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RESEARCH REPORT

Blockchain for Business

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Chapter 1

Introduction

1.1 Project Description

The research report presents the actual state of Blockchain technology and existing projects that aims to offer Blockchain based solution for businesses around the world. The report identifies the areas that will benefit most from the adoption of Blockchain and how they will look like after the switch. Another important aspect is the perception of business leaders when it comes to Blockchain technologies and what are their concerns related with these technologies. In order to be able to do such an analysis it's necessary to study the existing Blockchain businesses and their history from an idea to a successful startup. After determining the keys elements that made these businesses so popular we focus our attention to Decision Support System architecture and the existing solutions. Last but not least, we are going to describe what are the main advantages of the system proposed and what makes it better than the other available solutions.

1.1.1 Brief Project Description

Envision Blockchain for your Business is a decision support system that enables leaders to envision how Blockchain technologies will revolutionize the industry they activate in. Another main aspect is that the system is going to work as an extension of Hyperledger Composer framework, therefore, the modeling format will be compatible with Hyperledger Composer Model Files. In addition, the system offers support to determine whether or not the targeted business is suitable or not for Blockchain switch.

1.1.2 Project Scope

The project aims to achieve the following goals:

- to improve the existing modeling solutions by reducing the time and costs of design a Blockchain solution from scratch;
- to keep the compatility with other projects that have the same scope;
- to determine the fields that could be innovated by the adoption of Blockchain;
- to understand the needs and limitations of the existing solutions in order to offer the best version of a DSS.

1.1.3 Motivation and Objectives

Blockchain represents one of the five digital transformations in the I&T world along with banking, smart contracts, connected cars, healthcare and IoT. Developing a Blockchain based application requires knowledge from different fields from networking, protocols, cryptography, encoding, digital signatures, algorithms, etc. Therefore, developing a Blockchain system can be very complicated and complex even for experts and professionists in the field.

In addition, innovation is about building upon existing technologies and take advantage of the already knowledge of the communities so developing a Blockchain based solution from scratch is not necessary anymore.

Another reason why business people and decision makers are sceptical is the fact that traditional Blockchain projects allows anyone to connect to the network and their identity cannot be verified. Starting from these perspectives, we have decided to implement a blockchain solution that is using a powerful framework developed by the Linux Foundation, Hyperledger Project. Hyperledger Project is offering a solution to all the issues metionated above. The idea behind Hyperledger is to develop and nurture an ecosystem for the future of business blockchain technologies. Hyperledger represents an alternative to the cryptocurrency-based blockchain model, and it offers blockchain frameworks and modules to support global enterprise solutions. The main focus of Hyperledger is to provide a transparent and collaborative approach for Blockchain development community.

The purpose of this research paper is to identify ways of helping leaders around the world to innovate their business using blockchain technologies. It is easy to see the huge potential of Blockchain. Business leaders and organizations around the world believe that it will have the same impact on transactions as internet had on communications. Blockchain is still an young technology and its potential is yet to be discovered. Taking this information into consideration, we believe that a prototype system that enables leaders to visualize how their business will look after the adoption of Blockchain technologies will accelerate this switch.

Customers come first so we need to think about creating value for the customer through technologies. Leaders need to be open and aware of the transformation that happens around them. Therefore, we want to build a system that offers support for decision makers and business leaders to envision the future of their organization after the Blockchain switch. After doing some research on this direction, we discovered the existence of a Hyperledger framework, the Hyperledger Composer that creates Blockchain solutions for organizations with no expertise or knowledge of this technology.

Chapter 2

Background

2.1 Decision Support Systems Architecture

In a blockchain application, the blockchain will store the state of the system, in addition to the immutable record of transactions that created that state. A client application will be used to send transactions to the blockchain. The smart contracts will encode some (if not all) of the business logic.

All these details are already integrated into Hyperledger frameworks and modules, thus making use of the power of Blockchain was tremendous simplified. Hyperledger blockchains are generally permissioned blockchains, which means that the parties that join the network are authenticated and authorized to participate on the network. Hyperledger's main goal is to create enterprise grade, open source, distributed ledger frameworks and code bases to support business use cases.

