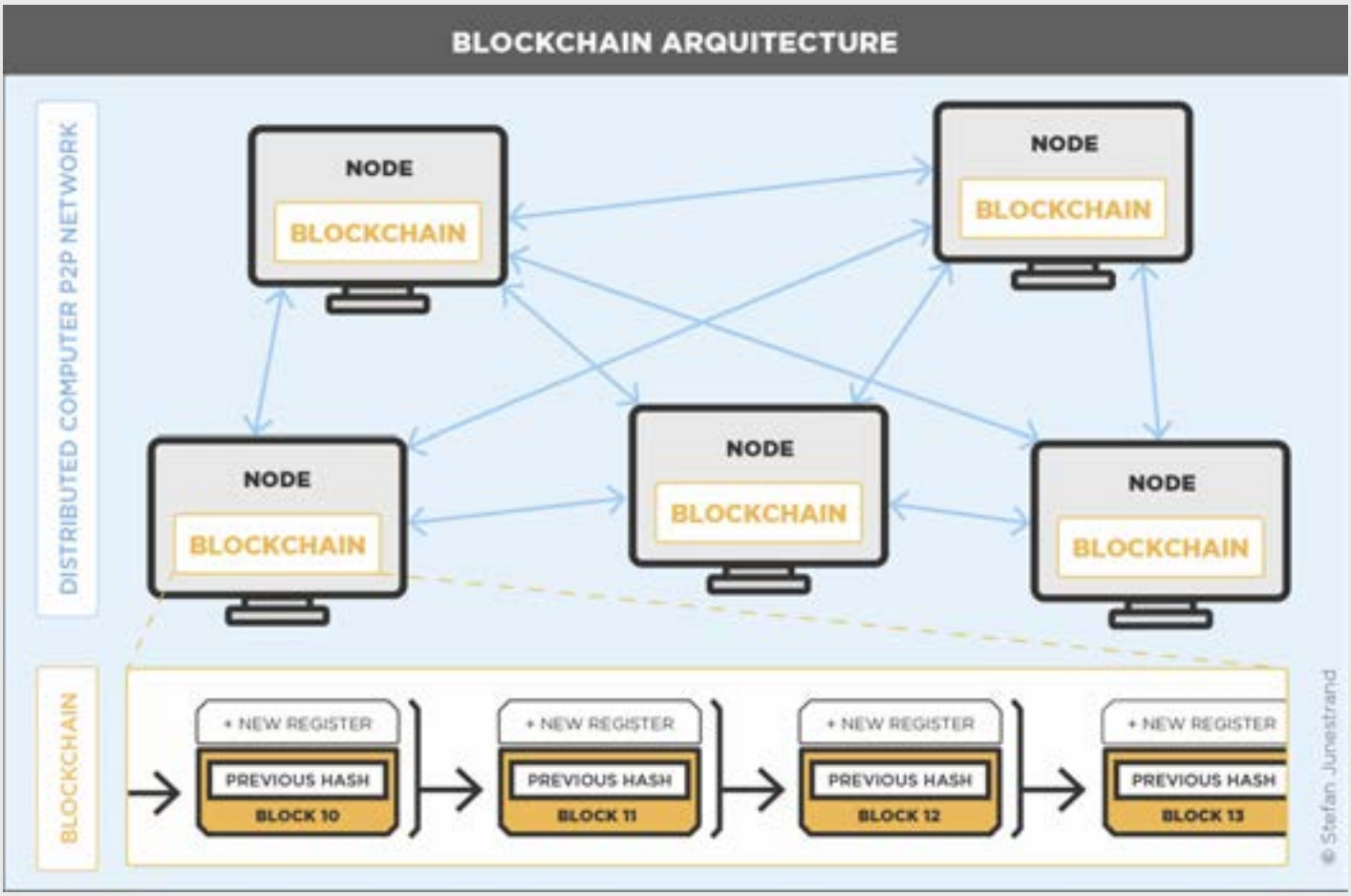

Figure 1. Model of the blockchain architecture with its principal elements. (Source: Stefan Junestrand)

It is worth pointing out that the political responsibilities for cities vary enormously around the world. And this article has a very open approach to this fact, as it considers that the city government could potentially provide almost any sort of public service in areas like administration, education, health, social services, transportation, security, energy, telecommunication, urban planning, waste management, etc.

What is blockchain?

Blockchain is a decentralised registry distributed on a computer network, where each computer stores the same information. On public blockchains, the information and functionality is owned and controlled by the members of the network and not by a central entity. The members of the blockchain system can add new information, but the previous records cannot be modified. The information can also be made public for any user to read.

