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DESIGN ARCHITECTURE INFLUENCER SOCIAL MEDIA MANAGEMENT SYSTEM USING DISTRIBUTED LEDGER TECHNOLOGY

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Abstract

The purpose of this study is to solve the problem of fraud by utilizing the architectural design of Distributed Ledger Technology. The social media industry is currently hype. But one thing born out of this industry is the endorsement business. The background that started this study is because this business has the possibility of fraud on endorsements. What is meant is a private blockchain called DLT or Distributed Ledger Technology. By using this technology there is a solution to make the endorsement business trusted and unchanged. With the superior nature of blockchain, we can make support trusted and unchanged, especially if we implement private DLT. The conclusion found is that in the last 4 years technology has developed that allows APIs for DLT, what we will create is the design of the AP layerI yang will communicate to the DLT network.

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INTRODUCTION

On social media, we know a user who is called an influencer influencing or inspiring people to do or buy a particular item. Users like this currently offer services for product reviews and Brand Endorsements, and it has become a profitable business today. But these kinds of businesses pose a hidden threat to each other between influencers and brands that support them. Usually there is no contract, only a gentlemen's agreement that binds them. This is where blockchain comes in. Their unchanging and secure transactions will make their business completely secure.

Blockchain was first introduced by Nakamoto's white paper (Nakamoto, n.d.), which became the cornerstone of bitcoin. From cryptocurrencies, Smart-contracts, NFTs, and Web3 of the Ethereum network were born a few years later. This evolution is constantly evolving, and private blockchains are also taken from the idea of a private blockchain called Distributed Ledger Technology (SHOBHIT SETH, 2022).

Distributed Ledger Technology is an enterprise blockchain, which is available and

open source called Hyper Ledger (Hyperledger Whitepaper, n.d.), backed by several well-known companies such as Intel and IBM. They make sure that the code is updated and secure. Its use today varies greatly in different industries.

Blockchain implementations vary, such as implementation in crowd funding (Ashari et al., 2020), then there is implementation in the utility industry (A et al., 2020). But not only the implementation of digital transactions and also digital video streaming applications (Alexandra et al., 2020; Pertiwi et al., 2020). There is also an implementation for the exchange of electronic signatures (Krylov et al., 2020) and also the implementation of EVM or Ethereum as a microservice (Tonelli et al., 2018).

The public blockchain that is being hyped up right now is Ethereum, which implements PoW (proof of work) methods for implementation in NFTs, Web3, and Cryptocurrencies (@sriashi0397, 2022). But it's not personal, it means that everyone can participate. The need for peer to peer contracts makes public blockchains too risky, and makes private blockchains like Hyper Ledger more attractive to implement (Yaga et al., 2019).

If theneed for this research is to implement microservices as a mediator, so the use of microservices is important. They are popular because they can be separated on implementations as read in architectural implementations on E-Commerce Web Services (Suthendra & Pakereng, 2020), (Tihomirovs & Grabis, 2017) The design may be a little challenging because the microservices layer must be in the middle of two technologies namely ui application and chain code. The chain code itself is a smart contract in DLT, with current application language compatibility, making implementation much easier.

In this study, researchers used software design standards with DDD (Domain Driven Design). Since Eric Evans' approach in 2003 (Evans, 2015), Domain-Driven Design (DDD) has received a lot of attention from the software development community. Many businesses have successfully used DDD (or its components), and recent publications have provided us with best practices and useful information. While the novelty of this research is in terms of its own utilization, namely for the Influencer Social Media Management System, considering that there has been no previous research that utilizes Distributed Ledger technology for this.

METHOD

The method that the author uses is the research methodology of design science. Systematics will be drawn from the cycle of relevance and the cycle of rigor.

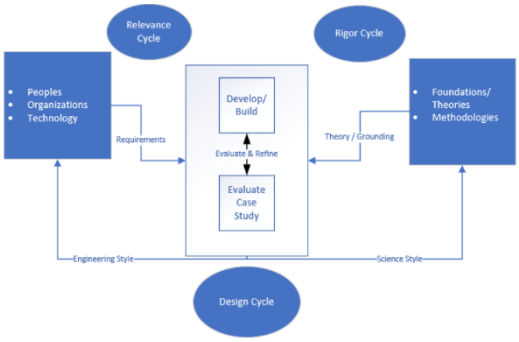

Figure 1
DSR (design research methodology)
(Szmydt & Abramowicz, 2018)

Combination of DSR with DDD to design microservices on top of Distributed Ledger Technology. The first thing to do is to create a Bounded Context, and clearly state the scenario in which the model will be used. Clearly define boundaries for team structure, application use within specific areas, and tangible manifestations such as codebase and database structure (Evans, 2015). From other studies on the implementation of DDD and microservices (Tomov, 2020), Tomov's work, using public smart contracts with microservices design and using MVC (Model-View-Controller). There is also Singjai research (Singjai & Zdun, 2022) that uses DDD architecture which we can use in this study as a reference but the drawback is that they use ADD (Architectural Design Decisions) which will be slightly different from what will be designed, it is because of the Architectural Design Decision (ADD) concentrate on architectural critical design choices of systems, where single-choice changes can have a major impact on the overall system architecture (Lee & Kruchten, 2008).

