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BLOCKCHAIN TECHNOLOGY IN E-COMMERCE PLATFORM

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ABSTRACT

The growth of the Internet introduced new ways on how customers receive services and how companies run their operations. In the current days internet connection and relevant services that it provides are essential for the majority of people. One of those services or industries is ecommerce. E Commerce involves transferring a large amount of sensitive data such as private customer's information or financial information. As a result it attracts cybercriminals who are willing to breach into the system and steal the data. The number of cyberattacks increases along with the ecommerce growth and therefore it raises the concern in the secureness of databases of the ecommerce platform. Organizations must ensure the secureness of the data as it contains private information of customers, working staff and transaction records. The data breach not only significantly damages the company's profits but also it will sabotage the clients' trust to the platform. In order to solve this problem, enhance data security and protect valuable data, a blockchain database management system is proposed. The proposed system addresses the issue by introducing blockchain nodes concept into the database and inheriting data secureness of distributed peer to peer connection.

Keywords: Blockchain, E-Commerece, Cybersecurity**.**

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1. INTRODUCTION

The internet has become necessary in our daily life, the requirements of online services are increasing and growing tremendously. The computerized world has brought a significant impact on the global e-commerce platform. Online business platforms bring convenience and flexibility from different stores for a wide range of network users (Balaji N, 2019). For example,

the registration and transaction process can be also completed easily through the online platform. Due to the reason, cyberattacks grow at an unexpected rate all over the world. Therefore, the security of network architecture became the biggest threat to the future of e-commerce platforms (Richard Apau et al., 2019). The data of an organization and customer trust are the key to success for the development cycle of an organization. Data is important for organizations in controlling and managing the organization and also contributes to the decision-making process (L. Steve, 2019). Based on this, data should only allow access to the stakeholders and management teams to ensure the data privacy and compliance of the organizations and customers meanwhile maintaining customers' loyalty. Therefore, it is essential to utilize reliable tools and technologies for protecting this asset from unauthorized access (P. Kale, 2019). The tool and technology selected for the E-commerce business platform company is Blockchain technology and the blockchain technology will be applied as their repository.

The concepts of the digital cryptocurrency called bitcoin with distributed ledger technology called Blockchain were proposed by an author under the pseudonym of Satoshi Nakamoto in 2008 (Nakamoto, 2008). The underlying technology of the bitcoin is decentralized and encrypted the data details had ensured the data integrity and data accountability. Due to this, the technology is getting attraction and adoption in many industries. It records and encrypts the data in a chain of back-linked blocks of information and creates a distributed database that is unalterable for unauthorized access (Wang, 2020). Smart contracts also became one of the significant features of Blockchain. It is a self-enforcing agreement between two or more parties, used to manage the access rights to the nodes that store data. (Voshmgir, 2020; Alam Khan et al., 2020).

Based on the characteristics mentioned, blockchain technology can be implemented into databases of the e-commerce platform business. It can be used to store values like money and contracts (Alex and Don, 2020). Besides, the blockchain concept in e-commerce platforms might improve supply chain management and transnational operations as well as provide transparency of the data management and minimize transaction costs (Sharma, 2020; Saakian, 2020). Most importantly, it can provide a secure environment for e-commerce platforms' users and make them trust the organizations. The unique structure of the Blockchain network enables increased level of security in the database systems and ensures high protection from cyber attacks. The chained data structure of blockchain is used for data verification and data storage, meanwhile, the process of data updating and data generation requires the mechanism of distributed nodes applied in the blockchain. The hackers need to break down all the nodes on the server, which is virtually impossible. Therefore, this research proposes a blockchain-based database system for e-commerce, to establish exceptional data security of the organization.

2. PROBLEM BACKGROUND

As the cyber-attacks are critically growing nowadays, the data breaches issues are getting vital for the individuals and organizations trying to ensure their privacy and security. Based on the research, the data breaches had increased at an unexpected rate, the data breaches issues in 2016 recorded as 36.6 million increased to 197.6 million in 2017, then created a new high record as 446.5 million data exposure issues in the next year (Wertz, 2019). The data breaches issues not only occur on the bigger companies but small businesses at the same time because they are easier to attack and ransom. The attackers threatened and ransomed the companies with the data that were stolen. For example, Uber paid $100,00 to the hacker to delete the stolen data and settle the data breaches issue in 2016 (C. Kate, 2018).