Blockchain is designed to offer a secure, immutable and transparent information management platform for almost any application and it is especially relevant in environments where there is a lack of trust between the actors.

Figure 1 shows a blockchain architecture, with the distributed peer-to-peer (P2P) computer network in which interconnected nodes ("peers") share resources amongst each other without the use of a centralised administrative system, and each node has a shared version of the blockchain. For every new register a new block is created, adding the new register to the previous information, which is then updated on the whole network.

Distributed ledger technologies

It is important to understand that there is not only one blockchain, nor one single blockchain technology, but that the use of the concept blockchain, on a daily basis, refers to what is called distributed ledger technologies (DLTs). Ledger relates here to the traditional book of accounting where all the economic movements of an organisational entity (company, public administration, etc.) are recorded in chronological order.

Nowadays, the use of blockchain is not limited to economic transactions, but it is also used to record any "event" that occurs and that we want to keep a record of, for example: the transfer of properties, weather conditions, gaming results or medical history.

Smart contracts

The second generation of blockchain offers additional functionality to the pure recording of data, which is called "smart contracts". Smart contracts allow the blockchain to be programmed for automatic actions of any kind, triggered by any external action, based upon simple conditional statements.

DAPPS

A Dapp is a blockchain enabled web application, although in blockchain, the applications aren't called Apps, but "Dapps" (decentralised applications). This refers to that, the blockchain applications are run on a decentralised network. The Dapps are built upon the smart contract and use tokens for the transactions within the application and can also use them to reward users that provide computing power to the network.

Tokens

In blockchain systems, "tokens" are the representation of the different values and are the components used for the transactions within the system. Tokens can be of many types, but what they have in common is that they serve as an identifier for any kind of digital asset, which could be anything from monetary (as in cryptocurrencies) to physical assets (such as a piece of land) and even voting rights in a company, a private club, or a public election, etc. The tokens are technically a digital series of encrypted numbers (called a hash) which are stored by the users in their digital wallet and can only be used by accessing that wallet.

What makes blockchain different?

The main aspects that make blockchain so interesting and different from other database solutions are the following:

Decentralised ownership: Instead of a centralised database, a blockchain uses many decentralised, distributed and replicated databases in a computer network. This decentralised architecture establishes the ownership of the network to the users and not to a centralised organisation.

Immutability: Data storage is done in "blocks", which are linked together in chronological order, generating a "chain" of "blocks", i.e. blockchain. These blocks are added using complex cryptographical methods, a process called mining. The changes made are also registered simultaneously in all databases. Hence, in the blockchain, you cannot change a block in the chain, only add new blocks. This means that it is impossible to change the history of records in a blockchain, it is immutable.

Cybersecurity: The decentralised architecture, combined with the information stored in "chains" of "blocks" using complex cryptography, is a combination that makes a blockchain almost impossible to hack or attack from a cybersecurity point of view.

Different setups of blockchains

As mentioned above, blockchain is a flexible technology and can be applied in many different ways. When a blockchain is set-up and depending upon the needs of each application, there are two essential characteristics to consider:

Public and private blockchains: A blockchain can be both public and private, as well as a hybrid between both. In a public blockchain (also called permission-less), anyone can join by setting up a copy of the database and participating, but in a private blockchain, the owners of the application decide who may join the network and participate actively on it.

Rights to read and write: Another aspect to define is who has the right to read the data, as well as who has the right to add data to the databases. For example, in a city that uses blockchain for their financial ledgers, the city administration should probably be the only one able to write new data, although any citizen should be able to read all the information.

Towards smart cities

There is a growing need to tackle a number of organisational and social issues related to our cities today. Some of the most prominent trends and tendencies related to the cities are:

- The cities themselves are a force to attract an ever-increasing part of the population. In 2014, 54% of the world population was located in urban areas,

a percentage that is growing continuously and is expected to reach 66% by 2050 [1].

- The cities are playing a more prominent role in the economy and welfare of the nations. Although, our cities are also a focus for administrative, organisational, logistical, social and environmental problems.

- New political and social trends are claiming changes, such as: the end of corruption; greater transparency; the improvement of administrative efficiency; new models for citizen participation; more and better access to information and; better protection of personal and public information from a cybersecurity perspective, etc.

- Environmental related issues are playing a critical role in the cities with demand for lower energy consumption, less poluted air, etc.

- The technological development in areas such as communication, informatics and robotics is enormous [2] and society today is developing towards what is called a hyper-connected information society [3].

