



REVIEW PAPER ON BLOCKCHAIN TECHNOLOGY IN 5G AND 6G

Mr. Chandrashekhar Vasant Dawal, Student,

Dr. Shiv Kumar Goel Associate Professor/ H.O.D, Mentor,

Department of M.C.A. ,

Vivekanand Education Society's Institute of Technology College, Mumbai-400074,

Abstract:

This research paper gives a brief idea about Blockchain technology and Blockchain technology in 5G and 6G. Blockchain, Blockchain technology, 5G and 6G all four are different technologies and when these four are used together it can create the innovative solutions and growth to industries.

Blockchain offers robust security measures by establishing tamper-proof communication channels and enabling secure identity management. By leveraging blockchain's decentralized architecture, 5G networks can mitigate vulnerabilities and enhance data privacy. Decentralized decision-making and resource allocation facilitated by blockchain can lead to more efficient network management and improved performance.

As we look forward to 6G, the integration of blockchain technology becomes even more critical. Blockchain provides a decentralized platform for managing the massive connectivity and complex infrastructure requirements of 6G networks. It enables secure interoperability, transparent multi-party interactions, and ensures data integrity in a scalable and distributed manner.

Both 5G and 6G networks can benefit from enhanced security, privacy, scalability, and trust.

Keywords : Blockchain, 5G, 6G, Bitcoin, Crypto, Ethereum, Smart Contracts, Solana, Polkadots, AI, IoT, Security

Objective of the study:

The objective of this study was research on what exactly the Blockchain technology is and how 5G and 6G technology playing role in Blockchain technology. And the main objective was giving a brief idea about the topic which will be

useful for those who all are unaware about this topic. So this research paper will help the people who are unaware about the Blockchain technology.

Need of the research:

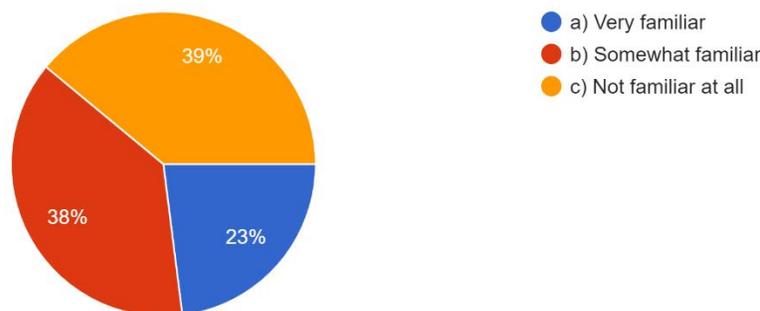
A small survey for the knowledge to know that how many are aware of this Blockchain technology. As the Blockchain technology is increasing now-a-days but with the help of data collected from the responses it was found that too many people are unaware of Blockchain, Cryptocurrencies, Bitcoin, Ethereum etc and also very few people are familiar with Blockchain technology, which means the main barrier preventing from the adoption of Blockchain technology is limited awareness and understanding.

Responses: 100 responses was received and by analysing the responses.

- 23% people were only familiar with Blockchain and rest 38% are somewhat familiar and remaining don't know anything about Blockchain.
- 53% don't know about they ever interacted with Blockchain based application.
- 52% people selected Increased security and data integrity as the benefits of Blockchain technology.
- 45% people voted for limited awareness and understanding as the barriers for preventing the adaption of Blockchain.
- Approximate 28% people are familiar with Cryptocurrencies.

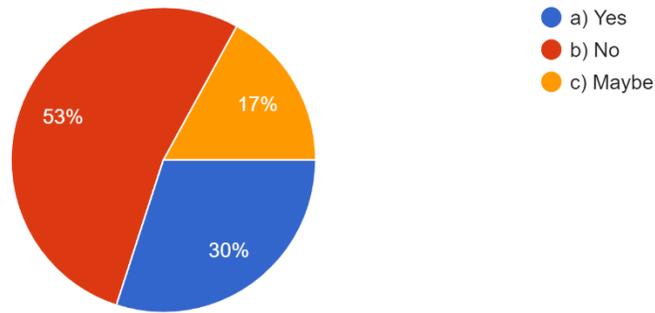
1. How familiar are you with blockchain technology?