If you look at permissionless blockchains, like the Bitcoin blockchain or the Ethereum blockchain, anyone can join the network, as well as write and read transactions. The actors in the system are not known, which means there could be some malicious actors within the network. Hyperledger reduces these security risks and ensures that only the parties that want to transact are the ones that are part of the transaction and, rather than displaying the record of the transactions to the whole network, they remain visible only to the parties involved. So, Hyperledger provides all the capabilities of the blockchain architecture - data privacy, information sharing, immutability, with a full stack of security protocols - all for the enterprise.

Hyperledger has taken a leadership role to develop cross-industry standards and provide a neutral space for software collaboration. The financial services industry, in particular, is witnessing an unprecedented level of collaboration between institutions that have traditionally been competitors. The advent of a new foundational or infrastructural technology like the blockchain - much like the Internet - requires collaboration of various actors in order to realize the full benefits of the technology. Unless all actors use a certain standard, the pace of technological dissemination will continue to be slow. Technological adoption is characterized by network effects, where the costs decrease with the increase in use of a certain technology. Since shifting to distributed ledger technology involves significant costs, open source software, communities and ecosystems that develop around these have a significant part to play.

The cryptocurrency-based blockchain model, popularized by public blockchains like Bitcoin and Ethereum, currently falls short of fulfilling a host of requirements that many types of organizations would have to fulfill in order to be compliant when using blockchain and distributed ledger technologies - for instance, in the areas of financial services, healthcare, and government. Hyperledger is a unique platform that is developing permissioned distributed ledger frame-

works specifically designed for enterprises, including those in industries with strong compliance requirements. Enterprise use cases require capabilities such as scalability and throughput, built-in or interoperable identity modules for the parties involved in a transaction or a network, or even access to regulators who can access all data in the ledger as read-only to ensure compliance. The latter is particularly important because, regardless of the innovation, it has to operate within the current regulatory framework, as well as comply with any new rules that come into place specifically targeted at blockchain technologies.

Hyperledger business blockchain frameworks are used to build enterprise blockchains for a consortium of organizations. They are different than public ledgers like the Bitcoin blockchain and Ethereum.

The Hyperledger frameworks include the following components, described also in Figure 2.1

- An append-only distributed **ledger**
- **A consensus algorithm** for agreeing to changes in the ledger
- **Privacy** of transactions through permissioned access
- **Smart contracts** to process transaction requests.

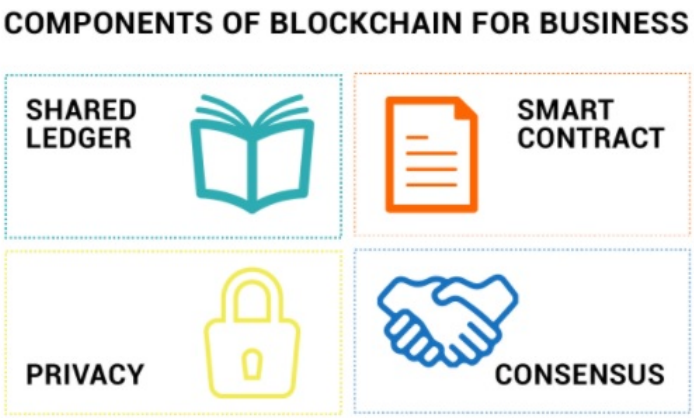

Figure 2.1: Components of Blockchain for Business(source [1])

The Hyperledger consortium has many different projects that focus on different aspects of how ledgers can work and what use cases they can be applied for.

Hyperledger Composer has created a modelling language that allows you to define the assets, participants, and transactions that make up your business network using business vocabulary. In addition, the transaction logic is then written by developers using Javascript. This simple interface allows business people and technologists to work together on defining their business network.

Hyperledger Composer provides a suite of tools for building blockchain business networks. These tools allow you to:

- Model your business blockchain network
- Generate REST APIs for interacting with your blockchain network
- Generate a skeleton Angular application.

Built in Javascript, Hyperledger Composer provides an easy-to-use set of components that developers can quickly learn and implement. The project was contributed by Oxchains and IBM.

The benefits of Hyperledger Composer are:

- **Faster creation of blockchain applications**, eliminating the massive effort required to build blockchain applications from scratch
- **Reduced risk** with well-tested, efficient design that aligns understanding across business and technical analysts
- **Greater flexibility** as the higher-level abstractions make it far simpler to iterate.

