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Blockchain Testing

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Abstract - Blockchain is basically type of database which is used for storing data in blocks. When fresh data is there its entered into fresh block considering its as first block. Data will be entered accordingly and suppose the block gets filled then this block will be lined upto its previous block and forming chain hence the name is blockchain. we can store different types of information but mainly we store transaction related information in it.

Need for blockchain as central database is already there?

Central database mainly stores data at a single point i.e centrally. so that hacker can easily trap the data.Whereas blockchain stores data in decentralize manner which is difficult to trap. Hence it acts as protection layer for data and guard layer for hackers.The above mentioned is the reason that industries/banks are moving toward blockchain technology for securing their data. The aim of research paper is to find best suitable testing technique for blockchain technology.

Key Words: Blockchain testing, evolution in blockchain testing, blockchain testing steps, blockchain testing approach.

1. INTRODUCTION

Blockchain is type of database which stores data decentralized and in distributed manner. Already some of industries already started using blockchain technology. Blockchain uses blocks methods to store information in chaining format.

It is also distributed ledger which means it can be replicated and synchronise among members of public, private or peer-to-peer members. Every data stored in blockchain will have particular timestamp and cryptographic signature generated for particular block which is difficult to crack. The cryptographic signatures make blockchain highly secure.

Blockchain uses consenus algorithm for making its distributed nature effective and SHA-1 algorithm where hash key is generated and vdded to its leading block. Mostly blockchain is 50% secure from attacks as of its distributed nature.

Blockchain also having immutable nature i.e if we have to change something in particular block we need to assess the whole chain as a block is lined up in chain. This will also effect testing process. If we have found bug in the development stage of blockchain we need to assess entire code of it which requires time, money as well as cost hence proper testing method must be used which must be effective for it.

Blockchain testing will be easy if blockchain is implemented for private organization because for private organization their customization helps to test it easily.

Found it difficult for public organization because length of peoples are not predicted here. Considered person/people as node. Larger number of nodes may lower the transaction speed. As well as to cover each and all aspect of nodes will be difficult to assume and consider.

Blockchain testing already including api testing, functional testing, node testing and security testing and smart contract testing with tool ethernum. To add an enhancement in existing testing method I am proposing this research method with new testing methodology for ensuring its quality, effectiveness and completeness.

1.1 Literature survey.

Blockchain do not store data randomly i.e erroneous data . blockchain stores data after validating it. Mainly data stored in blockchain ensures uniqueness and integrity.

Uniqueness – defines no redundant data is there **Integrity** – states data will be in original format only.

As we are here to secure our data in online mode so testing of blockchain must be there with all perspective. with testing it completely we can rely that our data is safe. Blockchain testing covers both traditional as well as functional testing like functional testing, non- functional testing, performance testing, security testing and integration testing.

Also some special capabilities testing is followed like

1. Smart contract testing.
2. Peer/Node testing.

Functional testing – basically it test each and every part of blockchain whether its working effectively or not. Along with effectiveness also its working as expected or not.

- **Block size :-** block size of blockchain is reduced from 36MB to 1 MB for security purpose as well as higher block size may also effects the performance

of 1 block and it will directly or indirectly will effect the entire blockchain also. Also small block size will have less response time as compare to bigger one.

- **Data transmission :-** as data will reside in the network we must focus on how data will be flowing in network in what manner, is there is any loss in data or not.

  Because if in network data gets loss because of transmission impairments and the next set of data is stored in block and forms the chain then we have to change entire blockchain which is time consuming.
- **Block addition :-** as new block is getting added to blockchain must properly verified by tester because if it contains some error then it will effect entire blockchain and we need to test each and every block again.
- **Node testing :-** nodes are basically peoples involved over network to access blockchain or add data in blockchain. A valid user only can have access to blockchain not everyone can come and access data.

  As well as if nodes of blockchain is directed by the organization it will be easy for tester to perform load and performance testing.
- **Smart contract** :- ensures nodes involved in blockchain must follow rules set by smart contract that is how tokens are generated for transactions and how transaction will get carried out.

Integration testing :-
Blockchain is comprised of several blocks hence we need to perform testing after integrating blocks also. Because there may be possibility of integrating blocks may give different result as expected.

Performance testing.

Performance of blockchain will depend on no of nodes involved in it, no of transactions are getting performed, and transaction type also effect.

If small no of nodes are performing limited amount of transaction then performance of blockchain will be working in effective manner only but as no of nodes increases, no of transaction increases it will effect blockchain performance.

Security testing.

Security is one of the reason organizations are investing in blockchain. Security testing involves testing of each transaction, detection of any mischievous activity along with that testing of cryptographic algorithm i.e for private key checking and other algorithm based testing to ensure data integrity and security for it.

2. Problem definition.

- Blockchain must have blackbox and white box testing.
- Blockchain must change its immutable nature based on organization need.
- Proper algorithm is used for testing cryptographic algorithm.
- Smoke testing must be performed(to know whether they have achieved what they want). This testing is done before testing and after developing it. Mainly it states that is it stable enough to go for testing purpose.
- Proper testing lifecycle with proper testing types must be used along with exiting one.

2. 1 Methodology to be used.

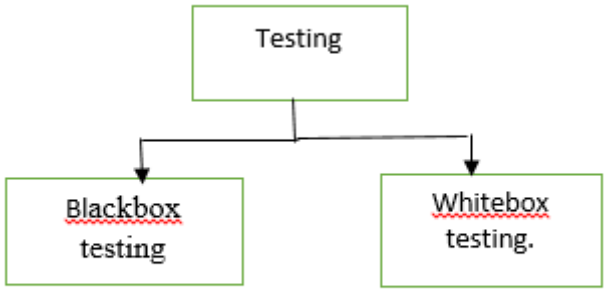

Fig: Testing methodolgy

Blackbox testing.