100 responses



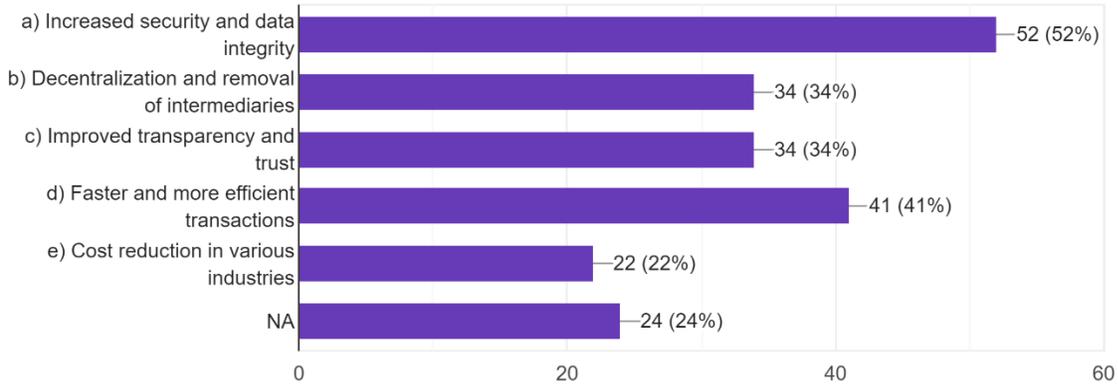
2. Have You ever used or interacted with a blockchain-based application or platform?

100 responses



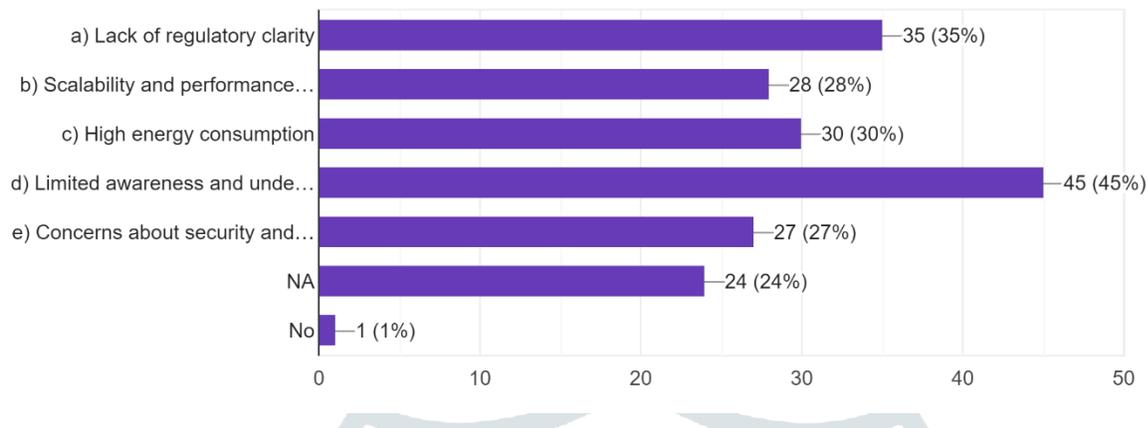
3. What do you think what can be the benefits of blockchain technology (Select all that apply).

100 responses



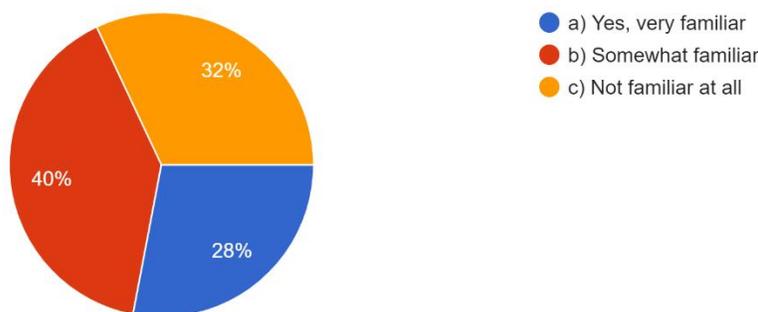
4. What can be the main barriers preventing from the adoption of blockchain technology (Select all that apply).

100 responses



5. Are you familiar with cryptocurrencies (e.g., Bitcoin, Ethereum)?

100 responses



Introduction:

A blockchain is essentially a chain of blocks, where each block contains a list of transactions or other data. The blocks are linked together using cryptographic hashes, which ensures the integrity and immutability of the data. Once a block is added to the chain, it becomes very difficult to modify or tamper with the information stored within it.