Chapter 3

Business Specifications and Architecture

3.1 Description and Business Specifications

We propose a Decision Support System that enables leaders and decision makers to have a better view of their business after the Blockchain revolution. This system aims to offer architectural solutions for business people based on their project's architecture and business needs. The main focus is to help users to have a simple dashboard where to describe the existing business design and architecture and the most important business flow along with the other organization they exchange data.

The system, **Envision Blockchain for your Business**, offers a clear understanding about the way a business will change after the adoption of Blockchain in just a few clicks. More than that, the system will be integrated with Hyperledger Composer framework in order to reduce the time and costs of redesigning/remodeling existing businesses using Hyperledger Composer.

Envision Blockchain for your Business aims to make decision makers more confident about the possibility of adoption of Blockchain and to accelerate the revolution of Blockchain.

3.2 Business Use Cases

The solution is a proof of concept that plans to achieve the following goals:

- Examine several use cases where blockchain technology is actively used to solve real world business problems.
- Discover the factors to look at when evaluating if blockchain technology is right for a particular project.
- Decide when to use and when not to use blockchain technology.

There are certain factors to consider when evaluating blockchain distributed ledger technology for your business. How many participants are in your system? What is the geographical distribution of the participants? What sort of performance requirements do you have? Defining the rules, risks, and responsibilities of each party in your blockchain system is useful as you consider transferring a database to a decentralized environment such as one of the Hyperledger frameworks.

Blockchain is best suited for business applications where one or more of the following conditions apply:

- There is a need for a shared common database
- The parties involved with the process have conflicting incentives, or do not have trust among participants
- There are multiple parties involved or writers to a database
- There are currently trusted third parties involved in the process that facilitate interactions between multiple parties who must trust the third party. This could include escrow services, data feed providers, licensing authorities, or a notary public
- Cryptography is currently being used or should be used. Cryptography facilitates data confidentiality, data integrity, authentication, and non-repudiation
- Data for a business process is being entered into many different databases along the lifecycle of the process. It is important that this data is consistent across all entities, and/or digitization of such a process is desired
- There are uniform rules governing participants in the system
- Decision making of the parties is transparent, rather than confidential
- There is a need for an objective, immutable history or log of facts for parties' reference
- Transaction frequency does not exceed 10,000 transactions per second.

Blockchain technology is a powerful tool, but it is not always the right tool for the job at hand. If you are contemplating using blockchain technology, be sure to evaluate the problem fully.

The following conditions are not currently well suited to blockchain-based solutions:

- The process involves confidential data
- The process stores a lot of static data, or the data is quite large
- Rules of transactions change frequently
- The use of external services to gather/store data

For some applications, other options are simply more efficient. When evaluating blockchain technology, consider whether regular file storage, a centralized database, or database replication with master/slave relationship between the original and copies is suitable. If those structures are suitable, then you can deploy your application with reduced complexity.

Similarly, some applications can simply utilize cryptographic methods common in blockchains, without the database replication mechanisms of a blockchain.

In the Diagram 3.1 we provide generalized, high-level decision points about when to use or not to use blockchain technology for your business.

3.3 Architecture

The system architecture is a client-server application. The client component is going to be represented by a intuitive dashboard that will allow users to determine whether or not their business is suitable for the switch and if so, how it is going to look like after the switch. The server component will be responsible for building the model and a high level architecture for an existing project that will involve Blockchain on Hyperledger.

