

Initial steps toward blockchain enterprise adoption

[research article, landscape orientation and examples by Dr. Tali Rezun]

Abstract

Blockchain has been acknowledged and recognised also in the mainstream enterprise sector. With its ability to improve online trust, transparency, efficiency and cut the middle man, blockchain solutions are developing at a light speed with the potential to revolutionise enterprise digital communication and collaboration. With major benefits to create, store and exchange sensitive information like electronic data and documents, blockchain can substantially change the technological landscape as we know it. This article clarifies the basic steps towards blockchain enterprise adoption and acts as a guideline using two suitable project use-cases as examples; (1) HashNet as an advanced scalable blockchain network, and; (2) 4thtech as a blockchain application suite, that leverages trust provided by the blockchain to provide secure, immutable, instant cross-border electronic data and document exchange and eDelivery.

Keywords; blockchain, enterprise, adoption, private chain, public chain, DLT, hashnet, 4thtech

1. The Opportunity

According to PwC Time to trust Report 2020¹, blockchain has the potential to boost global domestic product (i.e. GDP) by 1.76 trillion dollars over the next decade and hit the mainstream by 2030. PwC report also points out that some 60% of CEOs are placing digital transformations among their top three priorities and that organisations have recognised the value of online trust and cybersecurity between their business partners and customers.

Blockchain has been acknowledged, what's a fact by now. With its ability to improve online trust, transparency, efficiency and cut the middle man, blockchain is developing at a light speed with the potential to revolutionise Enterprise digital communication and collaboration. With major benefits to create, store and exchange sensitive information like electronic data and documents, blockchain can substantially change the technological landscape as we know it. It can safeguard online valuable personal credentials in the form of digital identity, eliminate online identity theft, save money, speed up transactions and improve

¹<https://cloud.email.pwc.com/blockchain-report-transform-business-economy-download-now.htm> [accessed 30 November 2020]

efficiency. With these advantages, blockchain technology offers key advantages to compete against centrally driven platforms. The blockchain economic benefits are proven and as blockchain is becoming an infrastructure technology it is time to catch the train.

To enable future enterprise adoption, a foundation must be built. Organisations must embrace decentralisation, find a balance between existing systems and blockchain implementations. The adoption will not come overnight and correlations between centralised and decentralised systems must be accomplished. Knowledge has to be acquired to differentiate between terminology such as blockchain solutions, blockchain transactions, hashes, wallet addresses and similar. You need to be able to recognise infrastructures such as blockchain network, blockchain as a service, blockchain protocol or blockchain application.

*Example 1; Let's take a look at 4thtech, an initiative that is developing a blockchain enterprise **application**, a **protocol** deployed on a **blockchain networks** Ethereum and Tolar HashNet.*

2. Introduction to blockchain networks

“Blockchain network is a hardware and software infrastructure that enables decentralised transaction ledger and smart contracts to power the blockchain applications.”

²<https://the4thpillar.io/> [accessed 30 November 2020]

Every blockchain transaction is executed by a blockchain network such as Bitcoin, Ethereum, Tolar HashNet, Polkadot and others. Every network has its own characteristics, so it all comes down with the project requirements. As blockchain networks evolve, new chains are emerging, so it is prudent to consider the interoperability and future compatibility of the solution that you use. For example, one of the 4thtech deployment networks is Ethereum. The Ethereum public-chain transaction price skyrocketed in September 2020, reaching the transaction price for 4thtech electronic data and document exchange to 60\$ (i.e. approximate transaction cost for one document exchange from wallet A to wallet B). If compared with the new Proof-of-Stake driven Tolar HashNet network, the same transaction would cost 0.03\$. The transaction GAS price corresponds to network congestion, network supply and demand, network validation model and other factors. The described example demonstrates the transaction fee volatility, which raises the first major consideration when choosing the underlying blockchain protocol for your future adoption.

“4thtech solutions are multi-blockchain interoperable and enable various blockchain network support, therefore offer multi transaction cost and speed choices²”

3. Towards Enterprise Adoption

According to World Economic Forum Blockchain Deployment Toolkit³, there are nine key requirements to address at any new Enterprise solution; (1) information sharing agreement; (2) known and trusted

³<https://widgets.weforum.org/blockchain-toolkit/modules> [accessed 30 November 2020]

participants; (3) formal governance; (4) scalability; (5) security; (6) interoperability; (7) regulatory compliance; (8) operational integrity, and; (9) defined business outcomes.

