International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 09 | Sept - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

BLOCKCHAIN TECHNOLOGY

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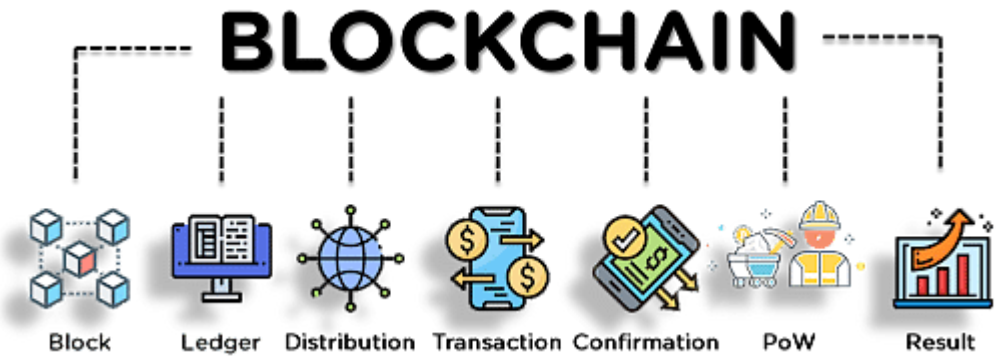
Abstract
Blockchain is the technology behind the safe, shared digital record system. First used for Bitcoin, it now has many more applications. The blockchain links together blocks of transactions; thus, the name - this system is decentralized because no single person or organization in control exists. If data is added, it cannot be changed, and everything involved can see and therefore verify the transactions.

Introduction to Blockchain

This is technology that's revolutionizing the way data is stored, shared, and verified in digital systems. At its core, blockchain is a decentralized distributed ledger system recording transactions across computers-it provides for the absence of central control on data management as opposed to regular databases, giving it to participants who form the network, thereby giving greater transparency, security, and trust. Blockchain, at its very heart, is a distributed ledger that is used to record transactions across several computers.

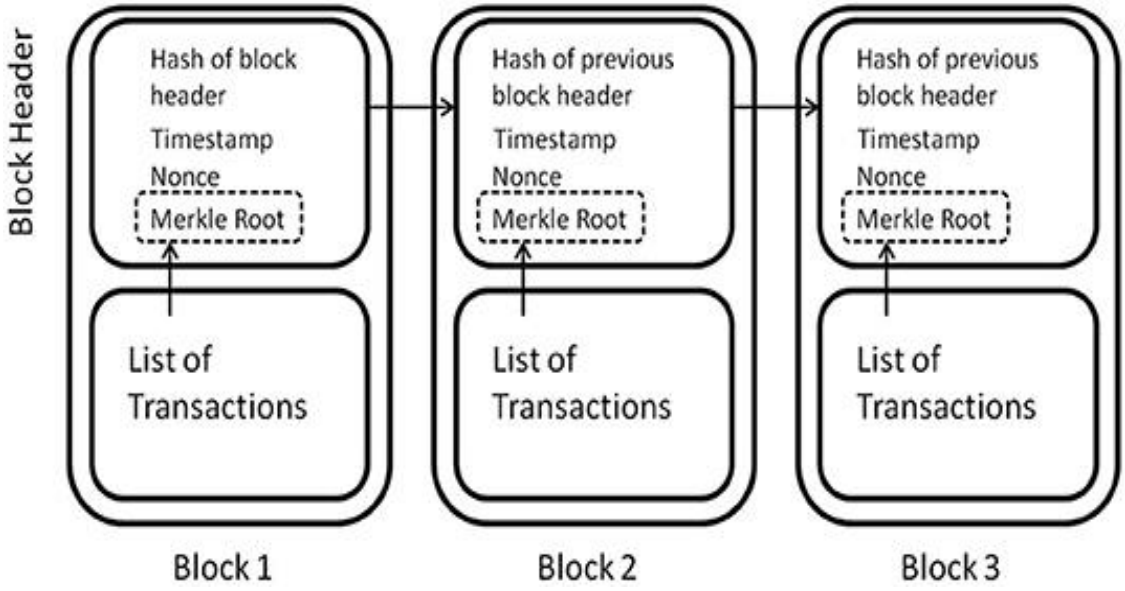


Objectives

A blockchain essentially provides safe, transparent, and decentralized means by which data or assets can be stored and transferred. Such major objectives include:

- **Decentralization:** Eliminate intermediaries or central authorities by allowing direct peer-to-peer transactions.
- **Security:** the methods are cryptographical result, therefore, adding data integrity and security making fraudster tamper proof.

- **Openness:** Allow each member of the network viewability over transactions and thus become an avenue for trust and accountability.
- **Immutability:** Once placed, data cannot be rewritten or erased, so transaction record is not changeable.
- **Efficiency:** Time and cost reduced as compared to the traditional systems of verification and settlement by streamlining. Trust and Reliability: Create an environment whereby participants may know each other, by allowing a shared, verifiable ledger system to build trust among participants.



