

# Topology, Database & Architectural design of Block Chain



S. Thirunavukkarasu, A. Rama, G. Ayyappan

*Abstract* Block chain is a fast growing technology and its gains its popularity after the invention of bit coin and crypto currency. Now a day's block chain is used in many real time applications that involve a lot of transaction. But still there lies confusion between storage in block chain and storage in database. This paper describes about the difference in database and block chain in their purpose, design, and topology. It also describes about the pros and cons of both storage structure and also about its applications.

**Keywords:** Block chain, database, topology, applications of block chain.

## I. INTRODUCTION

A database is used to store information in the form of a data structure called table. The tables have rows and columns. Each row in a table is called a record and each column in a table is called field. The collections of records for the table and collection of such tables form the database and is shown in Figure 1. The information stored in the database can be queried and can be displayed in the required format and are more useful in management, financial sectors and many government agencies. Government also uses database to store millions and millions of information in the form of records [1-3].

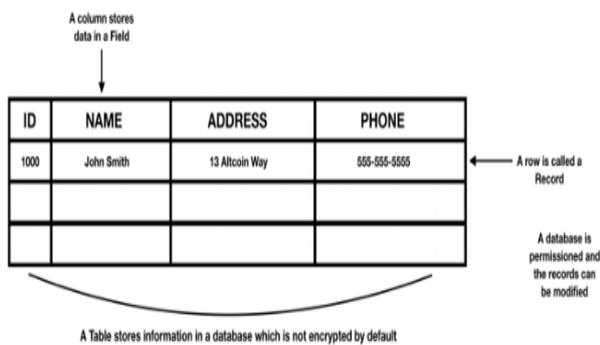


Figure 1. Database Design

Database was initially using a file structure for storing information. It gathers and store simple data. Later, relation database came into existence and was capable of handling

complex data, stores and retrieves data from multiple databases. They effectively handle the relationship between databases and their interlinking information is also considered. Each database can be managed, modified and controlled by a single user called the administrator. The admin is a single user in charge of entire database and can create, modify, delete and update any record stored in the database. When the records stored in the database increases, then the performance of the database decreases. It is then the responsibility of the admin to run optimization algorithm and to improve the performance of the system [4-8].

The admin can also designate one or more user to perform database management function to share the workload. The admin may allow one of the user to grant privileges to the user and may ask the other user to verify the authenticity etc. in case of server crash, which is more common in corporate world database can be restored if it has a backup.

## II. BLOCK CHAIN

Block chain was first implemented in bit coin. In bit coin, block chain is a digital ledger that is immutable and secured using SHA 256 algorithm. It is a continuously growing chain in which a block is added upon every transaction. The structure of block chain is shown in Figure 2. It consists of uniform sized blocks. Each block contains hash details of previous block to provide security. So that the contents of any block without altering its neighboring block. SHA 256 algorithm is used to generate hash code of block. The first block contains no hash information and is called genesis block in block chain. Block chain data structure is an example of merkle tree which is an efficient way to verify data [9-12].

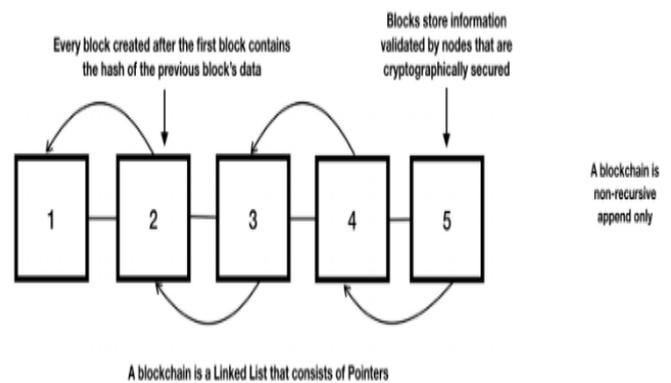


Figure 2 Block chain Design

All the nodes in the network participate to validate a block in a block chain. Game theory is involved in this process. All the nodes compete to add a block by computing a value called nonce, based on the hash function used in the block.

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The nodes that compete are called miners. Based on the total hashing power in the network and also on a protocol called difficulty level, a miner gets a chance to validate a block. The difficulty level will be higher if many numbers of miners compete for validating a block otherwise it will be less. Once the miner validate nay block they may get an incentive for providing their computing resource to the network [13-15].

Block chain uses distributed network of node that is decentralized, which means all the nodes in the network have a copy of block chain. There is no administrator to validate the block. Only the miner validate the block by solving cryptographic puzzles based on difficulty level and total network hashing power available. Once the block has been added to the block chain, the information is immutable and transparent to all the nodes in the network [16-19].