Even though blockchain enables decentralisation, online trust immutability and more, the crucial first step for every organisation is to define and recognise their use-cases. It has to be determined where the implementation of blockchain makes sense and provides additional value. In essence blockchain and its applications use shared ledgers to enable electronic data exchange via a peer-to-peer connection. With the ability to connect to existing enterprise infrastructure (e.g. Enterprise Resource Planning software systems), blockchain and its applications add additional possibilities and advantages.

4. Establishing Blockchain Enterprise Ecosystem

Establishing a viable ecosystem is another key requirement before blockchain implementation. There are several options to consider; (1) internal ecosystem of participants (i.e. data providers, data users and transaction validators), usually used within organisations, exchanging electronic data between different company departments, branches or even countries; (2) ecosystem that includes participants from the organisation and its partners (i.e. data providers, data users, data readers and transaction validators), and; (3) ecosystem that connects organisation with end customers (i.e. data providers, data users, data readers and transaction validators). Maybe all three examples seem similar but implementation grows more demanding with every case. As the internal Corporate

blockchain ecosystem demands integration only within the organisation itself, cross-enterprise integration demands more time and resources as different supporting IT systems must be synchronised and connected. Establishing a new blockchain ecosystem servicing organisation and end-users, proves challenging the most, as end-users must be provided with a wallet based application. Shared governance in any of the proposed ecosystems proved to be too complicated, especially in the infant blockchain implementation state, so it is most recommended to put the governance in the hands of the main organisation or the business owner.

5. Public versus Private

One of the most common questions when setting up a new blockchain ecosystem is should we go with public or private blockchain? Public blockchains allow anyone to read or write to the public charged ledger, while private Enterprise blockchains can restrict access to their network partners. There is no general recommendation on which way to go, rather there are advantages and disadvantages on both, and in the end, it all comes to what is best suited for a particular project need. For example, are there needs for near real-time transaction processing, large datasets management, higher governance control or fixed transaction price? What is the cost of ownership? HashNet for example supports high-end public and private chain solutions and helps with the decision and setup process.

Explainer; The public Tolar-HashNet blockchain runs actively and supports scalable, fast, secure and fair transactions. It employs Distributed Ledger Technology

(DLT) and consensus algorithms that keep all positive characteristics of blockchain technology while increasing throughput to more than 50,000 transactions per second. Established to develop a framework mechanism for development and implementation of Blockchain services infrastructure, which will be compatible and in line with European Blockchain services infrastructure and usable or extendable globally.

*Example 2; SI-Chain is an example of a **private-chain**, that was developed on HashNet technology in 2019 and it is the **first National Blockchain Pilot Infrastructure** that offers EMV smart contracts and Ethereum compatible dApp environment and explores supporting tools for implementing Blockchain services and outlines the technology infrastructures which can support high speed and scalable fourth generation blockchain technology. SI-Chain is a perfect testing ecosystem for Enterprise organisation, where actual conditions can be replicated and live testing can be done.*

6. Towards GDPR Compliance

The compliance with the European Union's General Data Protection Regulation is of extreme importance. GDPR applies to blockchain solutions and their transactions. GDPR dictates that no personal data including name, identification number, location data or other online identifier relating to a person should be published on the blockchain. While the data protection EU authorities have not yet concluded which blockchain approaches deliver GDPR

compliance, possible solutions are already emerging.

*Example 3; To ensure GDPR compliance, the 4thtech protocol **does not store any personal data on the blockchain**. The data is stored off-chain. **The protocol records links to encrypted files and hashes** of the encrypted content on the blockchain. The hashing of exchange data enables the GDPR compliance, for example, if there were a request to delete some electronic data or documents, the network controller would be able to delete the requested data from off-chain storage, leaving what would then become an empty hash on-chain. Additionally, 4thtech uses the advanced encryption standard (i.e. AES), with a combination of RSA encryption algorithms. The electronic data and documents are encrypted with a symmetric algorithm (i.e. AES), as the asymmetric algorithm (i.e. RSA) is used to encrypt symmetric key and initialization vector (i.e. IV) with the public key of the receiver. Person's digital identity is safeguarded in the system wallet by a blockchain wallet key, known to users only.*

GDPR compliance is an ongoing compliance process so additional legal counsel is advisable when setting up a new Enterprise blockchain ecosystem.