Data breaches issues of organizations will threaten the customer loyalty and the public's trust because the customers value their data privacy, especially if it is related to personal

information and transaction history. The online store system of Under Armour also experienced unauthorized access to the database in March 2018 and the more than 150 million of customers' username, emails and encrypted passwords were compromised (Dennis Green, et.al., 2019). Fortnite, an online video game which has 200 million users worldwide also attacked and exposed players' personal account information and eavesdropped on the game chatter (Alon Boxiner et al., 2019). The news proved the cyber-attacks are growing exponentially in the online platform and it needed to be controlled and monitored to minimize the loss of organizations. Blockchain technology should be implemented to e-commerce based organizations to protect the highly sensitive data of an organization and reduce the data breaches issues efficiently.

3. PROBLEM STATEMENT

The data of an organization not only included the company's information but also staffs' information and customer details which should be protected all the time. Therefore, organizations always put effort into the data protection to ensure the data privacy of the company and customers. A breach of an e-commerce corporation may lead to damage to brand reputation and revenue, online vandalism or being involved in other criminal cases by misuse of the data (L. Nick, 2018). The lack of database encryption and poor network security segment will increase the risk of cyber-attacks, therefore chosen tools and technology for the company should be focused on those areas to enhance the data security (R. Sophie, 2018). Chuen (2020) proposed a third party application to allow users to sell devices for premier credits.

Therefore, this research study recommended Blockchain technology for database systems with its unique characteristics that can increase the level of security of e-commerce organizations' data and defect unauthorized access. Blockchain created a secure platform for only authorized access to the data details in blocks which are connected to each other and having unique cryptographic signatures on each of them . The decentralized system of Blockchain makes the data modification process harder because it does not rely on a central control point which is easier for attackers to obtain and modify data in unauthorized ways. This technology can ensure the data integrity and data confidentially on a higher level than a traditional database system which uses a central control point and can be attacked easier by hackers (P. Santhosh, 2018). Hence, Blockchain is reliable for the E-commerce business platform company needs because it can increase the trust and data security in online services. Not only that, it can also contribute to channel expansion, supply chain management and the transaction process of the e-business and increase organizations' performances.

The aim of this paper is to evaluate and find out the appropriate ways to reduce the data breaches issues of e-commerce platforms by Blockchain technology.

4. LITERATURE REVIEW:

A number of researches were investigated to have a stronger rationale for the proposed solution. The online e-commerce business grows with internet usage and it has contributed to people shopping routines (Tam, C. et al., 2019). Nowadays, customers can purchase almost everything they want from online platforms easily. It is convenient and accessible for online users, customers can purchase online wherever they are and whenever they require the goods or services. As online business platforms grow, the number of cybercriminals increases at the same time. The high risk is coming from the fact that e-commerce databases inevitably store a large amount of personal information leakage which may directly affect the safety of the person. Therefore, Blockchain technology is recommended for the database system of e-commerce business platforms.

4.1. Data breaches in E-commerce

Roberts, S. (2019) mentioned, most of the companies underestimated the damages of data breaches issues might lead to and lacking actions of prevention of the issues. There are more than 90% of online business platforms experiencing login attempts from hackers (Detrixhe, J., 2018). That means the data breaches problem is getting serious and the e-commerce businesses are targeted by unauthorized entities.

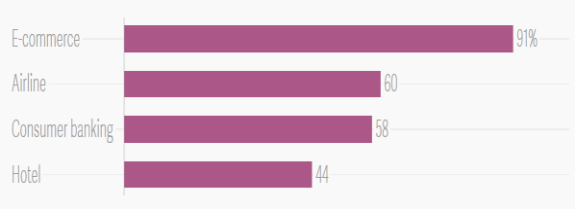

Figure 1 Share of login attempts that are credential stuffing attacks (Detrixhe, J, 2018)

The e-commerce companies should notice the issues and generate alternative solutions to them.