To continue the research, the author needs to create a Bounded Context for 3 Domains. The first is the domain for users/influencers, the second is the brand and the third is the admin. These three domains represent the actors who will use the application. These domains will interact with DLT by using microservices asits bridge.(Tempesta, 2018)

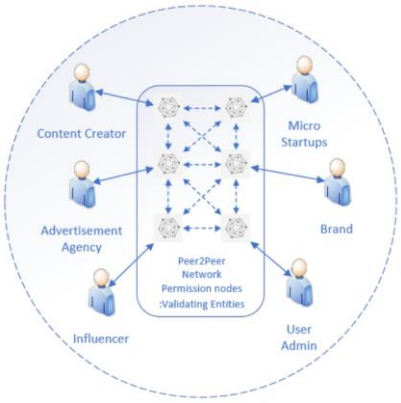

Figure 2
Peer2Peer Network on Private DLT

From the image above we can create a domain based by creating a DLT membership with 3 categories as mentioned earlier. The Peer2peer network is actually a blockchain or DLT interconnected by a certificate authority or CA (Androulaki et al., 2018). This design is slightly different from the public blockchains offered by the Ethereum network with proof of work as the main algorithm. Since DLT has its own private channel between the 3 main domains and DLT, it makes it irreversible and updated with each other with the approval of each admin domain to add chain code (smart contracts) or people who want to join (Fabric, n.d.).

System Design

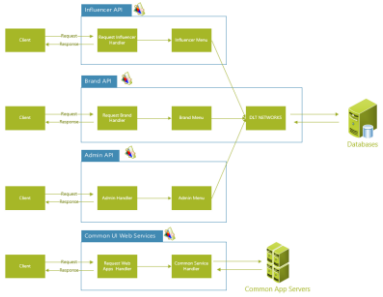

Figure 3
Design for DLT Microservices

The result of the 3 domains in figure 2 is broken down into 4 APIs connected to the DLT Network. There's an influencer API, Brand API, Admin API, and General UI. Based on Thomas Earl's book (Erl, n.d.), Service oriented is the same as SOA in the monolithic period, but some can be used to make the best of microservices oriented and combine them with blockchain networks or DLTs. This design is different from Tonelli (Tonelli et al., 2019), they used the Ethereum Network EVM for its use but unlike in the study it was researched using Hyper Ledger Fabric to make it happen. (Hyperledger, n.d.)

There are many implementations using Ethereum but this could mean the public will be charged for transactions such as fuel fees and other types. But with private DLT, we can make implementations lower the cost of using the application.

Databases and DLT

Since it is immutable, Hyper Ledger uses LevelDB to store all the data but to make the data mutable, the author uses CouchDB, but the blockchain is basically immutable but all other metadata can be stored there. (Hyperledger, n.d.)

API

APIs are an important part of this research is chain code; we need some external functionality to make it changeable whenever needed. (Soni & Ranga, 2019)

Influencer API

This Influencer API takes care of the need to bid on projects and send them to Brands. Using chain codes, we can store project submissions on the blockchain so that they won't change the documents submitted to brands.

Brand API

This Brand API addresses the need to approve project offers and deliveries to influencers. Using chain code, we can store project details and contracts and store them on the blockchain/DLT.

Admin API

This Admin API handles the need to set up bids on a project and can be delivered to brands

and influencers. Using chain codes, we can store submissions, project details, and contract history. Also, this API is used to resolve conflicts between 2 parties.

RESULT AND DISCUSSION

Result

From the design results, it can be seen that the use of microservices layers can be done to bridge between ui and chain code. For further research can be done for its implementation in an application based on Hyper Ledger Fabric.