Blockchain technology operates on the principles of transparency, immutability, and security. It enables the creation of a chain of blocks, where each block contains a list of transactions or records. These blocks are linked together using cryptographic hashes, creating a tamper-resistant and auditable history of all transactions.

5G is the current generation of wireless technology that succeeds 4G/LTE. It provides significant improvements in terms of speed, capacity, latency, and connectivity compared to its predecessor.

6G is the next generation of wireless technology that is currently in the research and development phase. While it is still in its early stages, 6G is expected to build upon the advancements of 5G and introduce even more transformative features.

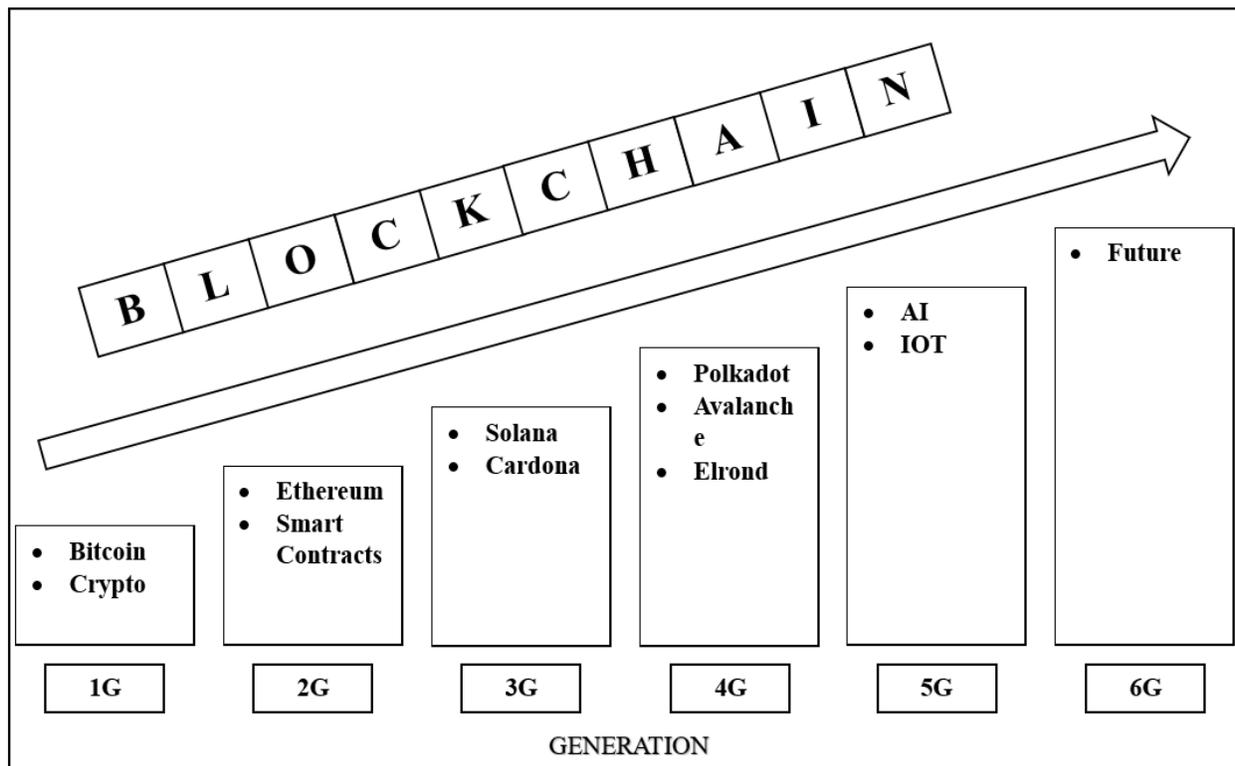
Uses: Blockchain is not only used for financial transactions but also its secure and transparent nature of technology can be used beyond one area of expertise. The industries covering energy, logistics, education and many more are utilizing the benefits of Blockchain every day.

Blockchain had increased from 1G to 5G and now 6G is on development stage, it is because of the changing of how we store data. The Blockchain technology made an actual game changer by introducing new possibilities and applications now and then technology gain its own share and scams.

