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A Comprehensive Study of Decentralized Cloud Storage Platforms-A Review

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Abstract— Recently decentralized cloud storage platforms become the future of distributed web due to easy, reliable, robust, faster access, storing and sharing of data. In this paper we presented a comprehensive study on decentralized cloud storage IPFS, FileCoin, Sia, Swarm and Storj platforms. These platforms are the backbone of an internet due to storage of huge amount of data. From the era of Web 1.0 of centralized system to Web 2.0 decentralized approach, now Web 3.0 of distributed decentralized web with use of IPFS, Sia, and Swarm and Storj storage platforms. Interplanetary File storage and FileCoin replaced HTTP traditional protocol. They worked on the requirements of the user with online backup services. All of these cloud platforms works on needs of the user for decentralized peer to peer storage but different in their implementation part. Further this paper studied the uses, advantages, disadvantages and their issues related to decentralized file systems.

Keywords: *P2P, IPFS SiaCoin, FileCoin, Swarm, Storj*

1. INTRODUCTION

Decentralized cloud storage is the future of an internet or web. Now a day's decentralized storage systems change centralized systems. The changes from the era of Floppy disk to Cloud storage provide more computing power. The idea of storing a large files using peer to peer approach replaced traditional protocols. There is need of providing decentralized solution for centralized systems. Google drive and dropbox also doing great in their services but due to their restrictive services decentralized system force to empower blockchain technology. The use of traditional protocol HTTP also replaced by Interplanetary File storage protocol. Such peer to peer file system like BitTorrent also have some drawbacks of downloading, credibility issues. Recently blockchain technology becomes buzzword in both industry and academia [2]. Currently we have future of storage internet having distributed and decentralized storage systems in the form of interplanetary File storage, FileCoin, SWARM, SiaCoin and Storj. Decentralized file system decomposed the large amount of data into smaller units and distribute data on different nodes. It means each node having data on it.

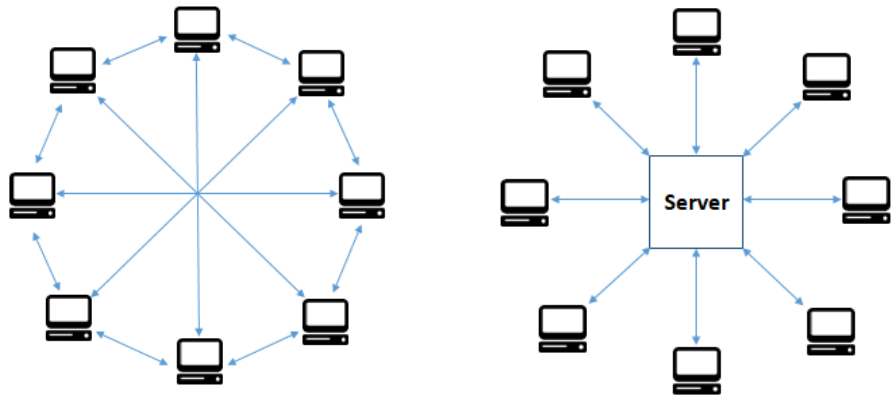

Figure 1. Decentralized and centralized Network

2. DECENTRALIZED CLOUD BASED PLATFORMS

The future of an internet is totally based on decentralized cloud storage platforms. We have different decentralized cloud storage platforms are summarized below as:

1. IPFS
2. FileCoin
3. SiaCoin
4. SWARM
5. Storj

2.1 Advantages of Decentralized Cloud based platforms

Firstly we will brief on advantages of decentralized cloud storage platforms because the use of these is becoming new and advanced in today's market. The idea behind is also this it replaces traditional file storage and sharing system with saving huge amount of data. Now the advantages of these are follows:

1. Bandwidth
2. Decentralized approach
3. Privacy
4. Peer to Peer approach
5. Remote access
6. Minimal threat
7. Reliable storage

