A Review on Distributed Management Systems Using Blockchain

Ashik Khaleel, Kiran K Nair and N. Praveen

Abstract--- *In most organizations, cloud services are used to implement an online management system when there are a lot of entities involved. Blockchain is a new technology that is currently being implemented onto various systems. Management systems can be engineered with blockchain at its backend that could solve a lot of the problems and risks that are associated with a cloud-based system. Blockchain has a copy of a ledger that is distributed to all of its participating nodes. The data on the ledger is immutable, transparent and hence secure. The data is transparently available for anyone to view but only editable by those who have privileged access. This secures the data from external threats and allows easy management. With this paper, we survey the existing systems and propose a better management system that overcomes the shortcomings of the current cloud-based systems.*

Keywords--- Distributed Management, Blockchain.

I. INTRODUCTION

Large organizations need large scale and sophisticated management. Currently existing systems use cloud services to provide such a scale of management. While this system seems to work for the most part, there is always a risk of data loss, security and a massive performance overhead. These risks question the integrity and reliability of such services. Yet they are still being used because of the lack of feasible alternatives. Blockchain is a new technology that is currently being implemented onto various systems. Management systems can be engineered with blockchain at its back-end that could solve a lot of the aforementioned problems and risks that are associated with a cloud-based system. Blockchain has a copy of a ledger that is distributed to all of its participating nodes. The data on the ledger is immutable, transparent and hence secure. Blockchain also doesn't need heavy infrastructure to implement as all the nodes participate in its functioning.

This saves a significant amount of money for the organization spent paying a cloud service for such infrastructure. Our system will be implemented as a student management system that tracks the attendance and marks of students and is recorded onto the blockchain ledger. Members of the system with privileged access such as faculty will be able to make changes to the data but no other members such as students. Such a system also promotes the self-reliability and local storage of sensitive information. Every connected node will have a copy of the data and when in invalid transaction is tried to be processed through, the system checks with at least 51% of the other devices to confirm the validity of the transaction. This protects the integrity of the data and secures it.

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II. LITERATURE SURVEY

Most organization management systems are implemented on the cloud. This would mean that in order to access the service, an active internet connection is required. All the sensitive and non-sensitive data of the organization are saved remotely on the cloud and the security and integrity of the data are placed completely in the hands of the cloud service. The cloud service provides its services to multiple external clients. This would make the data vulnerable to both internal threats and external attackers.
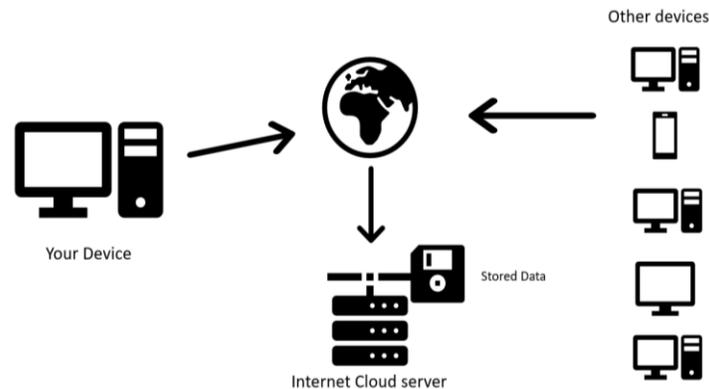
The member of the organization when they require to access the information will have to log into the cloud service platform. This is done via the internet and the relevant information are provided to the member. Any changes made to the data are instantly reflected as the storage system is a centralized one.

Having a centralized data storage would mean that any failure or loss of the cloud service storage would conclude that the data is lost and cannot be retrieved. It also means that during periods of heavy traffic, the system would slow down as the data is accessed by a large number of people at the same time.

The data is stored via traditional format which makes it prone to attacks and the integrity of such remotely stored data vulnerable to attacks in questionable.

Recent research on cloud computing and blockchain as an infrastructure have been surveyed and the conclusions have been listed in the table given below.

Upon analyzing the various research onto the problems of security associated with cloud-services on [8] and [10], it was found out that cloud services are always under threat from external and well as internal sources. This is a serious and unnecessary risk organizations have to take in order to manage their data.

[2] specified that blockchain was a flexible technology that could be used to power the infrastructure of various scale and structure. Hence, a management system using blockchain as its infrastructure can be developed to overcome the existing issues in cloud-based systems.