In this type of testing we are going to evaluate each and every part of blockchain.

- Whether timestamp is properly generating or not for transaction. If possible we are going to enter some transaction to check timestamp is properly working or not and if there is any glitch we can found it here only.
- Here we are going to check whether mentioned cryptographic algorithm is properly working or not.
- Consenus algorithm :- used for co-ordinate in distributed system.
- SHA -1 :- hash code is generated for each block which is lined up in other block for cross verification purpose.
- For consenus algorithm use Bounded Model Checking(BMC) to check whether its working properly or not.
- For SHA-1 use Cryptographic Algorithm Validation Program(CAVP) to check whether its working properly or not.

Whitebox testing.

Here basically we are going to test code of each and every part of blockchain.

- Check whether timestamp generation code is working or not.
- Check whether hash code and its line up to next block is working properly or not.
- Check whether consenus algorithm is working or not.
- Block addition code is working properly or not.

Advantages of using above testing methodology.

- No need to do rework after deployment of blockchain ate user end.
- Ensures blockchain development is landing successfully as per expected scenario.
- No need to recheck the code after deployment stage.
- assures that developed blockchain is working properly from each and every part of it.

3. Testing Lifecycle.

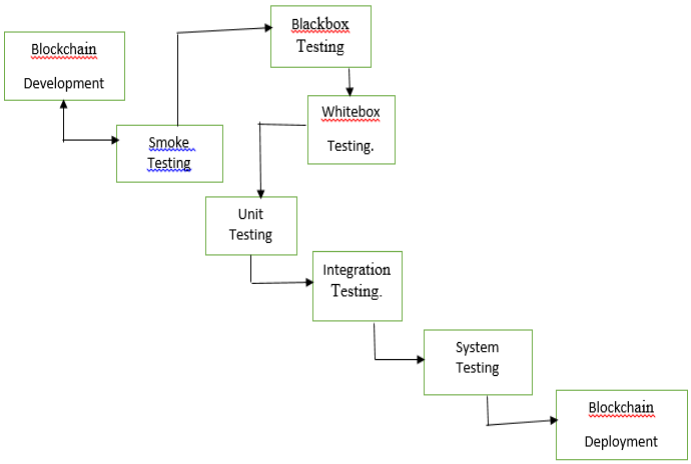

Fig: Testing Lifecycle.

Above figure is depicting how the blockchain testing will carried out in various stages. And how data is flow from each stage and get evaluated.

- After developing blockchain we are moving from smoke testing to ensure whether system is stable enough for moving to other process of testing.
- It also ensures whether proper development of blockchain is done or not.
- Smoke testing also includes blackbox and white box testing where we can track whether timestamp is properly generating or not, cryptographic algorithm is properly working or not after that each and every part of code is evaluated just to ensure that it will save our time and effort in future.
- After that we are moving towards for unit testing where we are testing each block of blockchain in detail hence if any glitch is there we can find out there only.
- As new block is chained to previous one we are testing them to ensure it whether it works fine or not which is integration testing.
- After entire block is chained than we are performing system testing where not blocks know blockchain is evaluated ones again and if any error is there we can sort it out for there before deployment stage.

Apart of it we are using several tools for testing api of blockchain, security and performance of it.

In mentioned above level of testing we can use our standard blockchain testing tool also like ethernum and api tester, etc…

Some of the tools are:

1. Embark.
2. Truffle.
3. Validate block and chain size.
4. Security
5. Populus.

Advantages of using above mentioned test life cycle.

- Errors can be found out previously.
- Errors can be easily gets tracked when blackbox and white box testing is done.
- Smoke testing ensures development is completed so if know there is any error we can rectify it easily rather than assuming whether we have done it or not.
- Various level of testing is envolved after smoke testing and before deployment which ensures its quality, saves time and effort.

4. Result & performance analysis.

Objective.

Objective of blockchain testing is defined as follows.

- To ensure its quality.
- To verify whether data is secure with that particular algorithm or not.
- To ensure that its security is trustworthy or not.
- To store information in it we must analyse each and every aspect of it.

- To ensure whetether its good for storing data or not.
- To ensure complete test coverage.
- To ensure data is properly stored in blocks.
- And properly hash codes are generated for linking up those blocks.
- Tampering of single block of data can be easily trackable via hashcode.
- Distributed nature of blockchain makes it to recover corrupted block easily.

Scope.

- One of the fastest growing technology.
- Blockchain safety features are liked by various industries so they started storing data in it.
- May be in future blockchain will completely occupy position of central database because of its decentralize nature, timestamp and cryptographic algorithm methods.
- Prevents from DDos attack because DDos mainly targets centralize database whereas in blockchain data is stored in decentralize manner.
- Possibility of health industry and mainly bank industry to move toward this technology.
- Its complete testing assures its quality which is more attractive for private as well as public organizations.
- Government Of India also adopting use of blockchain for their digital economic purpose.

5. CONCLUSIONS

In present work we are know focusing on managing scalability of blockchain along with its security reasons. Also found some issues in blockchain testing via various blogs. On the basis of analysis and for overcoming this issue we must find out the best suitable testing methodology and best tool for blockchain testing which will ensure its quality along with its completeness and also enhancing its features.

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