

# IPFS AND SWARM: FUTURE OF DECENTRALIZED STORAGE SYSTEM

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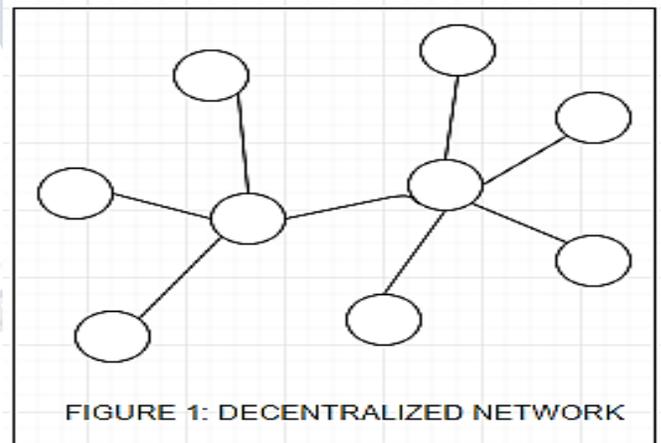
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**Abstract -** IPFS (InterPlanetary File System) and Swarm are both peer to peer to data storage system which is decentralized. IPFS uses hypermedia which is the advancement of hypertext protocol. These protocols give allowance to access data not from the single server but from multiple servers simultaneously. These protocols protect us from the system failure and prevent our data according to the requirements and needs of the user. Using these there is no chance of downtime of the services. Most importantly both can meet the requirements of blockchain and other upcoming technology. There are several limitations of both IPFS and Swarm. Swarm integration with smart contracts is strong which is becoming essential for the blockchain. Swarm is recently focusing on the Ethereum, but it can be used widely with other technologies. They both provide a sufficient and mannered way of storing and redundancy of data which is a backbone of the blockchain. These technologies reduce the chance of various malicious attacks like DDoS etc. which are more frequents in HTTP network protocols.

**Keywords —** IPFS, Swarm, Blockchain, DDoS, HTTP

## 1. INTRODUCTION

Interplanetary File System and Swarm are the emerging protocols which can change the future of the storage on the internet. Both are based on the peer to peer technology which means that there is no central system present for authentication and other purposes. They provide the block technologies to store and share our data in the permanent form. In this large file is broken into smaller files and are stored in separate nodes so at the time of retrieval all the distributed data can be accessed simultaneously from different nodes. They provide us best alternative to central systems which are having many drawbacks due to their increasing use day by day. Now, there is need to resolve all the issues related to a traditional central storage system which can be resolved by these new decentralized protocols. All the data stored are not stored on the server they are distributed among different nodes and allows accessing of data whenever required. They both provide decentralized storage layer which can be the future of the internet. Both the protocols are very similar having the main aim is to remove the present data layer and replace it with distributed storage layer. These protocols are content addressable in this file are addressed by the hash of their content [1].



## II. IPFS

InterPlanetary File System is a peer to peer network protocol that allows us to connect all the computing devices without any central system for sharing and storing of the data between all the computers. Larger file is

broken into small pieces and stored on the different nodes. Nodes are referring to the different computing devices that are present in the IPFS network. At the time of retrieval of data, all the data are linked with the hash key which is based on the content they are referring. Using these hash keys, one can access the data from all the different nodes simultaneously. This concept is known as content addressable storage. All this based on

Hypermedia. Hypermedia is the advanced version of the Hypertext protocols. Hypermedia provides a way of linking for non-linear graphical-based information also. Every file is linked with the unique hash key associated with it which can be used to access that data directly from any part of the world. There is no single point of failure in this system. In the present scenario, HTTP is widely used but there are many disadvantages of this, for example, HTTP is more prone to cyber-attacks which can shut down the whole system. IPFS advances our present technology with providing more add-on services to overcome all the drawbacks of IPFS system. HTTP is most successful when there is need to deal with the small amount of data but in present, there is need to deal with a very large number of datasets which can be done easily using this technology. A ledger is present which is called BitSwap ledger which is used to hold all the information regarding transfer and sharing of files which can be used to trace the history if needed and make data more secure. All the nodes in the IPFS are independent. The nodes do not need to trust each other in the IPFS. When one wants to send file then there is no need to go to central system and look for the receiver now we can directly send the file and address of the receiver can be found in the file content directly. There is no chance of storage limitations in this system, storage can be increased whenever there is a requirement. This is Content Delivery Network(CDN). All the files are automatically broken into small files to provide the fastest route at the time of sending or sharing of the file. IPFS can hold anything blockchains, Floppy Disks data, entire operating system and static sites. Mountable file system can be accessed through FUSE (File in User Space) [2]. IPFS allows low-cost communication between the nodes.

### III. SWARM

Swarm is a peer to peer storage and sharing service which is decentralized. All the data is redundantly stored in nodes. Basically, swarm deals with Ethereum storage and store it on public nodes. It also used to store the data of the decentralized application and blockchain. In this file is associated with hash and retrieval of the file is done by the hash of their content. Data can be accessed irrespective of user's location. It is part of Ethereum stack. It is more successful for small chunks of data with low latency. It basically focuses on replacing data layer with storage layer. It is more reliable than the present network. There is no chance of failure of the system. As one node present in the system fails then all the other nodes have redundant data to recover and there is no chance of failure of all the nodes in the system. It is more secure in than any centralized system. As to attack, this network one needs to access all the nodes at the same time which needs hundreds of supercomputers together which is not possible. So, there is no chance of downtime of the system. All the information store is stored in immutable content address chunk store while in some technologies distributed hash table is maintained like in IIPFS. There are many built-in incentives present in this which highly supports Ethereum. Swarm makes it possible to deliver small chunks of data at slow latency which is the requirement of some of the application [3]. The inclusion of incentives makes swarm stronger as it can easily use the concept of smart contracts and other related protocols easily and more effectively than any other system. One can easily use this service as it is cost effective with many integrated resources which make it easy to handle. It allows a flexible increase in storage limitation if required and further growth in resources according to the requirements. It is basically a collection of nodes which is working on a bzz protocol and all the nodes in the same network have the same network id which makes it easy to differentiate from the other networks. All the nodes can go offline as their uploading is done on the swarm. All the data in a swarm are divided into chunks. Chunks are fixed size blocks in swarm it is a maximum size of four kilobytes. Manifest is another important term related to the swarm which refers to the data structure that describes collection allows for URL based access to content. Manifest maintains the routing table for the data. It stores the entire directory or webs without any central server. So, the term coined is a virtual server which