History

- **The 1970s-1990s:** Huge leaps in public-key cryptography enabled the secure communication of digital information. Digital Cash, as one of the first types of digital currency, has been introduced in early 90s by David Chaum with Digi Cash.
- **In the late 90s:** There was b-money by Wei Dai and then bit gold by Nick Szabo, both were concepts to create decentralized digital cash system.
- **2009:** Birth of Bitcoin and the "genesis block" The first-ever dedicated Bitcoin block, called the "genesis block," is mined that effectively marks the start of Bitcoin.
- **2010-2015:** Rise of Bitcoin, the appearance of notable transactions, and commencing of other alts including Litecoin.
- **2017:** Bitcoin rose in price and attracted a lot of interest to the entire cryptosystem, as well as an ICO boom (a way for startups to accumulate money by selling tokens).
- **2020-** The emergence of DeFi and non- fungible tokens (NFTs) puts blockchain at the forefront of technological innovation.

Structure of block chain:

There are several core aspects of the blockchain that make this very specific technology secure as well as decentralized:

Blocks: Each block contains information, for example, about transactions.

It comprises three components:

Data: All information regarding the transactions themselves, including sender, receiver, amount.

Hash: A particular unique code that represents a block.

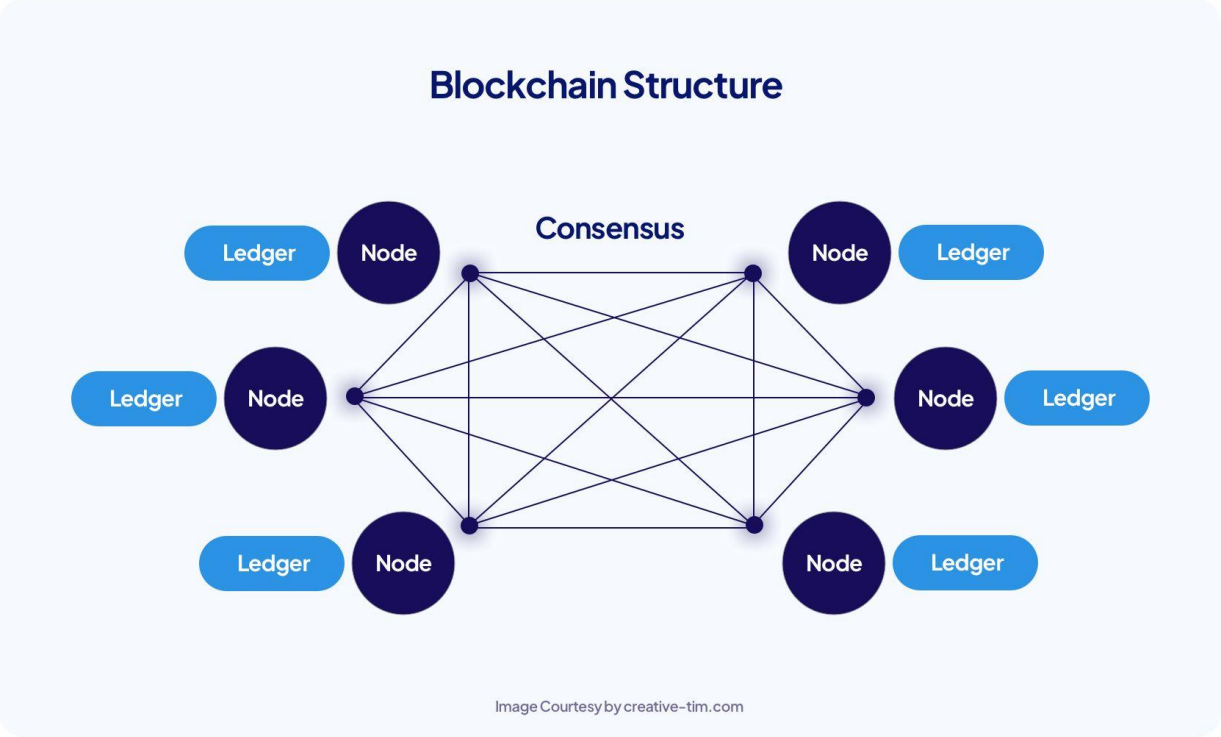
Preceding Hash: The hash of the previous block; thus, blocks make a chain in this case.

Node: These are computers on the network, carrying a full copy of a blockchain. Nodes successfully communicate with each other to validate and append new transactions.

The network agrees upon a set of valid transactions which would ensure the transactions.

The two major common methods used are:

- **Proof of Work POW):** Computers "solve" complex problems to add new blocks.
- **Proof of Stake (PoS):** Network randomly chooses a person based on the currency amount owned to add a block.
- **Smart Contract:** These are programs that automatically do things once certain conditions have been met-for instance, sending money upon completion of a job.
- **Cryptography**: Blockchain uses specific codes to ensure the safety of data. It comprises:
- **Public Keys:** Provided to others such that they can send you transactions.
- **Private Keys:** Kept secret to approve transactions. Decentralized Ledger that makes the blockchain distributed across all the nodes in the network, so no one is in control. A node contains the same thing as every other node.
- **Mining/Validation:** Validating miners called these add blocks by the verification of transactions. In return, they get cryptocurrency and other rewards for doing that work.