In response to the above challenges and new needs, the only reasonable solution is to incorporate technology to a higher degree in the management and operation of our cities. The concept that refers to an integrated and fully deployed use of information and communication technologies in the management of the cities is called "smart cities".

Given this background, it is understandable that there exists a growing interest in this topic and that large investments are being made in turning cities around the world into smart cities. For example, China is developing more than 200 smart cities [4], India is including more than 100 cities in the "Smart Cities Mission" [5]; the U.S. has developed the "Smart Cities Initiative" [6]; and Spain promotes the "National Smart Cities Plan" [7].

Smart city platforms

Until a few years ago, the process of digitalisation and automation of public services was stuck in the improvement of each service in an isolated way. But this limitation is no longer necessary since the different services in a city now can be integrated with each other. The technological solution that offers a horizontal integration of the different public services are called "smart city platforms". The platforms provide a single interface for the management of the whole city, which makes our cities capable of providing a radically more efficient type of management, as well as new and better services towards its citizens.

Smart city platforms are developed both by private companies and public collaborative initiatives and are implemented and used in a large number of cities around the world. Although the technical functionalities of current smart city platforms are generally good, many are still closed systems that show difficulties related to integration, transparency, security and robustness.

A possible solution to these problems presented is to build the smart city platforms upon blockchain technology. A correctly implemented smart city blockchain platform has the potential to revolutionise the governance model of the cities and provide a truly immutable, secure, open and transparent system for the citizens and the companies that operate within it. Below, the design of a "blockchain-based smart city governance platform for public services" is presented.

The design of a blockchain-based smart city governance model for public services

Applying blockchain for isolated services can be relatively easy and straightforward both within the private and the public sector. Nevertheless, it becomes more complex when it comes to using blockchain as a governance platform for the public services in an entire smart city. In this case, the whole governance model has to be designed to permit the implementation of political goals through the blockchain system. The main question then becomes:

- What should the organisation of a blockchain-based smart city governance model for public services look like?

Also, many other key questions arise concerning the model, such as:

- In what way can the different public blockchain-based services be best integrated with each other?