3. Proposed Work

In this paper we have studied the upcoming and future of a web in the form of decentralized cloud storage i.e. IPFS, FileCoin, SiaCoin SWARM and Storj. Their uses and working technology is discussed below:

3.1 IPFS

InterPlanatary File Storage protocol is a peer to peer protocol [1] that replaces traditional protocols i.e. HTTP, HTTP's. It is hypermedia protocol to access and share huge amount of data. It replaces IP addressing approach by content addressing with help of IPFS. Now a day's IPFS becomes future of distributed decentralized storage of web to designed the web faster, safer, efficient, open source and more reliable. Whenever we are adding files or data on InterPlanatary File storage system (IPFS) it creates a hash of it which is cryptographic hash key [10]**.** The form of cryptographic data is known as Merkle DAG which is data structure to model many other data structures. The idea of implementing decentralized IPFS network is to connect all the nodes (connecting computers) without centralized approach to share all data and files. This process removes duplications across the network where all nodes are connected with each other. There is no need to remember the hash code by the users of each upload or download because it is available in human readable form which is called IPNS. Each node on network takes content and indexing information that is required only and when we view or download the content or file will ask the network on which node data is stored. IPFS is the future of distributed and decentralized web in efficient and inexpensive way. IPFS is synthesis of internet technologies like DHTs, Git versioning and Bit Torrent. The advantages using of Distributed Hash table (DHTs) are decentralized, scalable and fault tolerance.

3.2 FileCoin

FileCoin is a decentralized cloud network that is powered by Blockchain and native token [3]. It creates incentivized system to put extra storage to be used in. FileCoin uses IPFS (InterPlanatary file storage), a P2P distributed protocol in which each file is encrypted by hash key and containing indexing information. It allows searching and distributing huge amount of data with high efficiency. FileCoin is like a BitCoin but it provides a proof of Replication and Proof of Spacetime used to create a useful and valuable storage services by the use of mining process but before this Blockchain not using this technique for storage [3].

The uses of FileCoin includes hosting files and mining, exchange FileCoin for tokens, reliable storage at cheap prices. FileCoin is DSN (Distributed Storage Network) that provides auditable, verifiable services designed on incentives. It is associated with two markets: Storage and retrieval market with same structure but different in design. It is built with IPFS and both complement each other.

3.3 Sia Cloud Storage

Sia is also a file storage system for the future [7]. Sia is distributed blockchain based storage system. It provides access to decentralized cloud storage platforms for renters. Renter means who uploading a file and hosts are storing the files. Sia has its own Blockchain that makes this technology most reliable, affordable, robust and low cost cloud based system. In this process everything is automated. It is reinventing cloud storage [7]. It powers a utility token as the SiaCoin.

3.3.1 Working of Sia Cloud Storage

Sia cloud storage concludes following steps:

In this process everything is automated, who upload a file is called Renter and host store the files. The working of Sia Software involves the process of first a file is uploaded then it is segmented into sub files that segments are 30 in count, then encrypted files are sent to network. The process of encryption using Threefish algorithm and host will get encrypted data only. Then files are sent by smart/file contract to the hosts.

3.4 SWARM

It is another protocol which is decentralized storage network, permission less and communication infrastructure [8].The main objective of swarm is to provide infrastructure services for the developer's of dapp. Swarm is using smart contracts platforms (Ethereum) to implement the services. It is also a peer to peer approach for decentralized storage. The implementation of swarm includes Swarm Go-Client and Swarm Nim-client.

Swarm defines Chunks, reference and manifest as notions [8]. Basically chunk is basic storage unit which contains data of limited size at max 4k. Clients use reference as unique identifier to store and access content. Whenever we using unencrypted data, reference is working as cryptographic hash of data and serves as content address of it. For the collections of a file manifest is data structure for it. Manifests are also considered as indexes for the services. Whenever content is uploaded on swarm it cut the data into smaller pieces of chunks and then these are crypted with chunk hash. So the reference of data chunks are also referred or packaged as chunk. The one important thing about Swarm is it does not revoke the content means when content is uploaded we can't delete or remove it.

