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Blockchain Based Object Storage System for IOT data.

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Abstract: With the massive increase in IOT data there is need of data storage systems which are maintainable, easy, secured and affordable. There is exponential increase in the data generated from the IOT devices, sensors. Large scale storage systems give importance to the reliability and availability of the system. Introduction of Blockchain is enhancing the functionalities of the storage methods. Blockchain largely focuses on the security and credibility of data, which are most important in today's times. Blockchain gives an added advantage of security to the data which most of the systems fail to give. We look towards the system which is interaction of blockchain with object storage. Object storage is a technique to store the data in a flat address space, where we can store the data in various objects having unique object ID (OID). There are many advantages of using object storage like better data analytics, faster retrieval of data, infinite scalability. Object storage can also be used to reduce the overhead produced by the IOT devices.

Keywords: Blockchain, Object Storage, Hyperledger fabric, Docker, IOT, Storage system

1. INTRODUCTION

The IOT network consists of a lot of interrelated and connected devices that have unique identifiers (UIDs). They have the ability to transfer data over any network without the requirement of physical human interaction. There are a large number of IOT devices in the network that generate data which represents thousands and billions of objects, hence we need a scalable distributed storage system. The Hyperledger Fabric is a blockchain framework which is used for developing blockchain based products, applications and various solutions. It is an open source and permissioned network meaning all the nodes/ entities participating in the network are authenticated and genuine.

Hence it gives an advantage of added security.
In this paper the inspiration is drawn from the blockchain distributed ledger technology, Hyperledger fabric. We design and implement a basic prototype of the suggested strategy and discuss the challenges of the approach and results. In this project data coming from iot devices will be stored in server OSDs in the blockchain network. The devices which store the data are known as Object based storage devices (OSDs). The applications and users can then connect to the OSDs via APIs. We use OSD based smart Contract (OSC) as a protocol in this network through which the IOT devices can communicate with the blockchain network. Without a central authority, blockchain systems guarantees the confidentiality and credibility of records. Transactions among IoT devices are reported on blockchains as smart contracts and executed dynamically to increase transaction performance tremendously.

2. RELATED WORK

A detailed discussion of the file system architecture of an Object-based Storage Device. The paper presents an idea to develop a very small and highly efficient file system targeted specifically for the workloads that will be seen by these object-based storage devices.[1]

In this thesis, it proposes a method to collect sensor data from IoT devices and use blockchain to store and retrieve the collected data in a secure and decentralized fashion within a closed system which is suitable for a single enterprise or a group of companies in industries like shipping where sharing data with each other is much required. It also compares the performance of some of the distributed systems like IPFS and Ethereum Swarm based on different parameters.[2]

This paper proposes a combination of the OSCAR architecture and the ACE authorization framework to provide an E2E solution for the secure authorized access to IoT resources named as IoTChain.It consists of two components, an authorization blockchain based on the ACE framework and the OSCAR object security model, extended with a group key scheme. A detailed description of the evaluation of the proposed architecture and the

implementation is explained by implementing it on top of a private Ethereum network.[3]

The paper gives a deep dive into designing a blockchain based IoT system using some of the best blockchain storage options out there. The paper gives a walkthrough to the parameters to be considered for an IoT system which has to be designed using Blockchain-Based technologies. The paper shares an informative perspective how a p2p network can be used to store data and code fragments, which enables IoT gateway to push data and interact with other peers.[4]

The paper explores the utilization of object-based active storage to improve the interaction between data analytics applications and storage systems in the Internet of Things. It presents a large-scale object-based active storage platform, called Gem, for data analytics in the internet of things (IoT) [5]

3. METHODOLOGY

A. Data Collection

Data is collected from different IOT devices in xml csv format. IoT data collection is the process of using sensors to track the conditions of physical things. Devices and technology connected over the Internet of Things (IoT) can monitor and measure data in real time. The data are transmitted, stored, and can be retrieved at any time.

B. Data Preprocessing

Data preprocessing is a technique which is used to transform the raw data in a useful and efficient format. If there is much irrelevant and redundant information present or noisy and unreliable data, then knowledge discovery during the training phase is more difficult. Data preparation and filtering steps can take considerable amount of processing time. Data preprocessing includes cleaning, Instance selection, normalization, transformation, feature extraction and selection, etc. The product of data preprocessing is the final training set.

C. Data Classification

We have classified the collected data into two types namely: Text and Media thus separating the data into homogeneous n heterogeneous types

D. Custom Process

Custom Process: The homogeneous and heterogeneous data collected is processed and customized accordingly and converted into objects as per our requirements.

3. IMPLEMENTATION DETAILS

A. System Description

The storage system takes input from the IOT devices, processes it using blockchain technology in the form of objects and then stores it in the system.

