International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 08 – Issue 03 || March 2023 || PP. 51-58

A Survey on challenges of Blockchain Technology and incorporating Cloud Computing Technologies

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Abstract: Block Chain Technologies and Cloud computing are on demand and emerging technologies which is used by the various applications, enterprises, Business , Medical and Health, Banking services. Block chain technologies are the one disruptive core technology and it creates impact on technological society due to decentralization, transparency and secure data transaction. BT plays major role in the application of crypto currency it serve as digital immutable ledger and transaction done in decentralized manner, Cloud computing provides data storage in cloud and it provides several online services such as infrastructure as a services, platform as services and software as a services in cloud computing data stored in the cloud is mutable Finally this paper elaborated on key future directions, novel use cases and block chain meets cloud computing and provide secure environment of data transmission based on consensus or validation protocol.

Index Terms: Blockchain, Cloud computing, Decentralization, Transparency, Consensus, validation protocol

1. Introduction:

Blockchain is a digital ledger technology that allows for secure, decentralized record-keeping of transactions. It consists of a distributed database or ledger that stores information in a series of blocks. Each block contains a set of transactions and a unique cryptographic code, which links it to the previous block in the chain. Once a block is added to the chain, it cannot be altered or deleted without affecting the integrity of the entire blockchain. This makes blockchain a tamper-proof, transparent, and secure way to record and transfer information, such as financial transactions, identity verification, supply chain tracking, and more. The most well-known blockchain is the Bitcoin blockchain, which was invented in 2008 by an unknown person or group of people using the pseudonym Satoshi Nakamoto. However, today there are many different blockchain platforms and protocols being developed and used for various purposes, such as Ethereum, Ripple, Hyperledger ,Cloud Computing refers to the delivery of computing services over the internet. These services can include computing power, storage, databases, software, and other resources, which are accessed and managed remotely by users through a web browser or mobile app. Cloud computing allows individuals and organizations to access computing resources without having to invest in expensive hardware and infrastructure.

2. Service Excellence

Blockchain technology

It has a wide range of potential applications across different industries. Here are some examples:

Cryptocurrency: The most well-known application of blockchain technology is in the creation of decentralized digital currencies, such as Bitcoin and Ethereum.

Supply Chain Management: Blockchain can help track the movement of goods through a supply chain, from production to delivery, providing transparency, security, and efficiency.

Identity Verification: Blockchain can provide a secure and tamper-proof way to verify identities and protect personal information.

Voting Systems: Blockchain technology can be used to create secure and transparent voting systems, ensuring the integrity of elections.

Smart Contracts: Blockchain can be used to create smart contracts, which are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code.

Real Estate: Blockchain technology can be used to streamline real estate transactions by providing a transparent and secure platform for the transfer of ownership.

Healthcare: Blockchain technology can be used to securely store and share medical records, reducing the risk of data breaches and improving patient care.

Gaming: Blockchain technology can be used in gaming to create secure and transparent platforms for digital assets and transactions.

Cloud Computing
It offers a number of benefits, including:

Scalability: Cloud computing allows users to easily scale up or down their computing resources based on their needs, without having to make large capital investments.

Cost-effectiveness: Cloud computing can be more cost-effective than on-premise computing, as users only pay for the resources they use.

Reliability: Cloud computing providers typically offer high levels of reliability and availability, with minimal downtime and data loss.

Security: Cloud computing providers typically have robust security measures in place to protect their users' data.

There are three main types of cloud computing services:
Infrastructure as a Service (IaaS): Provides users with access to computing infrastructure, such as servers, storage, and networking, which they can use to build their own applications.
Platform as a Service (PaaS): Provides users with a platform for developing, running, and managing their own applications, without having to worry about the underlying infrastructure.
Software as a Service (SaaS): Provides users with access to pre-built software applications that they can use over the internet, without having to install or maintain the software themselves.

3. Key Elements of Block Chain

Distributed ledger technology:

Distributed ledger technology (DLT) is a type of database distributed across a network of computer, the network has a copy of the ledger if any changes made in ledger it will automatically replicated to all other copies of the block. DLT is used for secure and transparent record transactions the main advantages of distributed ledger are decentralization it will protect from attacks and used to enhance the security and prevent unauthorized access to the ledger, DLT also provide faster and more efficient transactions it provides a transparent and auditable record of all transactions

Immutable records:

Records or data cannot be modified once the records have been created and added to a database or ledger, ensuring the integrity and accuracy of the information and immutable records are a key features of blockchain that is used for secure transactions , each block contains a set of transactions and once a block is added to the chain, it cannot be altered or deleted without affecting the integrity of the entire blockchain, immutable records offer several advantages security, transparency, accuracy, compliance.