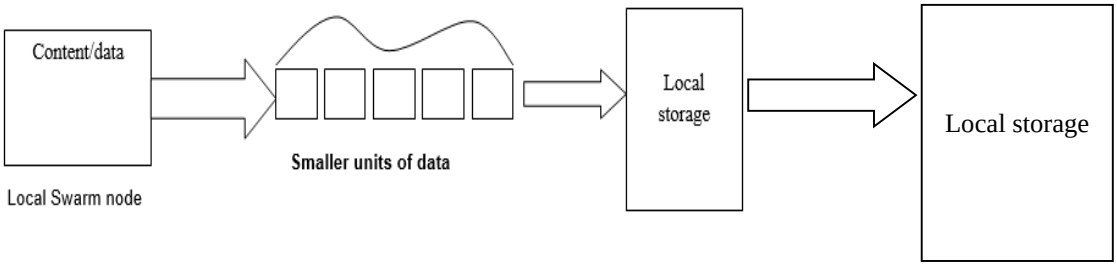

Figure 2. Swarm upload process

3.5 Storj

Storj is the one and first decentralized and end-to-end encrypted cloud storage platform. It is using Storj protocol for peer to peer and storage contract. The advantage of using Storj is communication between two users to exchange information without knowing each other. It provides exchange of information with money. The Storj has DHT (distributed hash table) system to build contracting and negotiation for Farmer and Renter at meet time. It provides movement of data between Farmer and renter. It includes computer selling and retrieving space as Farmer and renter. Whenever Farmer and Renter meet they negotiate an agreement. The process of an agreement involves as contract and audit, smart contract has its duration of time. Each time renter checks whether farmer is available or not. If available it means he has file with cryptographic hash. For verification and receiving by the Farmer, renter has to pay for it. This whole process includes challenge, proof and payment is known as an audit. As renter audit the Farmer's storage every time of contract. At the end they renegotiate as contract or relationship is over. Storj having the implementation of creating contract, communication, payment and close the contract.

4. USES, ADVANTAGES AND OPEN ISSUES FOR DECENTRALIZED CLOUD STORAGE PLATFORMS

Table 1
IPFS, Sia network, Swarm and Storj

	IPFS + FileCoin	Sia	Swarm	Storj
Definition	InterPlanatary file storage for P2P protocol	Reinventing Cloud storage	Decentralized storage network	End to end encrypted storage network
Uses	Merkle DAG for cryptographic hash	Threefish algorithm for encryption, use of Host and Renter	Ethereum smart contract service	Its build on DHT, use of Farmer and Renter
Advantages	Content addressing, Distributed, Decentralized, Faster, Reliable, Low cost service, Peer to peer approach	Based on SiaCoin, Free open source software without signup, Reliable, Decentralized	Content based DHT,beneficial for smaller chunk[12]s, part of Ethereum,	Exchange of content without knowing to each other, Reliable Fix price
Disadvantages	Consumes more bandwidth	Smart/file contract in host and renter	Testing phase for large chunks[12], is in developing phase	Single point of failure
Issues	Content resolution and gateway performance	Wallet and deposit issues	Connection infrastructure is in development phase	Concurrent database writes

5 CONCLUSION

In this paper we discussed the future of internet or web in the form of IPFS (interplanetary file system), FileCoin, SiaCoin, Swarm and Storj for distributed decentralized cloud storage with their potential and advantages. This study describes how these decentralized cloud storage store and share data using peer to peer service of distributed cloud. This paper also concludes working of distributed decentralized cloud using IPFS using Merkle DAG cryptographic hash key and Sia cloud storage using Threefish encryption algorithm. The working of these decentralized cloud storage platforms includes uploading on content on different software and store data using different techniques. The use of these platforms has same concept of storage network but different in their working and performance measures. Both distributed decentralized cloud system are more affordable, robust, secure and reliable. In future definitely proposed new generation decentralized cloud platforms come in complete implementation and in use.

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