7. Interoperability

According to the EU blockchain forum report⁴, blockchain platforms will need to be able to communicate and share data, which is a property usually referred to as interoperability. Even though blockchain promises key solutions on the way toward full

⁴ <https://www.eublockchainforum.eu/reports> [accessed 30 November 2020]

digital transformation, the technology did not yet reach full enterprise maturity. There are simple solutions in use, while advanced use-cases remain theoretical. The main enterprise challenge remains the interoperability between various blockchain networks to share information without sending copies or compromising data integrity. While the adoption of a single blockchain standard would be the easy choice, the world is not there yet.

Example 4; In the case of 4thtech, the challenge was how to achieve multi-blockchain interoperability. 4thtech uses hosted Ethereum-node on Infura over JSON-RPC protocol, to connect to the Ethereum node. In the case of Si-Chain (i.e. HashNet protocol), 4thtech uses Tolar Gateway which transforms JSON-RPC calls to gRPC (i.e. universal RPC framework) calls to connect to the Si-Chain node. Regarding the additional blockchain networks interoperability, the same connection principles with specific modification will apply.

8. Enterprise blockchain solution example

In most cases, new technology understanding is gained through solution enterprise advantages. As mentioned before, now is the time for basic blockchain adoption in the enterprise sector. Two suitable use-cases were chosen, 4thtech as blockchain application and HashNet as blockchain infrastructure layer.

Explainer; 4thtech leverages trust provided by the blockchain to provide secure,

⁵ <https://the4thpillar.io/> [accessed 30 November 2020]

immutable, instant cross-border electronic data and document exchange and eDelivery. Additional Notarisation features enable users to access the document time-stamp and verify its authenticity via file checksum. 4thtech identification mechanism verifies and maps the connection between a blockchain wallet and a person, utilising the X.509 digital certificate standard.⁵

Explainer; HashNet technology employs DLT and consensus algorithm that keeps all positive characteristics of blockchain technology while increasing throughput to more than 50,000 transactions per second, which gives us a significant advantage.⁶

It is not expected to adopt blockchain fully and exchange all the mainstream digital systems, so let's start with the basics. What does every organisation need and already use, that can be done better? Every organisation exchanges digital data in one form or the other, is it payslips, contracts, merchandise manifests, cargo documents. 4thtech and HashNet joined technology to provide a suitable enterprise blockchain adoption toolbox, helping organisations on their way towards the adoption of this new advanced technology.

Explainer; HashNet and 4thtech blockchain enterprise solutions enable; (1) immutable and permissionless blockchain used as a "trust" network; (2) private and public-chain integration possibility; (3) legal, governance and technical interoperability; (4) scalability with transaction speed up to 50.000 per second; (5) military-grade encryption; (6) X.509 digital certificate standard compatibility; (7) advanced encryption standard (i.e. AES), with a combination of

⁶ <https://www.tolar.io/> [accessed 30 November 2020]

RSA encryption algorithms; (8) electronic data and document exchange with source authenticity and data integrity features including a time-stamp and file checksum; (9) local or cloud e-archiving storage options, and; (10) cross-enterprise compatibility.

8.1 HashNet as Blockchain Infrastructure Layer

Not demanding in computer power and electricity consumption, the HashNet blockchain protocol employs DLT and consensus algorithm that keeps all positive characteristics of blockchain technology while increasing throughput to more than 50,000 transactions per second, which gives the network significant advantage.

8.2 System Scalability

Another key to successful blockchain enterprise adoption is system scalability. Not so long ago, most blockchain solutions failed at this task, but now new solutions are emerging. To understand one of the possible solutions let's dissect the 4thtech approach and learn about blockchain containerisation and Docker image.

8.2.1 Blockchain and Containerization

Containerisation is a standardized unit of software that packages up code and all its dependencies so the application runs quickly and reliably from one computing

environment to another⁷. According to Christopher Tozzi, there are shared fundamentals between blockchain and containerisation; (1) just as a blockchain stores data in a decentralized fashion, a containerized application is powered by several containers, across which the workload is distributed. No one container is more important than another, and load can shift across the environment as application demand dictates; (2) if some of the nodes on the blockchain disappear, data remains intact because it is stored on other nodes. This makes blockchain data storage more reliable than conventional databases. Containers operate similarly. A containerized application consists of multiple containers. When one fails, others remain available to keep the application running; (3) containers are a form of immutable infrastructure. When you want to modify your application, you don't change existing containers. You create new ones. Blockchains are somewhat similar in that once data is written to the blockchain, it is immutable. To change records, you write new data rather than modifying data already in place, and; (4) The ability to scale is the features of both technologies⁸.