Types of Blockchain

Blockchain technology is broadly classified into different types depending on the architecture, courtesy permissions or use case.

Here are the main types:

1. Public Blockchain: Anyone can join the network, validate transactions and read/write data.

Examples: Bitcoin, Ethereum.

Features: Decentralized, ultra-secure, and transparent, Metadata.

2. Private Blockchain: Controlled access as to who can take part in the network.

Examples: Hyper ledger, Corda.

3. Consortium Blockchain: Controlled not by one organization as public blockchains and not just private paper, a blockchain that has features of both public blockchains and permissioned-only chains.

Examples: R3, Energy Web Foundation

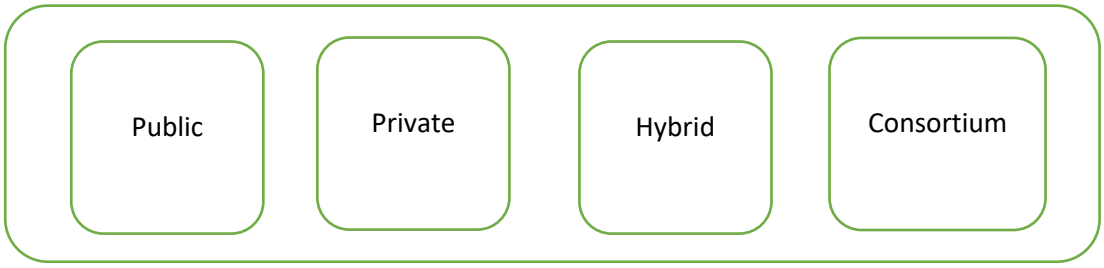
Features: Shared control, faster than public blockchains, more suited for joint projects.

4. Hybrid Blockchain: A mix between public and private blockchains, where the public section is available for anyone to participate openly, while a controlled portion of it is closed from outsiders.

Examples: Dragon chain.

Attributes: Adaptable — an arkXML-based standard that can be tailored by organizations to determine the type of data to make private/public.

Types of Block Chain



Adoption Challenges

1. **Scalability**
   Issue: Some of the existing blockchain systems are slow and do not perform many transactions at the same time or in a given time frame; hence this means that many such transactions are difficult to perform at once.
   Impact: Such sluggish networks can result in high expenses and annoyance of the users.
2. **Integration**
   Issue: There still exist traditional systems differing from these systems which even today do not support blockchain technology in enterprises.
   Impact: The implementation of this technology may, however, be the reason for a long wait and huge amounts of expenditure.

3. **Regulatory Issues**
   Issue: Has explanation of any of the reasons preventing the growth of the business especially ambiguous clients regulations.
   Impact: Regulatory concerns and fear of rapid changes in such rules may serve as a roadblock to the development of solutions that leverage the blockchain technology.
4. **Security Issues**
   Issue: There is improved security using blockchain technology however there are smart contract vulnerabilities and some other scalar units which have weaknesses.
   Impact: Users may be deterred by the likelihood of hacks and frauds occurring.
5. **Lack of Awareness and Understanding**
   Issue: Most people in today's supply chain do not know what is the blockchain's technology and where this technology can be used.
   Impact: Information not accessed by both investors and those who are looking for innovation might be the reason for this drawback.

Future Trends and Opportunities

1. Enhancement of Operability

Trend: Ensures the creation of the possibility of linkage between different blockchains.

Opportunity: Improved synergies and sophisticated decentralized applications.

2. Rise of Decentralized Finance (DeFi)

Trend: Development of finance to a wider market without reliance on intermediaries.

Opportunity: New types of financial services as well as new sources of funding.

3. Boom of Non-Fungible Tokens (NFTs)

Trend: People's appetite for NFTs will not go away and will, in fact, persist in different areas.

Opportunity: New forms of income can be generated from digital copyrighted works.

4.Enterprise Adoption of Blockchain Technology

Trend: More businesses implementing blockchain technology for supply chain and identity management.

Opportunity: More efficient processes and enhanced accountability.

5. Convergence with Other Emerging Technologies

Trend: Integration of blockchain with artificial intelligence, internet of things and big data.

Opportunity: More advanced applications and increased information security.

6. Green Initiatives

Trend: Emphasis on effective energy consumption in blockchain technology.

Opportunity: Gaining the trust of eco-friendly customers.

7. Regulatory Framework

Trend: Better regulations are forthcoming.

Opportunity: More funds and creativity in the industry.

8. Asset Tokenization

Trend: The ownership of both physical and virtual assets in shares.

Opportunity: Accessibility to expensive investments has been made possible.

Conclusion:

Blockchain is revolutionizing how we deal with data; both in terms of security and privacy as well as transparency and decentralization. It has a very great potential in improving the current business processes; from reducing fraud (but not entirely eliminating it) to making more efficient supply chains, finance or healthcare.

Yet, blockchain has its challenges– blockchain is slow, consumes immense amounts of energy, and faces regulation. Yet, continual advancements signal that the future of blockchain is bright.

In other words, the blockchain is a new technology and is still under progress but has enormous potential to enhance digital security and transparency.

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