- How can private, or semi-public, blockchain services

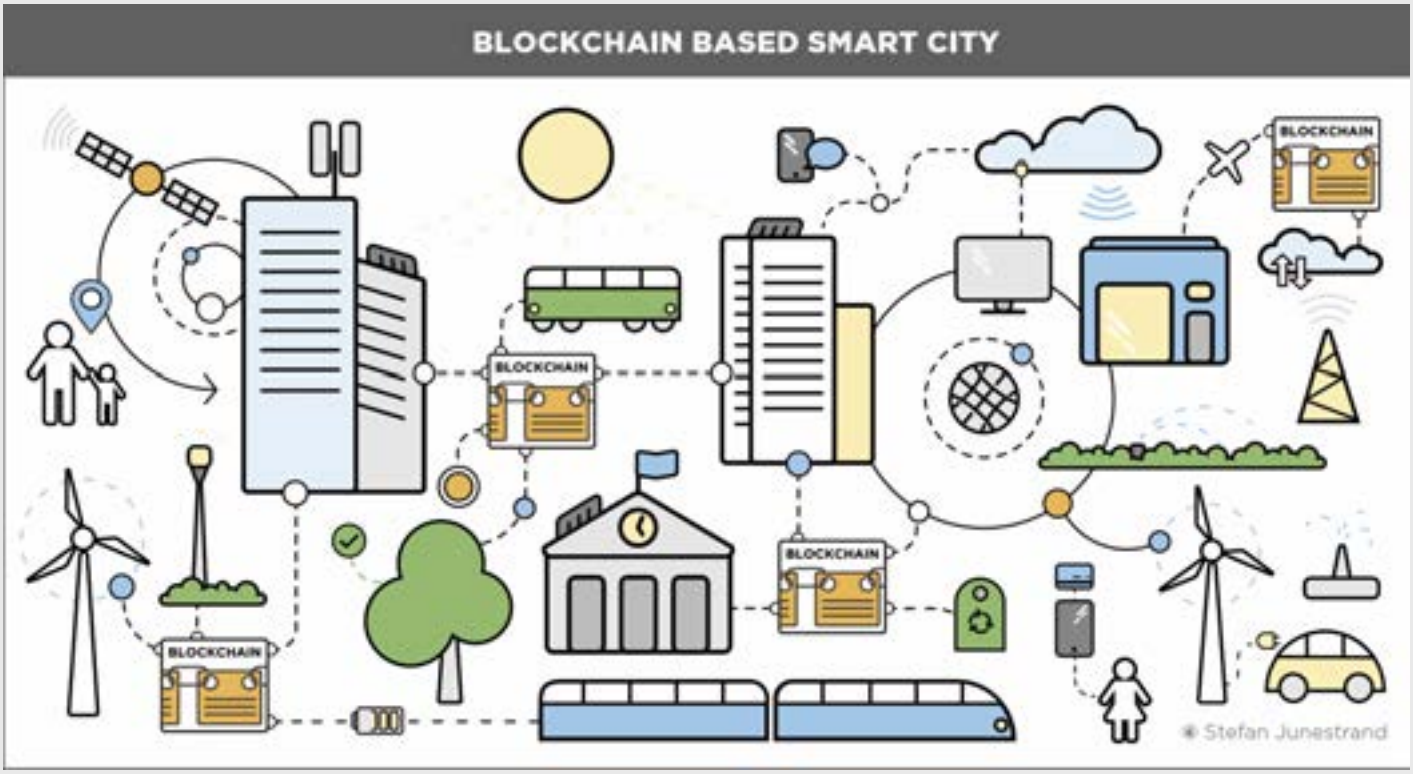

Figure 2. A smart city based upon blockchain. (Source: Stefan Junestrand)

be integrated with public blockchain-based services?

- Shall the public administration use one single token, or should a different token be used for each service?
- How can both private and open data within the system be structured, regulated and controlled?

Below, a model of a blockchain-based smart city governance platform for public services is presented, together with a discussion and presentation of some tentative answers to the questions above.

The components of the model

In a smart city governance platform for public services structured upon blockchain, some unique components such as: the digital wallet, Dapps, tokens, etc. are introduced, which are not present in governance models without blockchain.

Hence, to build a model for blockchain-based governance of public services in smart cities, the first step is to ensure that the main components are included and furthermore, that they are structured and organised in a relevant way, with a description of their functionalities.

The main components of the proposed model and their basic functionalities are:

- **Users:** Anybody with a relation to the public administration such as inhabitants, companies, institutions, etc..
- **User interfaces:** The interfaces through which the users interact with the different Dapps and information.
- **Digital ID:** The way the end user is identified within the system.
- **Open Data:** The information in the system that can be accessed by any person or system, such as public finances and records, voting results, urban data, environmental data, etc.
- **Digital Wallet:** The place where the users store their tokens (resources).
- **Tokens:** The units of value that represent different "rights", such as specific tokens for voting, health services, education, transportation, etc.