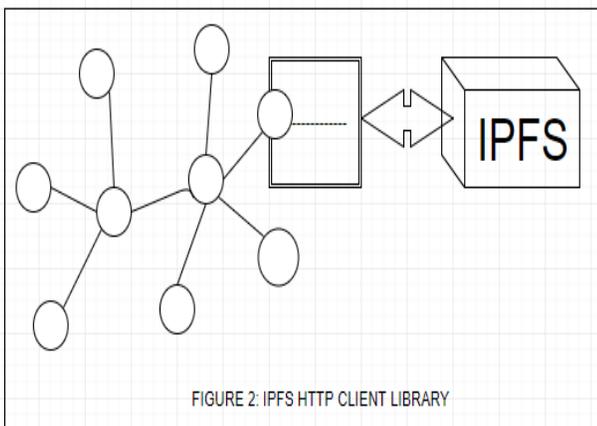


FIGURE 2: IPFS HTTP CLIENT LIBRARY

allows the whole directories to store and access and provide all the hosting services without the server. Swarm checks that chunk is uploaded and retrieve whenever and wherever required.

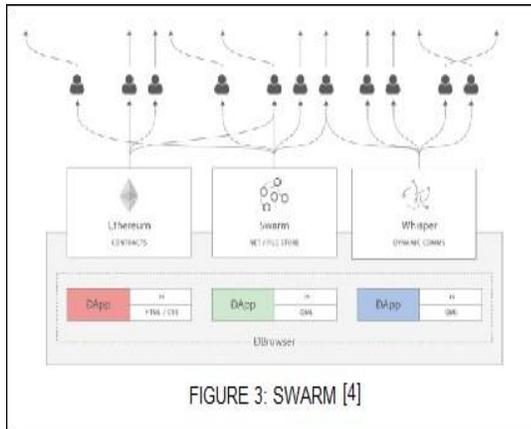


FIGURE 3: SWARM [4]

#### IV. IPFS VS SWARM

- Swarm is beneficial for small chunks of data with low latency.
- Swarm has many built-in incentives which makes it more flexible to use. Ethereum is linked with swarm which makes smart contracts and other features already present.
- Swarm is a part of Ethereum stack and IPFS is using in many live projects.
- IPFS maintain distributed hash table whereas Swarm maintains content addressed distributed hash table.
- Network management and per management layers used by both the protocols are different.
- Swarm uses bzz protocol and all the nodes in the network are provided with the same network id.
- IPFS prove to be scalable whereas Swarm is just in the testing phase for large chunks.
- The working network is present in the IPFS but it just started to develop in Swarm.
- Cloud hosting services are possible in a swarm but in IPFS you can publish content already present your system.
- Swarm heavily depends on Ethereum for peer to peer network.

- Filecoin is a project of IPFS which can add incentives to IPFS.
- IPFS has no guarantee of storage while swarm offers content-agnostic behavior and adjustable security to the users.

#### V. IPFS AND SWARM INTEGRATION

Integration of IPFS and Swarm minimizes the development efforts. Swarm incentives can be used to control over IPFS nodes. There are many problems related to their integration like swarm uses chunk based storage systems if it is applied on IPFS nodes then it can reduce the performance of the entire system. There are many built-in incentives in swarm which can affect the backbone of the IPFS [5]. Balancing will be more complexed and difficult if both the networks are integrated, and it also creates security issues. Using swarm integrated with the IPFS will pause the growth of both technologies. There are huge advancements that are still required in both technologies, so integrating them is not a suitable idea.

#### VI. ADVANTAGES

- Both are decentralized so there is no need of any central system for monitoring which makes the system more effective and fast.
- These systems are capable to handle large datasets which are not possible using traditional approaches.
- These protocols provide low-cost services with no point of failure and make our system more secure than ever before.
- Using traditional approach there is a high risk of data disappearance which can cause trouble in various segments which is not possible in these systems.
- Both are the technologies are in developing stages and have the power to change the network design in the future.

### VII. DISADVANTAGES

- These technologies use cryptography which needs mining and that requires large power consumption.
- Public-private cryptography technique must be used which makes our system more complex.
- Both are in developing phase so there is lack of stability and scalability [6].

[6] IJNRD: InterPlanetary File System: An analysis on Future File System IJNRD1710005

### VIII. CONCLUSION

This paper presents the review of two most emerging technologies that are IPFS and Swarm. Both are the surely going to be the future of the internet storage system. There are a number of advancements possible in these fields and increase the stability of these systems. Both these are very low cost and very much complex and deep understanding. These are the future permanent web replacing present technology but need some add-ons before coming into existence. Both the systems can be integrated but there can be some issues that are discussed above and must be considered before merging the two. After some add-ons, both will surely occupy the technology market soon.

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