Here we go with the generations of the Blockchain:

1. Blockchain in 1G was the first generation of the Blockchain and it was started with the creation of Bitcoin (BTC) and Cryptocurrencies (digital currencies) in 2009. It was written in C++ and used to employ the PoW (Proof-of-Work) consensus model. Developer later realised that the technology holds an immense potential beyond Cryptocurrencies and this became the reason for adapting second generation.
2. Blockchain in 2G was introduced in the year 2010, Ethereum and Smart Contracts came and it was self-executing programs that run on Blockchain and expands the concept of Blockchain. The concept of Smart Contracts are for automated transactions that are stored on a Blockchain and code written executes the term of the agreements or contract from outside the chain.
3. Blockchain in 3G include Proof-of-Stake Blockchains with more advanced throughput and faster time to finality. Solana and Cardano are prime examples of this Blockchain type. DLT (Decentralized Ledger Technology), IOTA and COTI are introduced in this generation and from this it changed the mind about how it will change the world.
4. Blockchain in 4G in this the typical examples are Polkadot, Avalanche, and Elrond. In 4th generation it is a solution for industrial revolution which focuses on automation, Integration of execution framework, enterprise resource planning and security insurance.

These were the evolution of Blockchain from generation 1 to generation 4 now going to 5G Blockchain.



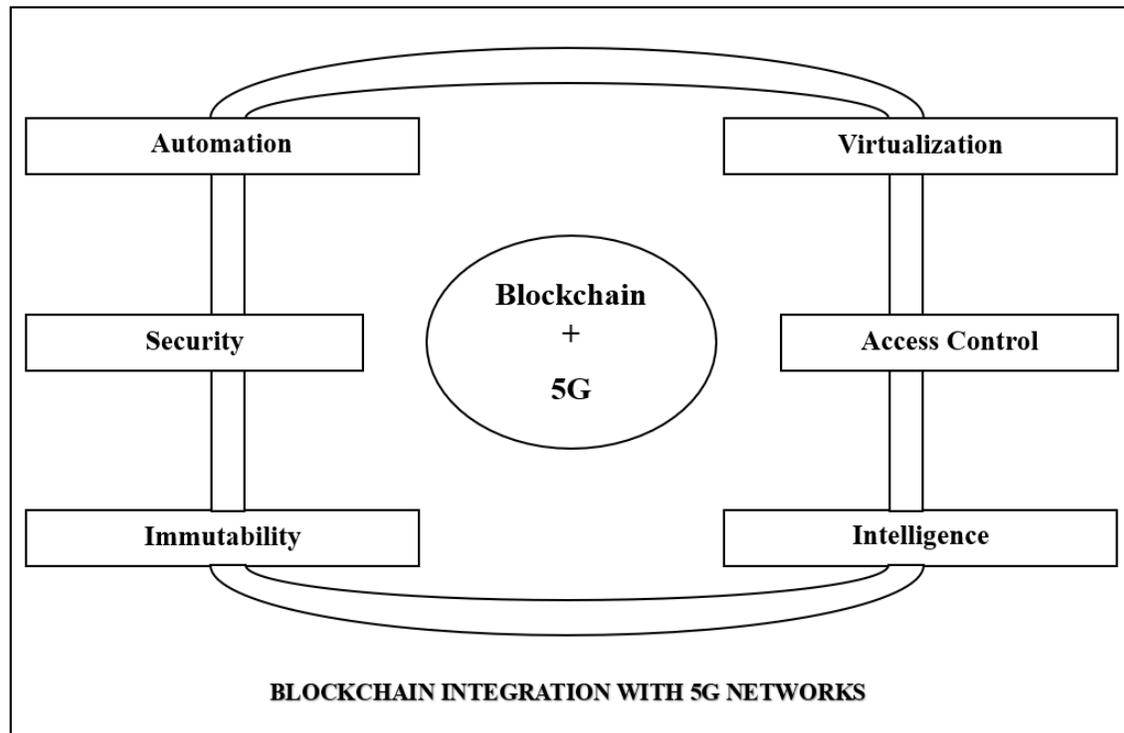
Blockchain Technology for 5G

5G networks are built for device-to-device communication that impacts all digital technologies in the world of Blockchain, crypto, and decentralized finance (DeFi). To equal measure, these new markets help shape the characteristics of future networks by influencing market demands and customer expectations. 5G had potential to completely change the business and communication with an unparalleled increase in speed and strength of internet connectivity, with that the impact of 5G technology on Blockchain the combination is a game-changer for the world. It improved the wireless connectivity, a low-latency exchange of large amounts of data through a variety of cloud-native software, upgrade hardware, IoT devices and mission-critical devices.