B. Software Requirements

Operating System: Ubuntu 12.0
Technology: Hyperledger
Development platform: Hyperledger Fabric
Languages used: Golang

C. Hardware Requirements:

Operating System: Ubuntu Operating System
Processor: Intel Core i5 9th generation
Ram: 4 GB

D. System Architecture

In this network each IOT device is considered as an OSD. The System consists of IOT Devices which are also known as Primary Nodes/OSD and Super Nodes/ Database Servers. The IOT devices interact with the Super Node via the HTTP methods put/get. The entire system is connected using Blockchain.
The IOT devices can communicate with each other using the blockchain transactions. Any kind of communication or exchange of data or information among the IOT devices is recorded in the blockchain in the form of transactions which are known as Smart Contracts. In Hyperledger Fabric the Smart Contracts are known as Chain Codes. The Chain Code in Hyperledger are nothing but programs that can be written in NodeJs, Java, Golang. The chain code runs in a secure Docker Container. It is used for initializing and managing the state of ledger.
A Chain-code invokes another chain-code to access the state. The chain-code should be approved by the organizations for the satisfaction of channel's LifecyleEndorsment Policy. After the approval the commitment of transaction is to be submitted by organization through the collection of endorsements from enough peers of organizations that have approved.

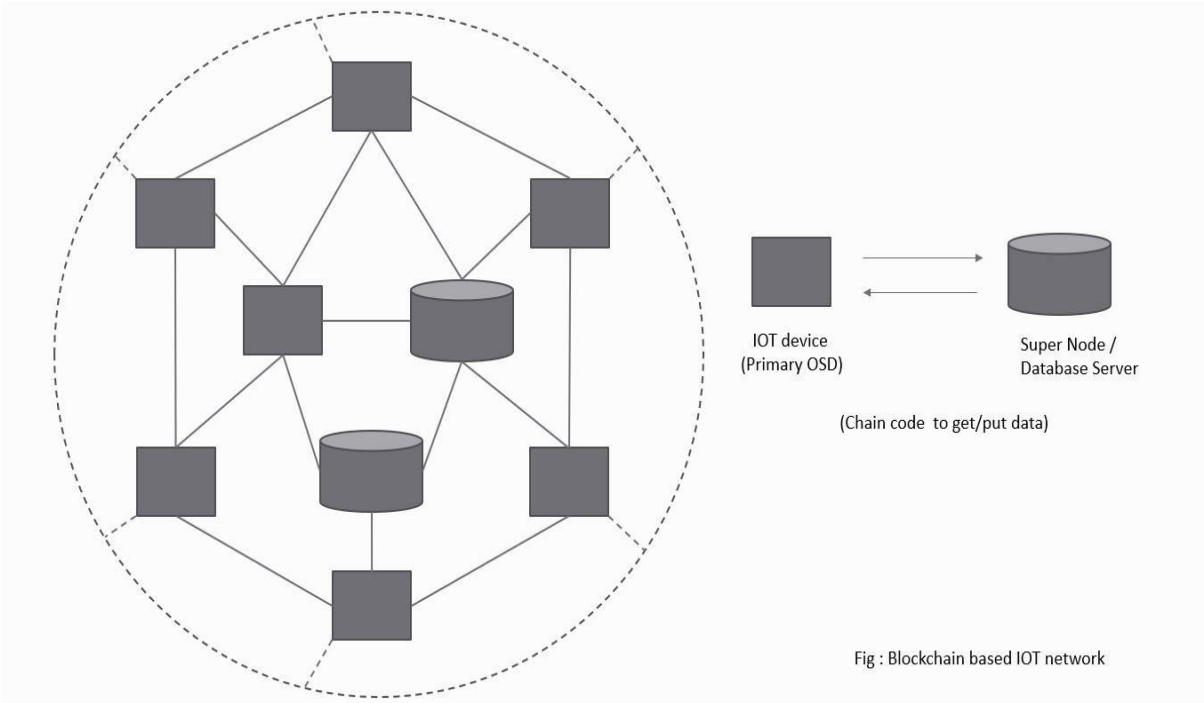

Fig 1: Architecture Diagram

4. RESULT AND DISCUSSION

Finally, we created a storage system which can store tons of data generated from IoT devices in the form of objects by creating and exploiting Blockchain and its features.

Now, the stored data in the form of objects is secured and also can be retrieved faster and easier for data analytics purpose.

5. CONCLUSION

This project is to develop the relationships between storage systems and data analytics applications in IoT. We propose a broad scale blockchain-based database infrastructure, for data analytics in the Internet of Things (IoT). We created an OSD-based smart contract (OSC) solution as a transaction protocol, where IoT devices communicate with certain blockchains in
the IoT network.

6. FUTURE WORK

1. Traffic control techniques can be improved further for a more smooth and seamless interactions between nodes.
2. Load balancing factors can be improved for a better performance and to distribute the hassle of handling OSDs more optimally.
3. IoT device coordination can be further improved to engage autonomous interactions and to avoid malicious IoT devices in the network.

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