4.2. Improve public trust in E-Commerce by Blockchain

One of the greatest impacts on e-commerce that Blockchain solution introduces, is related to public trust and loyalty. The study conducted by Rajesh Ramachandiran declares that existing investigations addressing trust-related problems focused mostly on blockchain ability to introduce rules and policies without necessarily having arbitrary control (2018). The proposed solution can ensure the trust of e-commerce platform users by applying a blockchain network into the company's database system. The integration of blockchain technology and database system of the company promotes data transparency as all parties may view their own information, including e-commerce platform providers, suppliers and clients. In the end, it increases the privacy and confidentiality of e-commerce platform users' which in return undoubtedly increases loyalty and trust to the organization behind it.

4.3. Performance of Blockchain

As was mentioned in another study carried out by Mohammad Jabed Morshed Chowdhury, et al., one of the most noticeable features of a blockchain solution is its immutability, achieved by the decentralization concept which introduces some sort of democratization of the system (2018). Along with it, there is a fact that the data that is being stored with the blockchain concept is utilizing the public-key cryptography approach. However, one of the most concerning the limitations of the application of Blockchain technology is performance. According to the study, the transactions happening with the usage of blockchain is infamously slow when compared to traditional methods. The time range can reach 10 minutes while a conventional database system could handle thousands of transactions per second with a suitable architecture. However, the researcher also states that the various algorithms are being studied and 10-20 seconds per transaction could be attained. This vulnerability will be taken into consideration before implementing the Blockchain network into the database of the e-commerce business.

4.4. Combine Blockchain technology with the traditional storage method

In the research conducted by Jian Chen, et al., the major drawback of Blockchain was found, the limited storage space of each node/block which makes the big data storage almost impossible and the problem of data redundancy in the Blockchain network (2019). The proposed solution for this problem is combining the Blockchain technology with the traditional

storage method which requires to separate the data in the blockchain and store it in the central database to improve the efficiency of the data storage process. The proposed solution can solve the problems of insufficient storage and information redundancy of Blockchain.

4.5. Blockchain-based database system

Based on the study conducted by Muhammad Mazammal, et al., the limitation of the Blockchain database was found as the data is hard to be modified and appended. Apart from this, the blockchain database system is a data-level disaster recovery backup and audit middleware. Therefore, the CHAINSQL has been recommended to enhance the weakness of the Blockchain network. The system can store data in a blockchain-based database system where the many-to-one architecture allows the data backup, in multiple production nodes efficiently. This method combines the main strengths of two different database systems which are the flexibility to manage and control, high throughput and high capacity in distributed databases and security with the audibility features in blockchain databases. In addition to this, this method improves the data integrity and reliability issues in distributed database systems meanwhile the tamper-resistant issues and latency issues in the Blockchain database are being improved too. This method is suitable for the e-commerce business platform, the data stored is adaptive to make changes for the authorization access, besides the security of the data can be guaranteed for the organizations and clients. This system will be taken as references when developing and designing the proposed system.

Saleh (2020) found that there is a relation between the web and Decision Support System which make it affordable to use.

4.6. Increase Data Security through Blockchain Technology

On another research, authored by Alex. R. Mathew, it was found out that the security of conventional data management systems is vulnerable to cyber-attacks (2019). The research discusses the centralized nature of currently used data management systems specifically addressing issues like usage of a single, independent security system which is prone to attacks such as DDoS (Distributed Denial of Service) where hackers target a single security system, put it out of order and then proceed to gather valuable personal data. On the contrary, the research states that blockchain technology has the potential to improve current security systems and achieve more protected data storage due to its peer-to-peer and distributed nature. The study concludes that the biggest weakness of the current data management system is the presence of a single point of break down or compromise and proposes the usage of blockchain due to its rigorous infrastructure. Since each block of data shared is hashed and connected to the next node, it is impossible for third parties to access it, only two parties able to read and manipulate data, hence it will be unusable by third parties in the case of leakage. Alex. R. Mathew mentions that security researchers determined that Blockchain technology could potentially enclose the current security loopholes that are beyond the scope of currently implemented security measures (2019). Meanwhile, the security of data in Blockchain can also be enhanced by using private keys and wallets. The Paper wallets and Hardware wallet are proposed to increase the level of secureness in the Blockchain database (Alam Khan et.al, 2020).