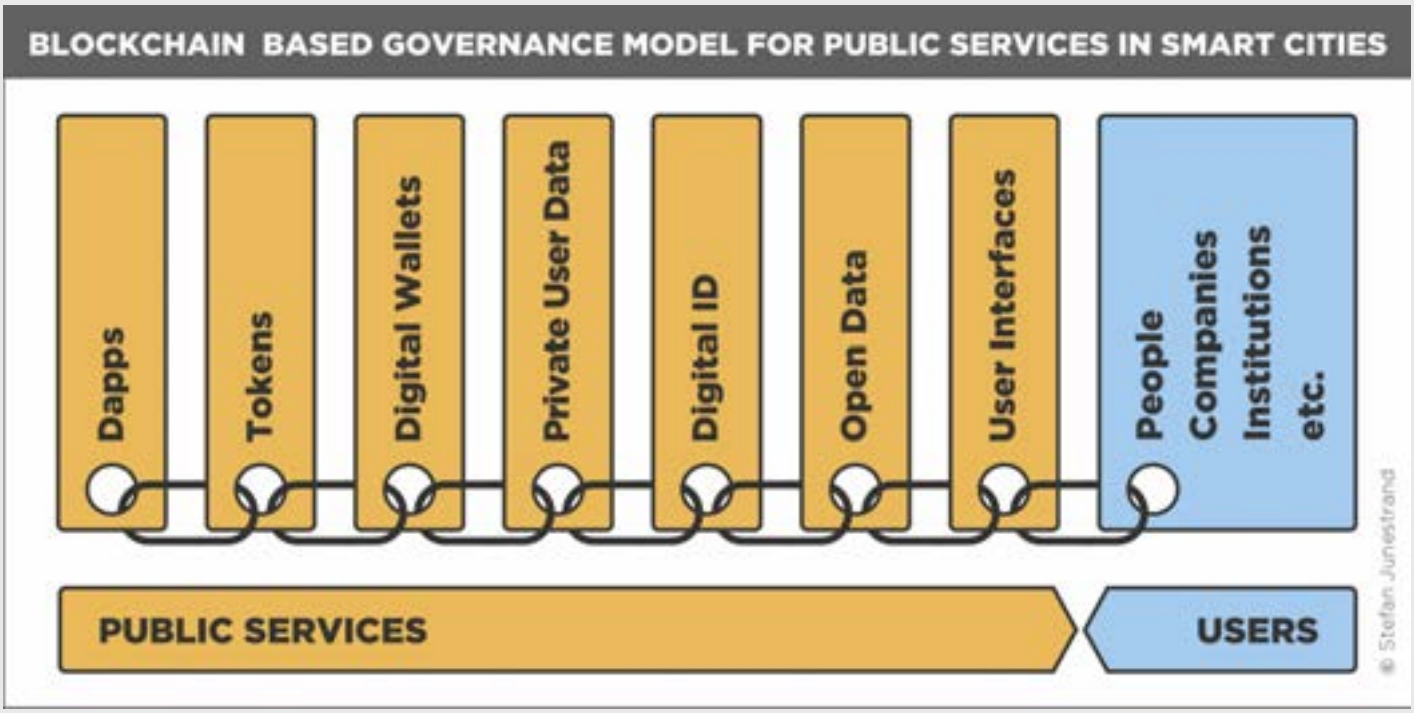

Figure 3. A blockchain-based governance model for public services in smart cities. (Source: Stefan Junestrand)

- **Dapps:** The distributed web applications developed for the implementation and management of the public services.

- **Public services:** The governmental activities from where the services are provided through the Dapps, and tokens and from where the private user data and the open data is delivered.

- **Private user data:** The information only accessible to the users with the specific rights, such as health records, social data, etc.

By structuring these components, a blockchain-based governance model for public services in smart cities is built (see fig. 3).

Reflections over the proposed blockchain based governance model for smart cities

Some general conclusions and discussions can be established when analysing the presented "blockchain based governance model for public services in smart cities" (see fig. 3):

- The "user interfaces" is the citizens first step towards any interaction with the applications and information. The design has to ensure the widest acceptance possible within the population, offering a variety of technology platform preferences, such as mobile, PC, etc. as well as the application of an accessible design considering different physical and intellectual capacities.

- The role of the "Digital ID" can't be overestimated, as it is necessary for any personalised interaction with the system, hence a successful deployment of a blockchain based governance model also has to ensure widespread implementation of the digital ID.

- The blockchain based governance model for smart cities will change existing tools and mechanisms for political steering, leaving public services to be implemented mainly through the Dapps, which will be the primary channel for the different services provided by a city.

- The development of specific tokens, in combination with the design of the Dappss, can ensure a high level of accuracy in the implementation of the public services.