8.2.2 Docker

A Docker container image is a lightweight, standalone, executable package of software that includes everything needed to run an application: code, runtime, system tools, system libraries and settings⁹. Docker plays a vital role when developing blockchain applications and acts as an important tool;

⁷ What is Container?'
<<https://www.docker.com/resources/what-container>> [accessed 30 November 2020]

⁸ Blockchain and Containers: More in Common than You Think - Container Journal [accessed 30 November 2020]

⁹ What is Container?'
<<https://www.docker.com/resources/what-container>> [accessed 30 November 2020]

(1) when creating distributed application locally, and; (2) providing automatisaton to reduce time spent on error-prone steps during deployment and testing¹⁰. During the 4thtech research testing, the Docker and Kubernetes performed without any issues on the same server. In the Docker case, conflicts can appear in the case of the same port usage if running multiple containers on the same machine. When dealing with blockchain and different container software interoperability, numerous use-cases have proven the interoperability between blockchain and Docker container software, but the blockchain interoperability with different container software remains an open issue.

8.2.3 4thtech Solution to Scalability

In the case of 4thtech blockchain applications, developed Docker containers will be integrated into Kubernetes clusters, which will enable the overall scalability and elasticity of the 4thtech systems.

8.3 Digital Identity as the key feature of any successful blockchain ecosystem

Trusted identities of blockchain participants are crucial to operational success and can enable complex transactions and reduce risk. Verified identity of any partner in the business process or a network builds core foundations for any business or blockchain endeavour. 4thtech *digital identity mechanism* is embedded into the solution design and enables wallet address

verification of an individual or an organisation. The mechanism creates a link between a user's online identity and blockchain wallet address. With the capability of; (1) connecting the X.509 standard digital certificate with blockchain wallet; (2) providing the digital identity for 4thtech *blockchain electronic data and document exchange*, and; (3) providing digital identity for 4thtech blockchain document *Notarisation*, the digital identity mechanism ensures the integrity and traceability in a decentralised ecosystem. Merging digital identity with blockchain wallet (i.e. wallet address) and enabling connection with the established digital identity standards, 4thtech initiative solves a specific niche challenge and serves as a good example.

How does it work?; (1) the user selects his or her X.509 standard qualified digital certificate; (2) simple KYC form is completed with users name, last name and tax number; (3) 4thtech digital identity mechanism prepares and sends WSDL request in a SOAP envelope via HTTP POST protocol to the government managed automated service (i.e. the issuer of the X.509 certificate), which replies with the verification. If the user's tax number corresponds with the qualified digital certificate serial number, the user is successfully verified, and (4); 4thtech digital identity mechanism then creates a link between the user's identity and his, her wallet or a wallet of the organisation.

Explainer; Key 4thtech blockchain digital identity advantages; (1) can be used for legal entities, delegates of legal entities, physical persons, public authorities; (2) verified by an EU trust anchor; (3) X.509 digital identity

¹⁰ Docker Usage in Blockchain - One Company - Medium [accessed 30 November 2020]

standard enables EU compatibility; (4) enables digital identity and blockchain wallet address mapping; (5) interoperable, sustainable and scalable blockchain digital identity system; (6) no identity data is stored on the blockchain, and; (7) minimum or no cost maintenance.

8.4 Blockchain electronic data and document exchange, service needed in any organisation

The need for immutable, unmodifiable digital data and documents exchange is imminent. E-mail is not appropriate, non-secure and does not fulfil the task in question. Digital content can be created, edited, manipulated and exchanged very easily, what causes trust issues and slows down digital transformation, as organisations must still rely on intermediaries such as notaries. 4thtech offers a solution in the form of *blockchain electronic data and documents exchange protocol*. The protocol leverage trust provided by the blockchain and provides secure, immutable, instant cross-border electronic data and document exchange.

How does it work?; (1) the electronic data and documents are stored in the repository; (2) the user is provided with the "link" of the saved location; (3) the link is sent to the blockchain, and; (4) the recipient can download the electronic data or documents and decrypt it with his private key saved in the browser's 4thtech add-on wallet.

Explainer; The 4thtech protocol does not store the transmitted electronic data and documents on the blockchain. The electronic data and documents are stored off-chain. The protocol records links to encrypted files

and hashes of the encrypted content on the blockchain. This safeguards the rights of individuals to confidentiality and privacy."

8.5 Blockchain electronic data and document Notarisation

Notarisation can be described as a fraud prevention process that enables document authenticity and guarantees that the document has not been changed in the course of a transaction between parties. Usually, the physical Notary acts as an intermediary and provides needed trust factor between parties, but in the case of blockchain, the system enables the needed trust.