Table 1: Issues with Cloud and Blockchain

S.No	Year	Authors	Concept	Drawbacks
1	2017	[1]Zhimin Gao ; Lei Xu ; Lin Chen ; Nolan Shah ; Yang Lu ; Weidong Shi	A fair contract partition algorithm that partitions a set of smart contracts into multiple subsets, and a random assignment protocol assigning subsets randomly to a subgroup of users.	Complete set of data is not locally storable leading to incomplete database.
2	2017	[2]Tomaso Aste Paolo Tasca ; Tiziana Di Matteo	Major implementation of blockchain is bitcoin but it is very versatile to be used for other applications	Analyses the feasibility of blockchain for applications beyond cryptocurrency
3	2016	[3]Mattila, Juri	Enumerates the key principles and concepts of Blockchain	Does not give a positive outlook on diverse applications of blockchain
4	2018	[4]Christopher Ehmke ; Florian Wessling ; Christoph M. Friedrich	By freezing activities onto the latest block, prevents increasing the complexity of the Ethereum blockchain	Hinders the reliability and performance of a database system on ethereum
5	2016	[5]Jesse Yli-Huumo Deokyoon Ko, Sujin Choi, Sooyong Park, Kari Smolander	Highlights the concurrency and complexity problems associated with the blockchain	The blockchain technology even with its advancements still has a lot of hurdles to cross
6	2017	[6]Si Chen Rui Shi ; Zhuangyu Ren ; Jiaqi Yan ; Yani Shi ; Jinyu Zhang	Reviews how blockchain can improve on management applications	Security of data is a core aspect that is not discussed on the paper
7	2008	[7]Nakamoto S	Brings forth a new currency system using distributed ledgers	Does not provide functionality beyond currencies
8	2010	[8]S Ramgovind MM Eloff E Smith	Discusses the security issues faced by the cloud-based systems; internal and external	Cloud based systems are always prone to security attacks
9	2017	[9]Craig Wright Antoaneta Serguieva	Envisions blockchain usage beyond currencies with the use of a new system	Does not provide interfaces for application technologies
10	2015	[10]Pierfrancesco Bellini ; Daniele Cenni ; Paolo Nesi	Cloud infrastructure and its complexity is increasing every year	Does not discuss the security issues associated with it

III. PROPOSED SYSTEM

In the proposed architecture using blockchain, every member device is connected to each other. When a member wants to access the data, then a web based portal is used to log into the service. The data to be accessed is stored locally on the device. The user can then access or modify the information based on their privileges.
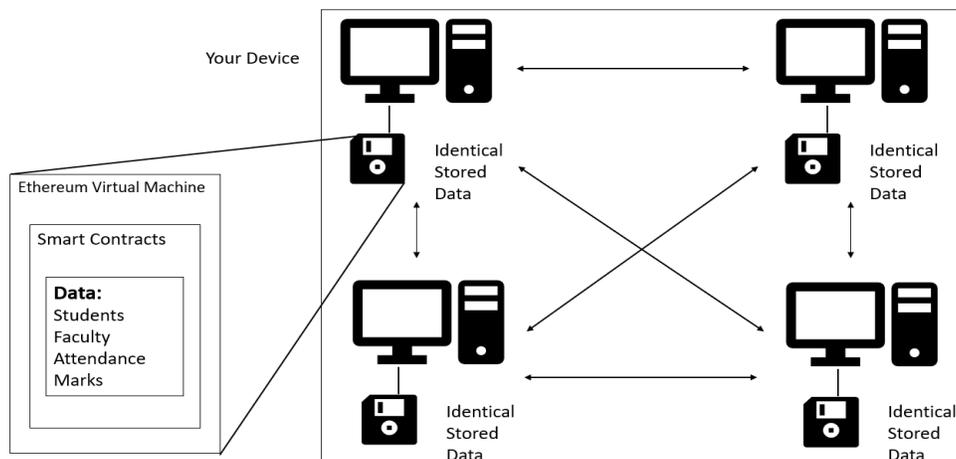
Any change made is first validated by the smart contracts implemented on the system and then the change is forwarded across the ledgers on all the connected member devices of the network.

This form of data handling gives the following advantages:

- Immutability: Blockchain is structured to be intrinsically prevent invalid transactions.
- Security: If only the majority of the nodes agree that a transaction is valid, then it is processed.
- Redundancy: All devices have a copy of the data.
- Overhead/cost reduction: Distributed system is implemented within the organization and does not require third party expenses.
- Accountability/transparency: The data is openly visible, but secure at the same time.