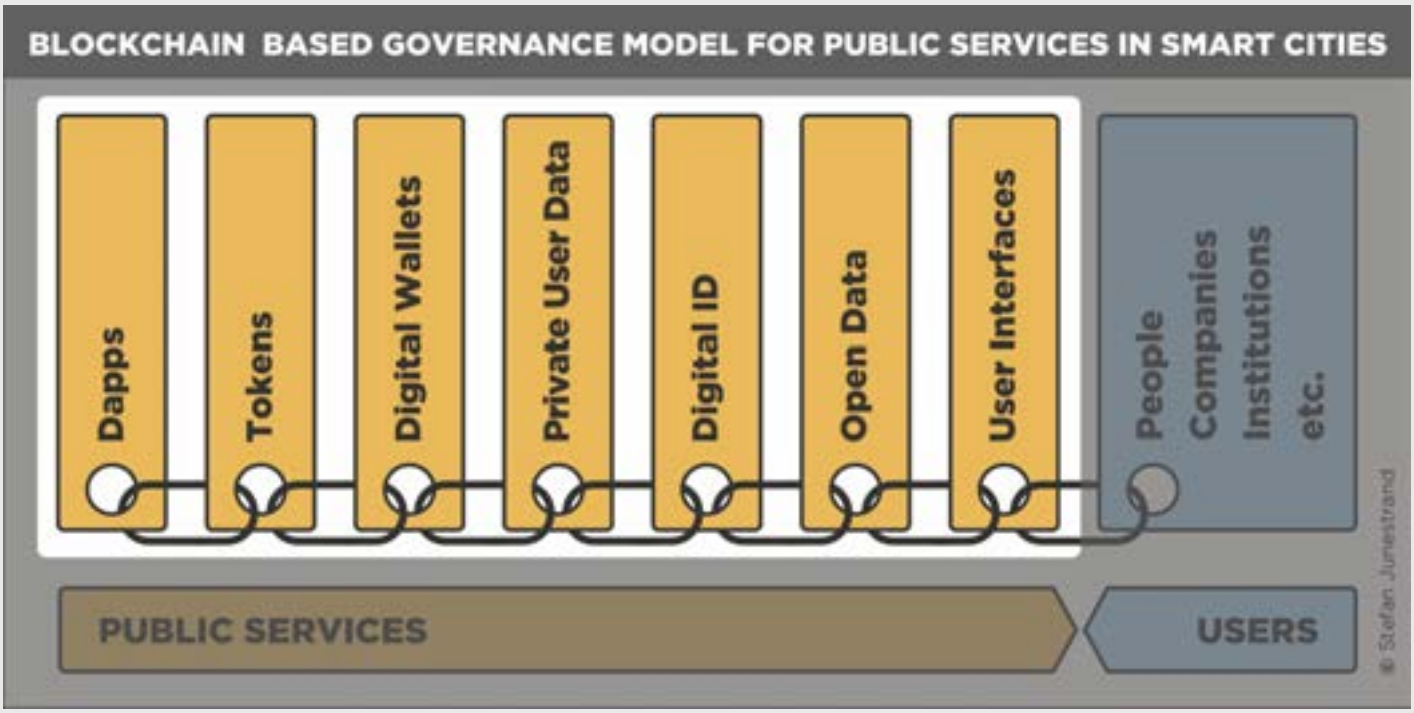

Figure 4. Illustration of the areas involved in a full scale interactive service Dapp within the blockchain-based governance model for public services in smart cities. (Source: Stefan Junestrand)

- All public services do not necessarily include the interaction with the end user, for example, the financial information of a city could be a simple informative public ledger Dapp.

- All public services do not provide both private user data and open data, as this depends upon the information related to the service that is desired to be shared.

- In a blockchain based governance model for smart cities, it is also crucial to establish which parts of the blockchain should be public, private or a mix of both.

Final discussion

This article points out that a blockchain based governance model for public services in smart cities is necessary to understand the broader context of both current blockchain based public service projects, as well as future developments. Below, are recommendations for these implementations along with some important questions to be considered for future research.

Recommendations for the implementation of blockchain based public services

Most cities that consider experimenting with blockchain technology for their public services will probably take a step by step approach, starting with isolated, small-scale pilot projects. When doing this, it is important though to understand the consequences of choosing which project to do, as some are more complex than others. Here are two examples:

The first is the development of a full scale interactive service Dapp, that generally implicates the use of many components within the model, such as the digital ID, a token, the wallet, etc. which results in a complex project (see fig. 4).

The second example is using blockchain only as a registry for public information which might be rather simple and involves few, and less complex, components within the model (see fig. 5).

To conclude, two main recommendations can be made for cities, either they are taking the first experimental steps with blockchain or advancing towards more complex services:

- As a starting point, it's essential for each city to develop their own governance model for public services based upon blockchain.