To understand the feature, let's take a look at it through the lens of an example. 4thtech *Notarisation Service* can be also described as a digital notary of the decentralised world and with its main solution to provide sensitive electronic documents time-stamp and origin verification using blockchain as a "trust" source. During exchange from wallet A to wallet B, the document hash is stored on the blockchain. In the case of future dispute over the document authenticity, the user can match the document exchange transaction hash stored on the blockchain ledger.

How does it work?; (1) user account creation using 4thtech blockchain wallet; (2) user account verification using 4thtech digital identity mechanism which uses established online verifications protocols (i.e. digital certificate standard x.509 public key infrastructure); (3) digital data or document upload to the data repository, using edelivery protocol, and; (4) blockchain notarisation checksum and timestamp verification, using 4thtech unique Notarisation Service.

Explainer; the 4thtech Notarisation Service enables users with; (1) storing and timestamping a digital data or document; (2) providing the checksum verification of the digital data or document authenticity, and; (3) providing access and review of the document Notarisation details.

9. The Connection between both worlds

To connect to existing enterprise server backend systems, a high-end blockchain-enabled Access Point (i.e. AP) is needed. Governed by an Application Program Interface (i.e. API), the Access Point serves as a connection point between existing enterprise IT infrastructure (i.e. ERP) and blockchain network. The Access Point is installed on the prospect's enterprise servers.

Again, let's examine 4thtech AP, as it provides a detailed insight into a practical solution. 4thtech AP is designed according to enterprise needs, in the same role, it acts as an enterprise blockchain gateway and wallet, a connecting point and a bridge between both worlds.

Explainer; AP key features and functionality; (1) blockchain electronic data and document exchange as AP key function; (2) serves as blockchain enterprise wallet; (3) generates and saves RSA key pairs (i.e. public and private keys), that decrypt received electronic data and document; (4) holds encrypted private keys; (5) compatible with HashNet and Ethereum public and private chains; (6) enables various data repository options; (7) enables blockchain digital identity verification over 4thtech web services, and; (8) enables hardware modules as an option provide additional cybersecurity.

9.1 Sending and Receiving electronic data via AP

To provide a deeper understanding, let's take a look at electronic data and documents exchange processes.

So how does the AP send the data?; (1) electronic data or document is sent from an organisation backend system (i.e. ERP); (2) ERP send a request via API to the Access Point; (3) Access Point accesses the Public Key Infrastructure (i.e. PKI) to obtain RSA public keys of the recipient; (4) Access Point calculates electronic data or document checksum; (5) Access Point encrypts the send electronic data or document with the RSA public key; (6) Access Point saves the encrypted electronic data or document in the storage repository (storage repository is defined by the organisation); (7) Access Point uses the blockchain wallet private key to sign the transaction, which is relayed to the blockchain. The send electronic data or document checksum, time-stamp and link is saved to the blockchain

How does the AP manage the data receiving?; (1) Access Point monitor all-new blockchain blocks for newly received data or documents; (2) Upon arrival Access Point decrypts the received electronic data or documents; (3) Access Point validates the received data using the file checksum (Notarisation process); (4) API request.

10. Conclusion

At this moment blockchain enterprise adoption brings various challenges from legal to technical. It is imperative to identify beneficial adoption use-cases and start small, 100% adoption will not come

overnight. Despite the current adoption challenges, early enterprise adopters will be able to secure a considerable advantage in regards to technology understanding and tailored use-case solutions. Blockchain enterprise adoption is here with technology specific solutions that will change the digital enterprise landscape as we know it.

Bio

Dr. Tali Rezun¹¹: started his entrepreneurial career at the age of 18 and grew his business organically until this day. Under the domain of Cotrugli Business School, Tali finished his Business Master (i.e. EMBA) and later in 2018 his Business Doctorate (i.e. DBA). Dr. Rezun specializes in online technologies with focus on brand awareness, web application development and blockchain technology. He enjoys the title of lecturer, advisor and UN/CEFACT expert. Currently, Dr. Rezun publishes articles associated with his expertise, serves as a project consultant and appears as a guest speaker to the media. Dr. Rezun is one of the main founders of the 4thpillar technologies and holds the title of Council Chain.

¹¹ Dr. Tali Rezun - Entrepreneur, Business Developer and Lecturer' <<https://talirezun.com/>> [accessed 30 November 2020]