4.7. Metadata Segregation in Database System

Based on the study conducted by Devanshu Trivedi et al., 2016, the metadata in the database, represented as the details of the data. Based on the research, the database columns will be segregated based on sensitivity level and will create referential integrity at a run time to make sure all of the metadata are isolated from each other consequently increasing the difficulty of unauthorized access to the database system. The metadata will be segregated by using

referential integrity constraints when the information from one of the tables is suspected to be attacked by hackers. Therefore, the other tables can be prevented from being compromised by the attackers and it is difficult for the hackers to connect the database objects and collect or migrate the data.

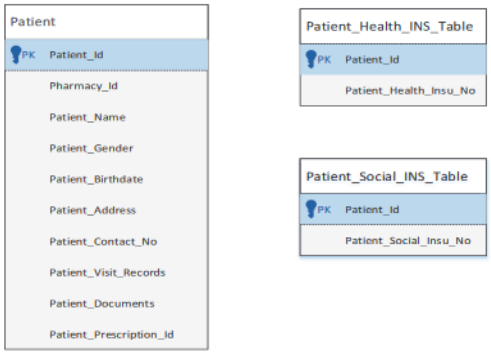

Figure 2 Segregated tables in a database system (Trivedi, et.al, 2016)

This method is powerful for protecting data from unauthorized access, however, the different levels of sensitivity and different types of relationship between data tables will increase the difficulty in the data recovery after the segregation process. The implementation is not suitable for the e-commerce database system since the e-commerce platform has various data types and applications, such as and usages such as transaction details, customers details or even competitors data. Besides, the method is hard to apply in e-business network architecture as servers are located in distinct geographical areas and it will require unnecessary effort and a high cost. Nevertheless, the main idea of metadata segregate can be taken as reference in the progress of developing the proposed system.

5. PERSONAL REFLECTION

Required highly skilled technical teams. For the database of e-commerce fields, the blockchain can be the middleware of the organization's software and the database. However, blockchain technology is still in the early stage of verification and this proved the technology is still immature (Chen, Lv and Song, 2019). Therefore, the technical teams of the organization were required to have a deep understanding and high skills to maintain and support the system when the system required updates or maintenance. Besides, the database system of e-commerce platforms always needs to be updated with a high load of data, it shows the technical teams must master the system to operate it in daily business operation. For instance, it will be a challenge for the technical teams of the organization to implement the database system of the organization with the complex structures of the queries (Alam Khan, et al., 2020).

Cost issues, The cost will vary when developing and maintaining the proposed system with blockchain technology. The organization required budgets for transactions and computational power and additional hidden costs of the technology (Bojana et.al, 2017). The system requires a team of experts in marketing, designers, system analysts, software development, security consultants and more to make the system work perfectly. Besides, the costs will be used in development tools and automated code generators. Therefore, a high budget from the organization is expected.

6. SIGNIFICANCE OF WORK

Database stored in queries to enable business operations of a corporation and manageability with the data management system (Vincetabora, 2018). It has a central control point and can be

controlled by the administrator. It is stable and sufficient for large scale data storage and efficient in the data transaction process for the business platforms. However, the central control point became a vulnerability of the system and it is easy to be attacked by the hacker. On the other hand, several studies propose the usage of blockchain and describe the benefits compared to the regular database systems (Dunphy P., et al., 2018; Beck R., et al., 2017; Wang X., et al., 2017). According to mentioned studies, Blockchain technology has qualities such as decentralization, non-tamperability, and programmability, which completely solve security vulnerabilities, notably personal data protection of traditional database systems. Based on the qualities, Blockchain technology contributes to data privacy and data security areas to E-commerce platforms. However, the limitations of Blockchain need to be considered at the same time. The blockchain technology which is unstable and technical issues like scalability or immutability of data will be the challenges for the operations e-commerce business platforms.