[A]. Tools Used

- Remix Ethereum IDE
- Ethereum Blockchain Network
- HTML+CSS+JS

Remix Ethereum is a web-based IDE that allows native development of Smart Contracts using a programming language called Solidarity. The contracts and the ledger are deployed over an Ethereum network and is accessed using a web portal build using HTML,CSS and JavaScript.

[B]. Workflow Diagram
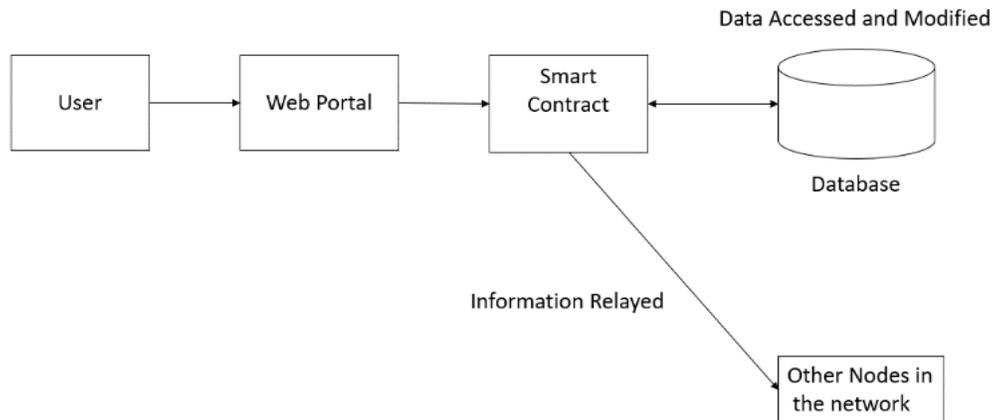
When user or an admin needs to access the system, they are provided with a management portal on a webpage. After logging in with their credentials, they are given access to the management interface. Here they can view or edit the database depending on the access rights defined to them by smart contracts. The changes made to the data are validated with the majority of the other nodes in the network before it is processed. Once processed the new ledger is shared among all the participating nodes.

[C]. Data Structure
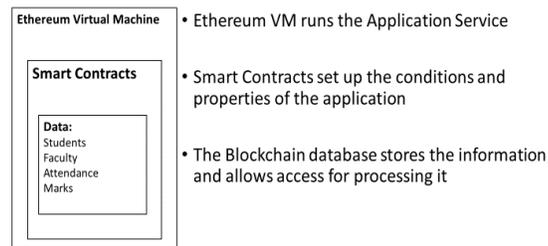
The Data for the system is stored in a blockchain ledger with members such as:

- Students: Contains basic information of all students.

- Faculty: Contains basic information of all faculty

- Attendance: Has a day by day tracking of attendance of students.

- Marks: Contains the marks for the various subjects that the students are enrolled for.

[D]. Modules

Front end webpage

- A webportal to provide access to the users and administrators for viewing and managing the database.

- Developed using HTML+CSS+JS.

- Acts as the interface for the user to interact with the blockchain database.

Ethereum Blockchain Network

- The networking technology used to deploy the blockchain. A custom network will be integrated onto existing network to connect the participating nodes together.

Ethereum Smart Contracts

- The smart contracts allow us to set up conditions and an application level overlay over the basic ledger that blockchain supports.

- Using smart contracts, we can control the permissions for admins and the students.

- It can also help set up minimum passing marks, minimum attendance, etc conditional thresholds for the students.

Blockchain Ledger

- The basic blockchain ledger will have the information about the students, storing values of their attendance and marks.

- A list of administrators with the priority level.

- The ledger will be identically stored on all participating nodes.

- This data is used by the Ethereum Smart Contracts and the Ethereum Virtual Machine to work as an application that manages members of an organization.

IV. CONCLUSION

After analyzing the currently existing cloud system, it was noticed that there are heavy data risks on running a management system via the cloud. It is expensive, always under threats and there is no redundancy of data. Blockchain was a technology that was primarily used to develop cryptocurrencies, but on analyzing their feasibility to be used as the infrastructure for data storage for a management system, it was found that it seems to be an excellent alternative that overcomes some of the major issues existing with cloud systems. Intrinsically, Blockchain is immutable and transparent which prevents from malpractices or threats of data integrity and security. The data on it is redundant to a degree that even if only one node exists of the network, the complete data can be recovered.

With these advantages in mind, we created an alternative management system, that uses the distributed blockchain ledger to store its data and we used the Ethereum blockchain in order to set up smart contracts that regulate the access and validation of data augmentation.

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