Smart Contracts

To speed transactions, a set of rules called a smart contract is stored on the blockchain and executed automatically. A smart contract can define conditions for corporate bond transfers, include terms for travel insurance to be paid and much more.

4. Blockchain Architecture

Components of a blockchain architecture
Node: A node in a blockchain network is a computer or device that is connected to the network and participates in the validation and verification of transactions. Each node in the network has a copy of the blockchain ledger, which contains a record of all transactions that have been verified and added to the blockchain.

Transaction: A data record verified by blockchain participants that serves as an almost immutable confirmation of the authenticity of a financial transaction or contract

Block: A sealed data compartment that contains: 1) a native hash code that identifies the block, 2) the hash code from the previous block in the sequence of blocks, and 3) a set of time stamped transactions

Chain: The chain serves as a tamper-evident and auditable record of all transactions on the blockchain network. Once a block is added to the chain, it cannot be modified or deleted without affecting the integrity of the entire blockchain. This ensures that the records on the blockchain are secure, transparent, and tamper-proof.

Miners: Nodes that validates blocks before adding them to the blockchain structure

Types of blockchain Architectures

Public blockchain architecture

It operates on the basis of proof of work consensus algorithms and uses appropriate protocols. A public blockchain don't need any permission as its open source. It allows for transparent yet anonymous or pseudonymous transaction. Eg: Litecoin, Bitcoin, Ethereum

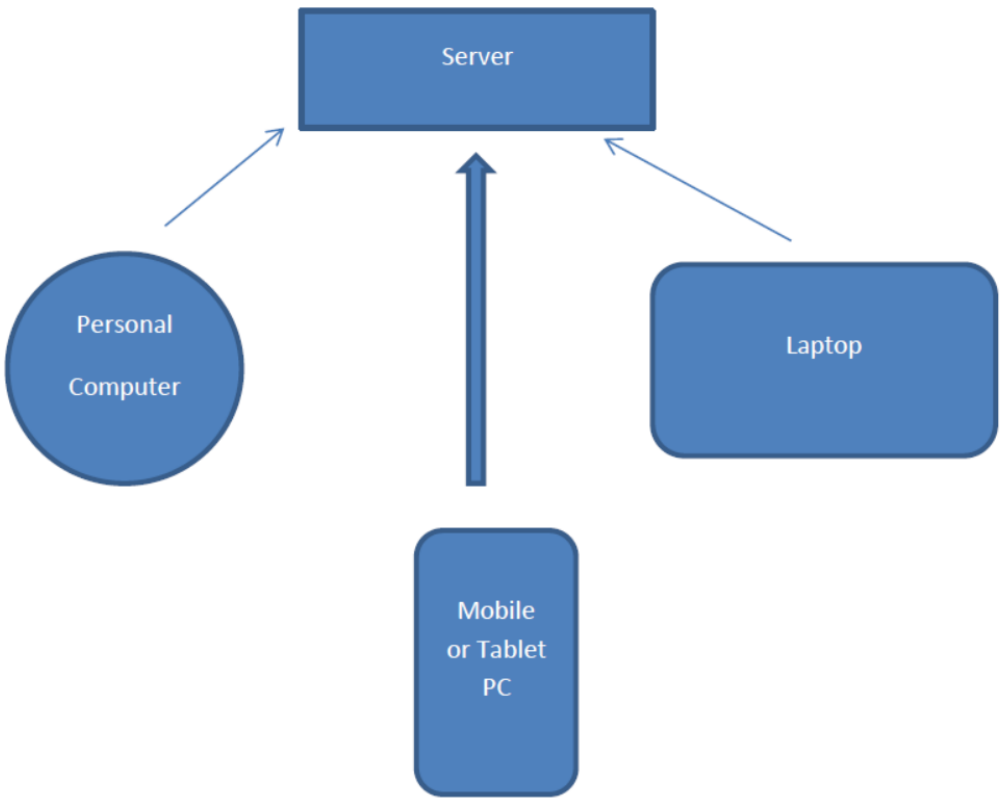
Private blockchain architecture:

It allows restricted participants to access the information aims to increase the benefit or efficiency. Their reliability is ensured by the common goals of the participants and proof of stake private blockchain architecture decouples the main blockchain protocol from the smart contract layer