Here is a sample Chain Code to bind employment contracts between influencers and brands

Table 1. Define Chain Code ContractDetail

Define ContractDetail
{contractID,funame,bday,address,phone,nik,email,igUrl,nameBankAccount,nameBank,noBankAccount,price,docType }

Table 2. Chain Code CreateProjectContract

```
Function CreateProjectContract (ctx,ContractDetail,ContractID)
BEGIN

ContractStatus = CheckContractExist (ContractDetail)

IF ContractStatus = exist THEN

        throw "Contract Already Exist"

END IF

ctx.stub.putState = (ContractID, ContractDetail)

END
```

Table 3. App Code QueryAsset

```
FUNCTION QueryAssets (ctx, query)

BEGIN

        return ctx. GetAllResult (query)

END
```

4. Gateway Psuedocode

And for microservices / API it will more or less look like this.

```
FUNCTION Gateway()

BEGIN

        loadLibrary(Blockchain)

        loadLibrary(HTTPS)

        createserver.on.port = 3000

        listen.for.request()

IF Request("PostProjectContract") THEN

        Respond.Set (ContractDetail)

        Commit.to.Chaincode (ctx. CreateProjectContract)

END IF

IF Request("QueryAssets") THEN

        Respond.Get (ContractDetail)

                Read.from.Chaincode(ctx. QueryAssets)

END IF

END
```

Finally experiment by using Postman for the example chain code with the microservices/API layer,

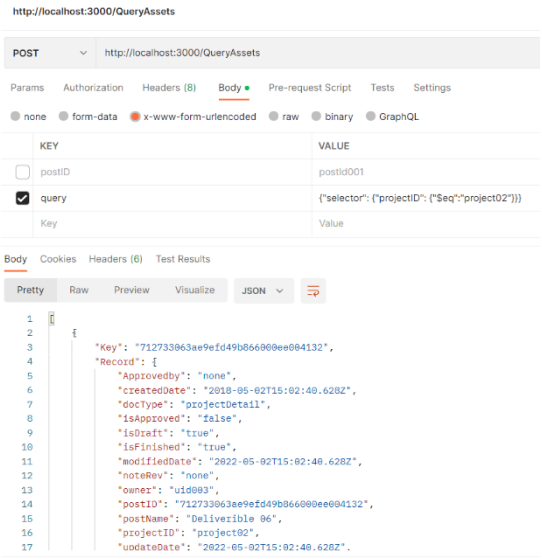

Figure 4. Postman Testing

From this research it can be proved that employment contracts can be securely drawn up in DLT / Blockchain. As for the speed test with EVM Ethereum which can only be with 1 transaction per minute then the calculation for DLT will use the Slovin approach with size n as a sample and population which is represented by N and the margin of error is represented by e, then with the following approach

n = N / (1+Ne2).

Thus this study will take 99%-100% sample as many as 100 people and 100 iterations 2 times, then the result is approximately 100 commit transactions per 7 minutes.

Table 5. Performance Commit Run Test

100 x Rep	1st Run 22/01/2023	16:38:58 16:46:52	00:07:54
100 x Rep	2st Run 22/01/2023	16:50:19 16:55:35	00:05:16

And the result for the read performance is 0.1 s to read 200 contract records on the blockchain.

Table 6. Performance Read Run Test

Querying 200 Record	1st Run 22/01/2023	0.19758

Distributed Ledger Technology (DLT) is one solution that can help strengthen endorsement business systems and reduce the possibility of unintended data changes (Coppi, 2019). DLT uses distributed networks and cryptography to manage and verify transactions, which allows the data stored in it to be difficult to manipulate or change by unauthorized parties. This makes DLT a secure and reliable technology in processing transactions in various sectors, including in the endorsement business (Zhu et all, 2019).

The main advantage of DLT in the endorsement system is its ability to ensure data security and resilience. Every transaction and data recorded in blocks on the blockchain network cannot be altered, as each block is cryptographically linked to the previous block. This ensures the integrity and authenticity of the recorded data, making the endorsement system more reliable and trustworthy. In addition, the private nature of DLT allows access only to certain parties who have been designated or authorized, thus maintaining data privacy and security, and preventing unauthorized actions in the endorsement system (Shaema & Balamurugan).

The use of APIs connected to Distributed Ledger Technology also provides many benefits for the development of related applications. In its development, the use of APIs can enable integration between different systems with DLT technology. This allows developers to create applications that are connected to blockchain networks or other DLT technologies, without having to build the entire infrastructure from scratch. The use of APIs can also help facilitate the interaction between applications and blockchain, thus providing convenience in the development of applications based on DLT technology (Bakolo, 2022).

In addition, DLT also has the potential to reduce transaction costs and speed up the transaction process in the endorsement system. DLT allows transactions to be carried out digitally and decentralized, thus cutting costs incurred in conventional transaction processes involving third parties. A fast and automated transaction process

can also reduce operational costs associated with transaction processing (Li et all, 2019).

However, the use of DLT in the endorsement system also has some disadvantages. One of the disadvantages is the dependence on distributed and complex technological infrastructure, which requires sufficient resources for its development and maintenance. In addition, the rules and regulations related to the use of DLT technology are still unclear and vary in various countries.