- It is important to describe how each project could fit

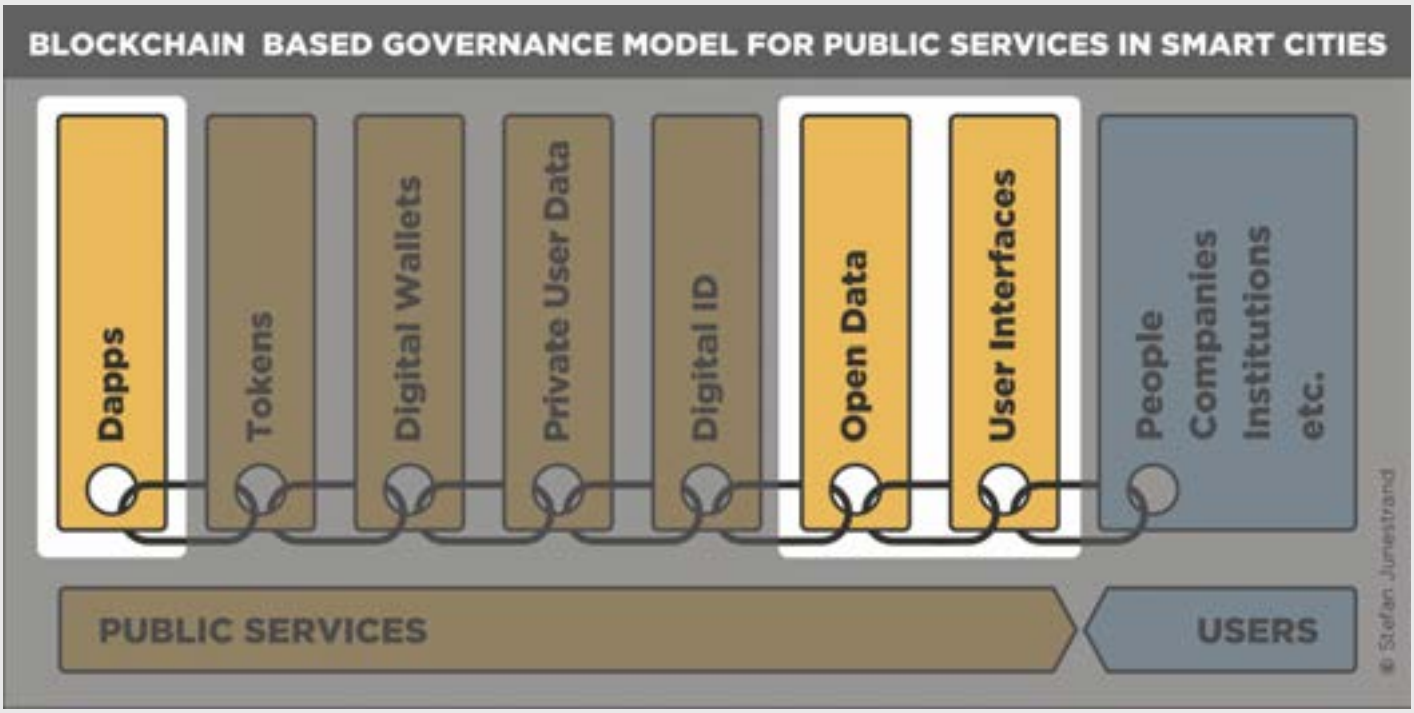

Figure 5. Illustration of the areas involved when using blockchain as a simple registry within the blockchain-based governance model for public services in smart cities. (Source: Stefan Junestrand)

into the cities complete blockchain base governance model for public services based upon blockchain and the components involved in the development.

- It is important to select blockchain projects that match the available human resources, budget, time-frame, etc.

Future research

Below some recommended general research activities that could be of special interest to improve the proposed blockchain-based governance model for public services in smart cities:

- Further analyse the different components of the model and how they are interconnected, as well as the role and functionality of each one of them.
- Study real life blockchain-based public service projects in cities and compare those with the model.
- Evaluate the model from technical, legal, social and economic perspectives. ■

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Distributed technologies to bootstrap the sharing economy

Professor Samer Hassan, explores how blockchain has the potential to help sharing economy projects to overcome several challenges they face at infrastructure, governance and economic levels

The sharing economy has experienced significant growth in recent years and is estimated to reach $300 billion in 2025. This growth has been accompanied by a number of challenges at different levels.

At the infrastructure level, sharing economy platforms are centralised and concentrate massive amounts of user data, often making surveillance their business model. At the governance level, communities have no say in the decision-making, since only the platform owner decides how the platform evolves. Finally, the sharing economy markets are owned by just a few major industry players, which appropriate the value created by the communities, without redistributing the profits with their users.

Samer Hassan, Faculty Associate in the Berkman Klein Center for Internet and Society at Harvard University, and Associate Professor at the Universidad Complutense de Madrid (Spain), is the principal investigator of the P2P Models project. "The P2P Models project aims to create a new generation of sharing economy platforms powered by decentralisation", says the Professor, who has studied communities and decentralised systems for a decade.

Commons-based peer production communities

Commons-based peer production (CBPP) communities could contribute to a powerful perspective to sharing economy as it is understood today. CBPP is an emerging innovative model of production characterised by peer to peer collaboration for the creation of shared resources, which are freely accessible and reusable by anyone.

Different experiences of CBPP communities such as Wikipedia, free/open source software, or Couchsurfing, provide radically differing values and practices when compared with those in markets. CBPP communities show us how cooperation can triumph over the competition.

The experience of these communities offers an interesting perspective to tackle sharing economies' challenges, as they propose common ownership over appropriation of value, and participatory production and governance models over corporate control.

Blockchain technology could bootstrap the transformation of the sharing economy, providing a decentralised technology to challenge current centralised monopolies, and building decentralised governance and value distribution tools we could not have imagined before.