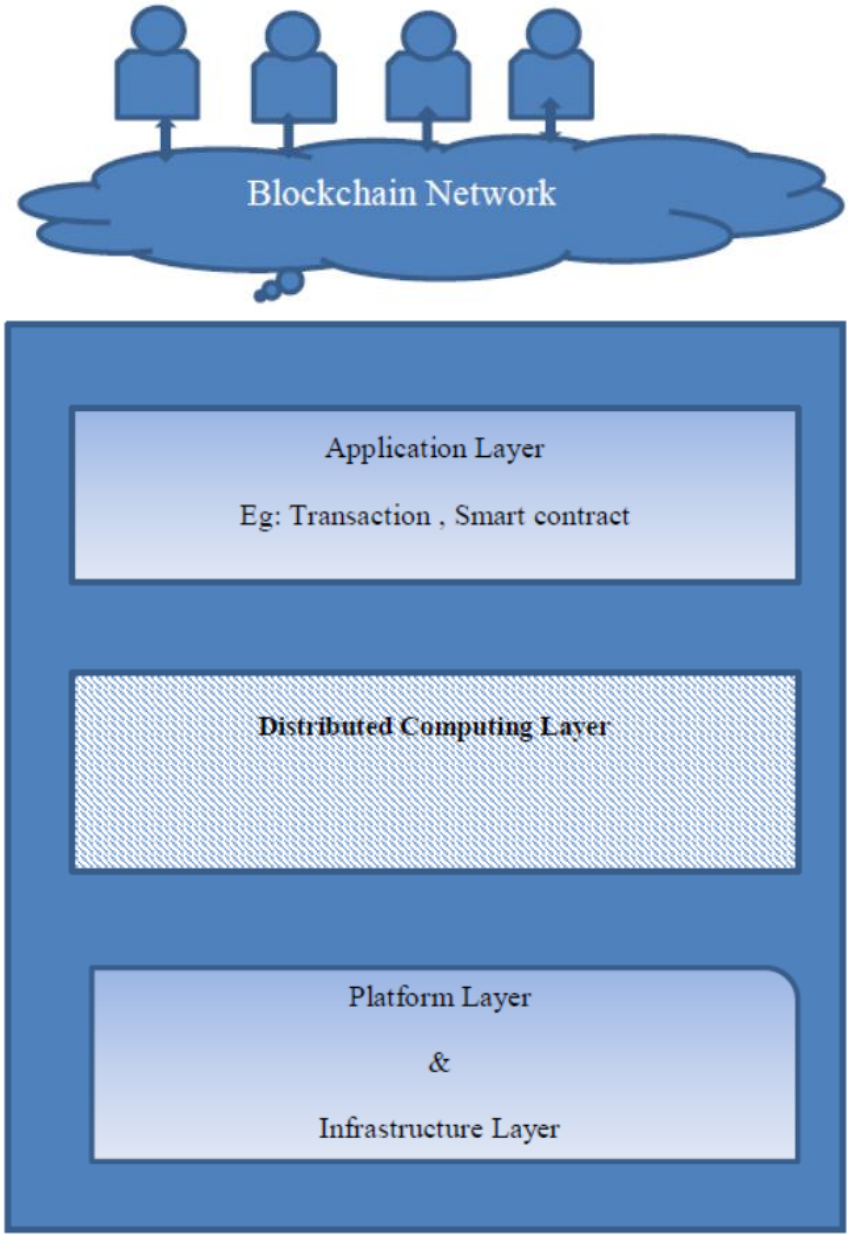
Consortium blockchain architecture:

A consortium blockchain is a type of private blockchain that is shared and governed by a group of organizations, rather than being controlled by a single entity. In a consortium blockchain, the participating organizations work together to validate and verify transactions, and have a shared interest in the success of the network. Unlike public blockchains like Bitcoin, where anyone can join and participate in the network, consortium blockchains are typically restricted to a specific group of organizations that have been granted permission to join the network. This allows for greater control and privacy, as well as faster transaction processing times.

Client –Server Architecture



Structure of Blockchain



5. Cloud Architecture

Cloud architecture refers to the design and structure of cloud computing systems, including the hardware and software components, network infrastructure, security protocols, and management tools that enable cloud-based services and applications.

Cloud architecture typically includes several layers, each with specific functions and capabilities. These layers may include:

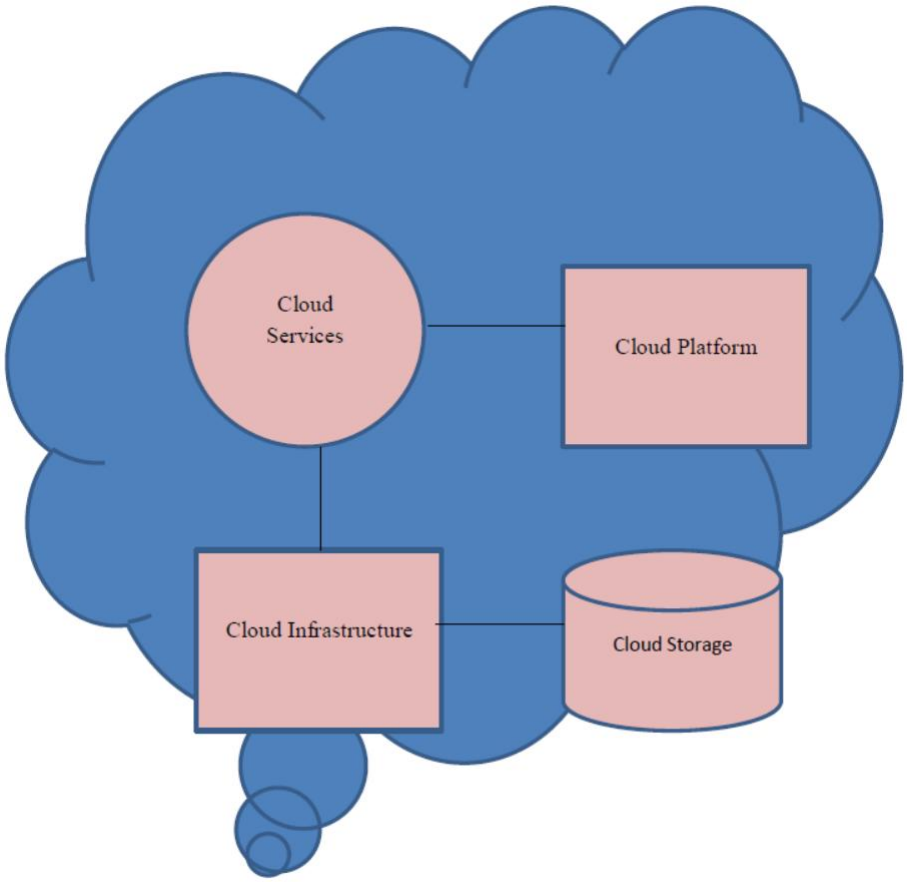
Infrastructure layer: This layer includes the physical hardware and software components that make up the cloud environment, including servers and networking equipment.

Platform layer: This layer provides the tools and services that developers use to build and deploy applications on the cloud infrastructure, such as operating systems, databases, and development frameworks.

Application layer: This layer includes the actual applications and services that run on the cloud platform, such as web applications, mobile apps, and analytics tools.

Security layer: This layer includes the security measures and protocols that protect the cloud infrastructure, platform, and applications from cyber threats and attacks.

Management layer: This layer includes the tools and services that enable administrators to monitor and manage the cloud environment, such as automation tools, performance monitoring software, and service-level agreements (SLAs).



6. Challenges of Blockchain Technology

Challenges of blockchain technology are predominantly focused as technological aspects such as scalability, flexibility, security, liability and storage . Moreover the lack of legal and regulatory support is identified as the main environmental barrier of adoption and public sector should approach the blockchain technology adoption.

Lack of adoption

Despite the potential benefits of blockchain technology, there has been a relatively slow adoption rate of blockchain across various industries. Some of the reasons for the lack of adoption of blockchain include:

Complexity: Blockchain technology is complex and requires specialized knowledge and skills to implement and manage. This can be a barrier to adoption for organizations that do not have the necessary resources or expertise.

Lack of standardization: There is currently no standardization for blockchain technology, which can make it challenging for organizations to integrate blockchain solutions with existing systems and technologies.

Scalability issues: As mentioned earlier, scalability is a significant issue for blockchain technology. Blockchain networks can become congested, leading to slow transaction processing times

Rising Cost

The rising cost of using blockchain technology is a concern for many organizations. Some of the factors that contribute to the rising cost of blockchain include:

Network congestion: As more users join the blockchain network, the number of transactions increases, leading to network congestion. This can slow down transaction processing times and increase transaction fees.

Energy consumption: The energy consumption required to power blockchain networks can be significant, leading to higher operating costs.

Storage costs: As the amount of data stored on the blockchain grows, so do the storage costs. This can be a significant expense for organizations that need to store large amounts of data.

Mining costs: Mining is the process by which new blocks are added to the blockchain. As the difficulty of mining increases, so do the costs associated with mining, including hardware and energy costs.

Scalability

Scalability is one of the main challenges facing blockchain technology. Blockchain networks can become congested when there are too many transactions being processed at the same time, leading to slow transaction processing times and increased transaction fees.

Security and Privacy Challenges

Privacy is a significant concern for blockchain technology, as the transparency and immutability of the blockchain make it difficult to keep sensitive information confidential. Some of the privacy challenges in blockchain include:

Pseudonymity: Blockchain transactions are recorded using public keys, which can be linked to specific individuals or organizations. While this provides a degree of privacy, it also makes it possible to trace transactions back to their originators.