In developing an endorsement business system that uses DLT technology, there needs to be cooperation between various related parties, such as developers, technology manufacturers, and regulators. With this cooperation, it is hoped that it can ensure the proper and effective adoption of DLT technology in the endorsement business system, as well as minimize risks and obstacles in its application.

One of the important keys in such cooperation is open and transparent communication between the various parties involved. Developers need to understand the needs and requirements of technology manufacturers, and ensure that the DLT technology used is in accordance with established standards and protocols. Conversely, technology manufacturers must also understand the needs and requirements of developers, and provide technical support and advice related to the development of endorsement business systems that rely on DLT technology.

In addition, regulators also have an important role in overseeing and ensuring the security and reliability of endorsement business systems that use DLT technology. Regulators can help ensure that the DLT technology used meets the requirements of applicable laws and regulations, and help prevent unauthorized or unlawful actions (Uddin et all, 2021).

In addition, the development of an endorsement business system that uses DLT technology also needs to consider financial factors. Developers need to consider the cost of developing and implementing the system, as well as the operational and maintenance costs of the system used. However, on the other hand, the use of DLT technology can help minimize costs in the long run, especially in terms of speeding up the transaction verification and validation process, thereby reducing the need to incur additional costs in the process (Anthony, 2022).

The development of an endorsement business system that uses DLT technology requires cooperation and collaboration between various related parties, including developers, technology manufacturers, and regulators. With good cooperation, it is expected to ensure the proper and effective adoption of DLT technology in the endorsement business system, as well as minimize risks and obstacles in its application.

It is undeniable that the use of DLT technology in the endorsement business system has great potential to increase security and reliability, and minimize fraud and fraud in business transactions. However, to be able to implement this technology successfully, there needs to be cooperation and collaboration between various related parties.

First of all, developers are one of the most important parties in the development of an endorsement business system that uses DLT technology. Developers have the main role in designing and developing applications that can be integrated with DLT technology, as well as ensuring that these applications run well and according to user needs. In addition, developers must also be able to collaborate with technology manufacturers to develop the infrastructure needed to effectively implement DLT technology.

Technology manufacturers also have an important role in the development of endorsement business systems that use DLT technology. Technology manufacturers are responsible for designing and developing effective and secure DLT technology, as well as providing the necessary technical support for the implementation of DLT technology in the endorsement business system. In addition, technology manufacturers can also collaborate with regulators to ensure that the DLT technology used meets applicable regulatory requirements (Farahani, 2021).

Finally, regulators also need to be involved in the development of endorsement business systems that use DLT technology. Regulators are responsible for ensuring the proper adoption of DLT technology and compliance with applicable

regulations, as well as minimizing risks and obstacles in its application. Regulators can also collaborate with technology developers and manufacturers to develop the regulatory framework needed to implement DLT technology in the endorsement business system (Donova, 2019).

With the cooperation and collaboration between developers, technology manufacturers, and regulators, it is expected to ensure the proper and effective adoption of DLT technology in the endorsement business system, and minimize risks and obstacles in its application. This will increase security and trust between parties involved in business transactions, and accelerate growth and innovation in the endorsement business industry.

Cooperation and collaboration between developers, technology manufacturers, and regulators can ensure that the development and adoption of DLT technology in the endorsement business system is smooth and well-coordinated. This will increase trust and security between parties involved in business transactions, and accelerate growth and innovation in the endorsement business industry.

In developing an endorsement business system that uses DLT technology, it is also necessary to educate and socialize the public and business people about the benefits and risks of DLT technology. The use of DLT technology in the endorsement business system can bring benefits such as security and transparency, but it is also necessary to pay attention to risks such as losing private keys or computer attacks. In conclusion, the adoption of DLT technology in the endorsement business system can bring many benefits if done properly and effectively. Cooperation and collaboration between developers, technology manufacturers, and regulators are needed to ensure proper adoption of DLT technology and minimize risks and barriers to implementation. With the proper adoption of DLT technology, it is expected to increase security and trust between parties involved in endorsement business transactions, as well as accelerate growth and innovation in the endorsement business industry(Pearson et all, 2019). One of the main benefits of adopting DLT technology in the endorsement business system is to increase the reliability of the endorsement system and minimize unwanted data changes. DLT allows transactions and data recorded in blocks on the blockchain network to be immutable, thus ensuring the integrity and authenticity of the recorded data. In addition, the use of DLT can help prevent fraud and cheating in the endorsement business, and increase trust between the parties involved in the transaction.

CONCLUSION

In this study, the goal was to encourage the use of blockchain using the microservices service layer. Thus, we are already looking at the design produced by the creator. Implementation is underway on the Information System for Influencer management. The implementation is compatible with Hyper Ledger Fabric, and the author recommends this. The design is simple: microservices layer between DLT and Frontend UI. For future use, this can be combined with nodeJS for its code.

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