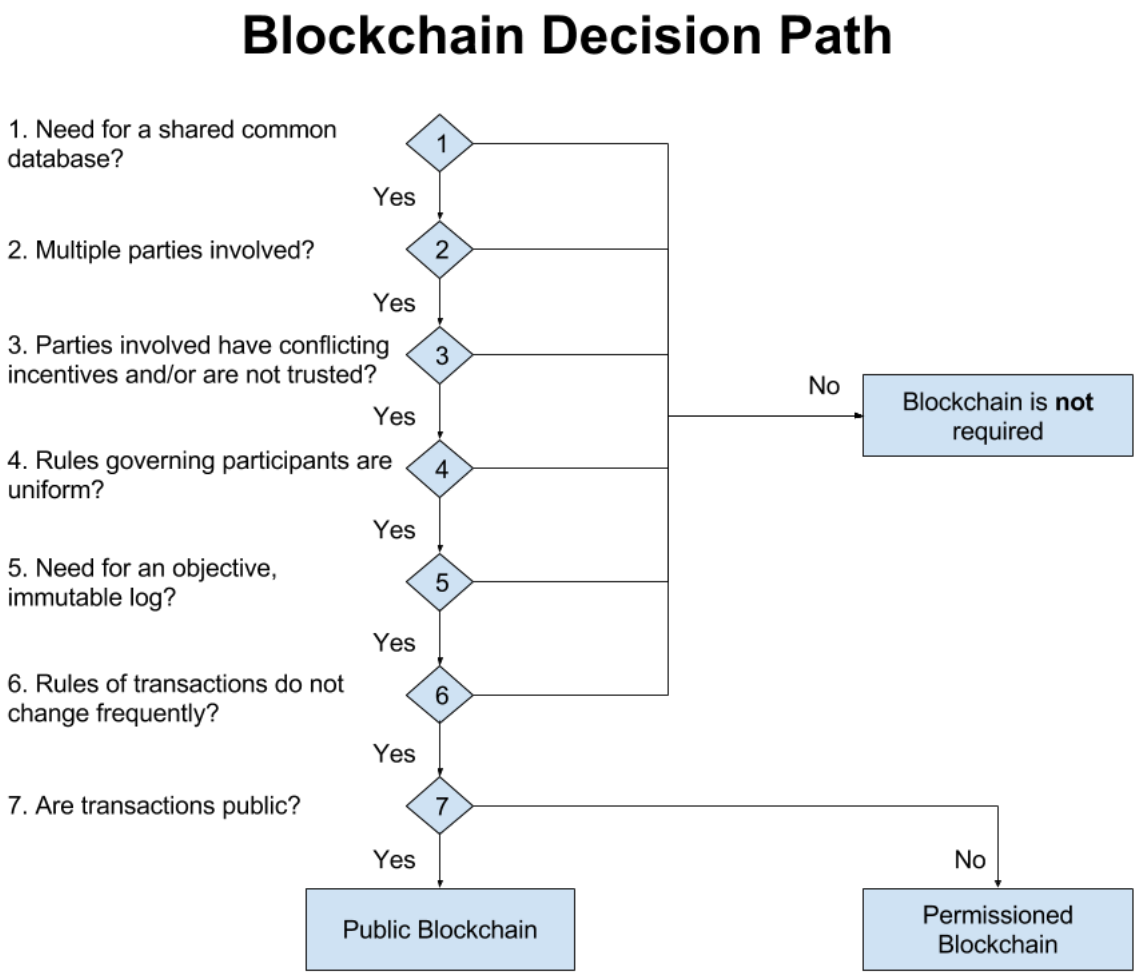

Figure 3.1: Blockchain Decision Path(source [1])

The model is going to be store in a format compatible with Hyperledger Composer Model File in order to make the integration process easier and faster.

A sample of a Hyperledger Composer Model file for a Digital Property Network:

```
/*
* Licensed under the Apache License, Version 2.0 (the "License");
* you may not use this file except in compliance with the License.
* You may obtain a copy of the License at
*
* http://www.apache.org/licenses/LICENSE-2.0
*
* Unless required by applicable law or agreed to in writing, software
* distributed under the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language governing permissions and
* limitations under the License.
*/
```

```
namespace net.biz.digitalPropertyNetwork

asset LandTitle identified by titleId {
o String   titleId
--> Person   owner
o String   information
o Boolean  forSale   optional
}

asset SalesAgreement identified by salesId {
o String    salesId
--> Person    buyer
--> Person    seller
--> LandTitle title
}

participant Person identified by personId {
o String personId
o String firstName
o String lastName
}


transaction RegisterPropertyForSale {
--> Person seller
--> LandTitle title
}
```

Chapter 4

Conclusion

A Decision Support System that enables leaders around the world to envision how their business will look like in the era of Blockchain is the main focus of the system described above, Envision Blockchain for your Business.

After a semester of exploration of Blockchain for Business modeling solutions, we reached the conclusion that a system that will assist decision makers to invest into Blockchain technologies is going to accelerate the process of Blockchain adoption and will be of great help for leaders and business people. Right now, there is no available solution that enables users to design their business need and to envision how Blockchain can innovate the existing models without the help of specialists and developers with a deep understanding of the industry.

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