Traceability: The immutability of the blockchain means that once a transaction is recorded, it cannot be deleted or altered. This can create challenges for privacy, as sensitive information may be permanently stored on the blockchain.

Smart contracts: Smart contracts are self-executing contracts that are programmed onto the blockchain. While they can be used to automate complex transactions and improve efficiency, they can also make it difficult to keep sensitive information confidential.

Criminal Activities

The absence of stringent legislation and the fact that blockchain is still a developing technology have fueled the rise of fraudulent projects and other bad actors seeking to profit from inexperienced investors. There have also been several high-profile cryptocurrency exchange thefts, in 2014, nearly destroying the entire cryptocurrency industry.

51% attacks

A 51% attack is considered to be a significant security risk for blockchain networks, as it can undermine the trust and immutability of the blockchain. The attack can also result in financial losses for those using the blockchain, as funds can be stolen or transactions can be invalidated.

Private Key issues

The private key is a crucial component of blockchain technology, as it is used to access and manage a user's digital assets on the blockchain. Issues related to private keys can have serious consequences for users, including the loss of their assets. Here are some of the private key issues that can arise in blockchain. If a user loses their private key, they will be unable to access their digital assets on the blockchain. This can result in the loss of funds or other digital assets.

7. Consensus Algorithms

Consensus algorithm is a key component of blockchain technology that allows multiple parties to agree on the validity of transactions and update the blockchain ledger in a decentralized manner. The consensus algorithm is responsible for maintaining the integrity and security of the blockchain network.

There are several consensus algorithms used in blockchain technology, including:

Proof of Work (PoW): This consensus algorithm requires network participants, known as miners, to solve complex mathematical problems in order to validate transactions and add blocks to the blockchain. The miner who solves the problem first is rewarded with cryptocurrency. PoW is used by Bitcoin and several other cryptocurrencies.

Proof of Stake (PoS): In this consensus algorithm, network participants (also called validators) are chosen to validate transactions based on the amount of cryptocurrency they hold. Validators are required to stake a certain amount of cryptocurrency to participate in the network, and they receive rewards based on the amount they stake. PoS is used by several cryptocurrencies, including Ethereum.

Delegated Proof of Stake (DPoS): This is a variant of PoS where network participants elect a small number of delegates to validate transactions on their behalf. Delegates are responsible for validating transactions, and they are incentivized by the network to behave honestly. DPoS is used by EOS and other blockchains.

Byzantine Fault Tolerance (BFT): This consensus algorithm is designed to tolerate Byzantine failures, which occur when nodes in the network fail or act maliciously. BFT is often used in private and permissioned blockchains, where the number of nodes in the network is relatively small.

8. Advantages of Cloud Computing in Blockchain Technology

Cloud computing can help blockchain technology in several ways, including:

Scalability: Cloud computing provides a scalable infrastructure that can help blockchain networks handle an increasing number of transactions and users. By using cloud resources, blockchain networks can dynamically scale up or down their computing power and storage, which can help them address the scalability issues that often arise with blockchain technology.

Security: Cloud computing can provide secure infrastructure and storage for blockchain networks. Cloud service providers often have strong security measures in place, including encryption, firewalls, and access controls, which can help protect the blockchain from attacks and other security threats.

Cost-efficiency: By using cloud computing, blockchain networks can reduce their infrastructure and operational costs. Cloud service providers offer pay-as-you-go models, which can help blockchain networks save money by only paying for the resources they need.

Interoperability: Cloud computing can help blockchain networks integrate with other technologies and systems, including legacy systems and emerging technologies. This can help blockchain networks overcome some of the interoperability challenges that they may face when trying to integrate with other systems.

Development: Cloud computing can provide a flexible and scalable environment for developing and testing blockchain applications. Developers can use cloud resources to quickly spin up and down development environments, which can help them iterate faster and develop more efficiently.

9. Conclusion

Blockchain is a transformational technology, which provides a basis to develop distributed and secure applications for all industry The purpose of this paper will provide understanding of early stage scholars, practitioners to gain a issues related to the blockchain technologies and it can be resolved by cloud computing support, Cloud computing provides more flexibility, efficiency, scalability, More storage, less expense for improving adoption by blockchain technology and it serve to various application as health care services, research, education, banking and other services . Discussed the consensus algorithm used in blockchain and Some possible future directions are also proposed. Nowadays blockchain based applications are springing up and we plan to conduct in-depth investigations on blockchain-based applications in the future

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