Therefore, a blockchain-based database is a better choice for the business rather than implementation of a traditional database system. The organization can update and modify the data from time to time in the nodes of the blockchain network. It can ensure the data is encrypted and hard to attack by unauthorized parties. All the data stored in blocks and connected to each other by the hash value. A change of data will affect the subsequent of the blocks. Meanwhile, the large scale of data scalability and efficiency in data storage and backup process and the data is available all the time for supporting the business operating. In a nutshell, the limitations of blockchain and database systems can be modified and the combination system can support the operation of e-commerce platforms with high levels of security. This system is suitable for e-commerce business with a high level of data security, scalability, flexibility and stability in the daily operation. The data breaches issues can be avertable efficiently at the same time.

7. OVERVIEW OF THE SYSTEM - SIMULATOR

The research is to study and analyze the potential of implementing blockchain technology into the database system of e-commerce business platforms. The main function of the system is for data protection. This technology is suitable to implement into the database system of enterprises for controlling data and increasing the level of data security.

Blockchain had divided into public, private, and consortium blockchain (Chen, Lv and Song, 2019). A public blockchain is decentralized and accessible by everyone without control by any agency. It is transparent and trusted by the users. The example of the public blockchain is Bitcoin. The difference between blockchain and cryptocurrency is the blockchain represents the platform and the cryptocurrency means the application which is working on it. On the other hand, the private blockchain means an ecosystem which cannot be accessed by outsiders and it is accessible for the organization only. Meanwhile, the consortium blockchain combines the public and private blockchain and it is usually implemented among ecosystems which contain multiple user roles.

The private blockchain will be selected to implement in the system instead of Public Blockchain or Consortium Blockchain which the data might be accessed by the public randomly. That is because the information of an organization which contains highly sensitive data should not be accessed by outsiders instead of the organizations. The data should be collected and accessed for business purposes only therefore the data protection needed to be focused by the organization. Within the private blockchain, strict access mechanisms and regulatory measures can be ensured for the data. It is similar to the public blockchain but the access rights data like reading, writing, executing or storing data required different permissions from certain participants from the enterprises (Mary Thibodeau, 2019). Besides, the speed of private blockchain is higher than public blockchain which can increase the speed of data transactions on the nodes in the private networks of the organization. It also provides the

scalability to the data storage that the organization can increase or decrease based on its demands easily.

At the very low level of the system, consensus involves multiple peer to peer connected machines agreeing upon the current data. Once all machines agree, the decision is final and data is committed. The proposed system will utilize a consensus algorithm based on the very core concept of blockchain. The algorithm ensures that if the state was determined all of the nodes are going to apply committed data and each of the nodes is going to compute the same data, as a result, the system will achieve fault tolerance. For example, for a client, it will appear that the state machine is fully functioning and reliable even if only 2 out of 5 servers are operating. It is the part where blockchain technology is implemented to the fullest as all the nodes in the state machine are connected together to form the blockchain that in the end determines which data is stored

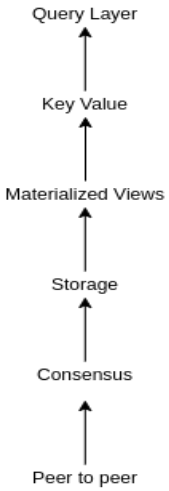

Figure 3 The architecture of the proposed database system

On top of the consensus layer, there is a storage layer. Once all the nodes agree on the data it can proceed to be stored in the database. The storage involves materialized views and key values in order to allow users to query data. The data is represented in the form of primary keys and tables to be accessed by the client. Finally, the proposed system will implement query language, PromQL, in order to manage and query the data.

8. CONCLUSION

For this paper, it can be summarized as integration of blockchain technology into the database system of e-commerce business platforms is essential for protecting data from data breaches issues. This method is significantly better than implementing a traditional database system since it is easy to be attacked by hackers or using only blockchain technology as the database system which is inefficient to the daily business process. The proposed system can support business operation of online retails with an efficient and stable repository with its characteristics. However, the limitation of the research including expensiveness should be improved by a further study on blockchain technology. Moreover, the system requires highly skilled technical teams to support the system which is also one of the challenges for the organizations that should be solved through future in-depth investigation.

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