### III. TOPOLOGY

A database is implemented in client server architecture and is shown in Figure 3. It operates on master salve principle. The database is managed, modified and controlled by the server. The client or the user who wants to store information in the database has to establish a connection to the database which is configured by the server. The software run by the client to establish the connection must also be authenticated. The authentication is usually provided by passwords but now a days web interface is also used [20-23].

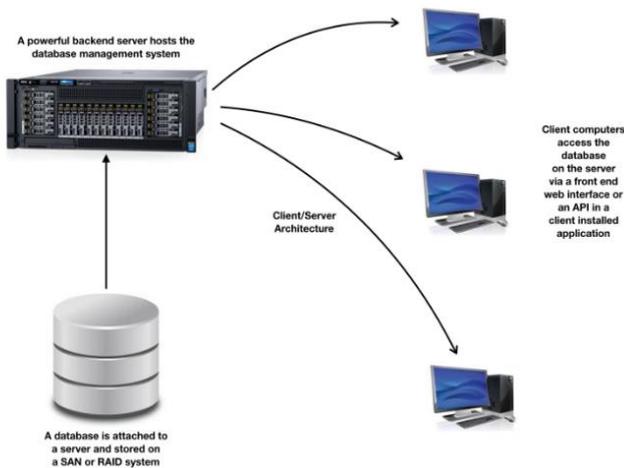


Figure 3. Database-Client server Architecture

The database is highly centralized and permissioned. It requires the user (client) to ask the administrator (server) to grant permission and privileges like read, write or both. Based on these privileges the user is allowed to access the database. Because of this reasons the role of administrator in database is indispensable.

Block chain is implemented in a peer to peer architecture. Each node is connected to all other nodes participating in the network. All the nodes in the network have control over the block chain. There is no single master as in case of database. Each peer gains equal priority in accessing the block [24-28].

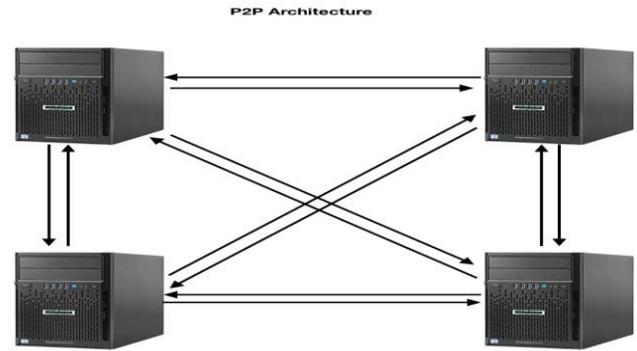


Figure 4. Block Chain-P2P Architecture

The major problem in block chain is 51% attack which occurs due to the act of one of the peer being rogue. But 51% attack is not easy to implement as it is very costly and it requires a lot of computing to initiate such an attack. Block chain operates on the mechanisms of decentralization and there is no need for administrator permission to access block chain. It is highly secure. No peer can alter the contents of the block chain without the help of other nodes in the chain. In that case also a separate chain will be created and is considered valid only if it is greater than the main block chain [29, 30].

### IV. ADVANTAGES OF DATABASE

- Depending on the requirements it is possible to customize the database.
- It provides user friendly interface.
- With the help of powerful server and properly managed database, the system can handle larger volume of data and is very stable.
- Transaction speed is very high and can handle extremely large volume of data.

### V. ADVANTAGES OF BLOCK CHAIN

- Block chain is decentralized and hence highly fault tolerant.
- It is impossible to change the information stored in the block , once the block is validated.
- Highly resistant to tampering.
- Information about the transaction cannot be hidden and is very transparent.
- Cryptographic technology and hash function provides additional security to the stored data

### VI. APPLICATIONS OF DATABASE

- Real time monitoring system and sensor applications which requires continuous updating.
- Online transaction for faster processing
- Confidential information like information from government sectors.
- Applications involving data that does not require verification.
- Relation data

## VII. APPLICATIONS OF BLOCK CHAIN

- Monetary transactions
- Transfer of values
- Applications involving data that require verification.
- Any decentralized applications
- Voting systems

## VIII. CONCLUSION

This paper has described about very few facts of database and block chain from technical perspective. There are many more things that are not discussed and can be considered for future work. To conclude, database is not better than block chain and also block chain is no better than database. Both are having different purposes and can be used based on the requirements needed on the data to be stored.

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