Decentralised technology to support CBPP communities

CBPP communities have three main characteristics which are: decentralisation, as authority resides in individual agents rather than a central organiser; the use of open-access shared resources; and the prevalence of non-monetary motivations.

These three characteristics of CBPP are aligned with blockchain features. First, both CBPP and blockchain strongly rely on decentralised processes, thus the possibility of using blockchain infrastructure to support CBPP processes arises. Secondly, the shared resources in CBPP are aligned with the shared ledger present in blockchain's infrastructure, where data and rules are transparent, open and collectively owned. Finally, as previously mentioned, CBPP relies on multi-dimensional forms of value and motivations and blockchain enables the emergence of multiple types of non-monetary interactions and rewards (sharing, voting, reputation, etc).

Such an alignment leads us to think that blockchain could facilitate coordination, scaling up, or sharing of different forms of value amongst communities in an interoperable way. David Rozas, a social researcher (PhD in Sociology) and computer scientist (MSc and BSc in Computer Science) at P2P Models, thinks that "Decentralised technologies are a thrilling arena to experiment with cooperative dynamics. They could provide means to increase transparency, facilitate coordination or make visible forms of value which have been traditionally ignored".

Blockchain can also enable new value distribution models, including the

Image: © Tony Webster, Unsplash

distribution of a token that can be exchanged for real goods and services. This may improve the economic sustainability of both contributors and communities.

Tokenization as a multi-purpose tool

The rise of blockchain-based cryptocurrencies is a product of "tokenization", i.e. blockchain's unparalleled facility for the creation, transfer and management of tokens in a distributed manner. This process of tokenization facilitates the distribution of value and incentives. Furthermore, such tokens may be used as more than holders of monetary value: they may represent equity, decision-making power, property ownership, or access permissions.

Thus, blockchain capabilities, such as tokenization, enable the encoding of governance rules into code deployed in the blockchain. This enables communities to readdress latent power relations. This implies an exercise within the community to specify its internal processes and tasks to be carried out, including traditionally invisible tasks. That is, caring tasks such as emotional labour, conflict management, maintenance, or events organisation, may be visibilised and acknowledged by the community – along with those undertaking such tasks.

Silvia Díaz Molina, P2P Models anthropologist specialised in gender studies, underlines that "one of the blockchain's most interesting characteristics when talking about communities and power balance comes when automatizing processes and encoding rules in the software. Since communities must then discuss every process and every task, this makes all the power dynamics explicit. If the whole community is involved in the creation of the tool, even the most forgotten tasks, like the caring tasks, will come to the surface".

We strongly believe that the combination of CBPP and blockchain provides an exciting field for exploration. However, "we should be careful with the blockchain hype and be critical with the dominant techno-determinist discourses surrounding the crypto-world" adds Rozas.

P2P MODELS

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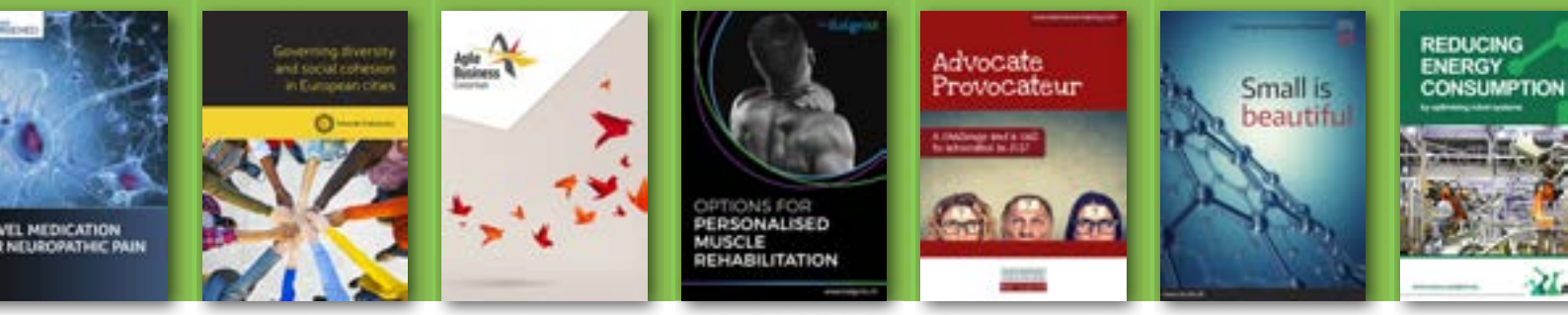

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