Blockchain platform are different but all are built on leveraging a variety of peer-to-peer solutions that emulate 5G networks.

- Permission-less: public network in which both customer & provider data are publicly available, thus risking data privacy
- Permissioned: managed by an administrator with granted access to designated the participants, and managed by a known administrator
- Consortium: a hybrid of permission-less & permission carried out by more than one administrator, emulating the kind of partnerships that exist today between service providers & operators

It holds lots of opportunities for business within and outside of the telco ecosystem. The 5G infrastructure for uRLLC are the examples of mutually beneficial relationships between Blockchain and telco. It is an safeguarding of large amounts of sensitive and complex information.



Characteristics and Benefits:

- Blockchain operates on a decentralized network i.e, there is no failure as it helps in greater reliability and resilience by elimination the reliance on central authority.
- It offers security features through the use of cryptographic algorithms and consensus mechanisms. Provides secure authentication and identity management, preventing unauthorized access
- It reduces the complexity associated with traditional centralized architectures. Also, it enables faster transaction processing, reduces network congestion and allows seamless integration of IoT devices.
- Enabling the automation and execution of predefined agreements these self-executing contracts, facilities, seamless interactions between various parties or devices, enabling new cases and business model in areas like autonomous vehicles, IoT and supply chain management.
- In traditional Blockchain network scalability and performance was challenges but shifted towards 5G it ensures the high transaction volumes and low latency requirements.

Security: In 5G technology Blockchain can be used to enhance the security by a tamper-proof and decentralized way of storing the data. Protects the confidentiality of the initial non-access stratum (NAS) messages between device and the network. For example, In a transportation application Blockchain provides a secure data access system that allows relevant external bus transportation participants in the system to access a passenger's payment collection data.

Role of 6G in Blockchain Technology:

A sixth generation of wireless technology, is still in the early stages of development and it has the potential to play a significant role in the advancement of Blockchain technology. 6G network will enhance the 5G system lag by overcoming the drawbacks/challenges of 5G technology. Following are the ways or challenges in which 6G could impact Blockchain:

- 6G is expected to offer faster data transfer speeds and increased network capacity compared to its predecessors. This could enable Blockchain networks to handle a much larger volume of transactions and data, improving the scalability and performance of decentralized applications (dApps) built on Blockchain platforms.
- It aims to achieve ultra-low latency, potentially reducing it to milliseconds no delays. Reduced latency would enhance real-time interactions on Blockchain networks, enabling faster transaction confirmations, improving the user experience, and supporting high-frequency applications such as IoT (Internet of Things) devices interacting with Blockchain networks
- Blockchain is known for its inherent security features, such as immutability and cryptographic verification. 6G can further enhance the security and privacy aspects of Blockchain by incorporating advanced encryption algorithms, secure key exchange protocols, and decentralized authentication mechanisms. This could strengthen the overall security of Blockchain networks.
- 6G is expected to drive the adoption of edge computing, where data processing and storage occur closer to the edge of the network, reducing latency and improving efficiency. Combining edge computing with Blockchain could enable the creation of distributed ledger technology (DLT) networks at the edge.
- With the increased bandwidth and connectivity offered by 6G, Blockchain networks can seamlessly integrate with other emerging technologies such as AI, IoT, and cloud computing. This integration can enable the exchange of data and value across different platforms and ecosystems, fostering interoperability and unlocking new possibilities for decentralized applications.

It's important to note that 6G is still in a research and development phase, and its full capabilities and impact on Blockchain are yet to be realized. As a technology evolves and standards are established, more specific use cases and benefits of 6G in the context of Blockchain are likely to emerge.

Application and Services Opportunities of Blockchain 6G technology

- Industrial Applications for Beyond Industry 4.0:
Beyond Industry 4.0, the integration of 6G and Blockchain technology opens up numerous industrial applications that can revolutionize various sectors. They are
Supply Chain Management, Manufacturing Process Optimization, Product Lifecycle Management, Intellectual Property Protection and Licensing, Energy Trading and Grid Management, Digital Identity and

Access Management, Data Sharing and Monetization these applications highlight the potential of Beyond Industry 4.0 in leveraging 6G and Blockchain technology to transform industrial operations, enhance efficiency, enable trust, and unlock new business models. As a technology progresses and matures, specific use cases and implementation strategies will emerge to address industry-specific challenges and opportunities.

- **Seamless Environmental Monitoring and Protection**

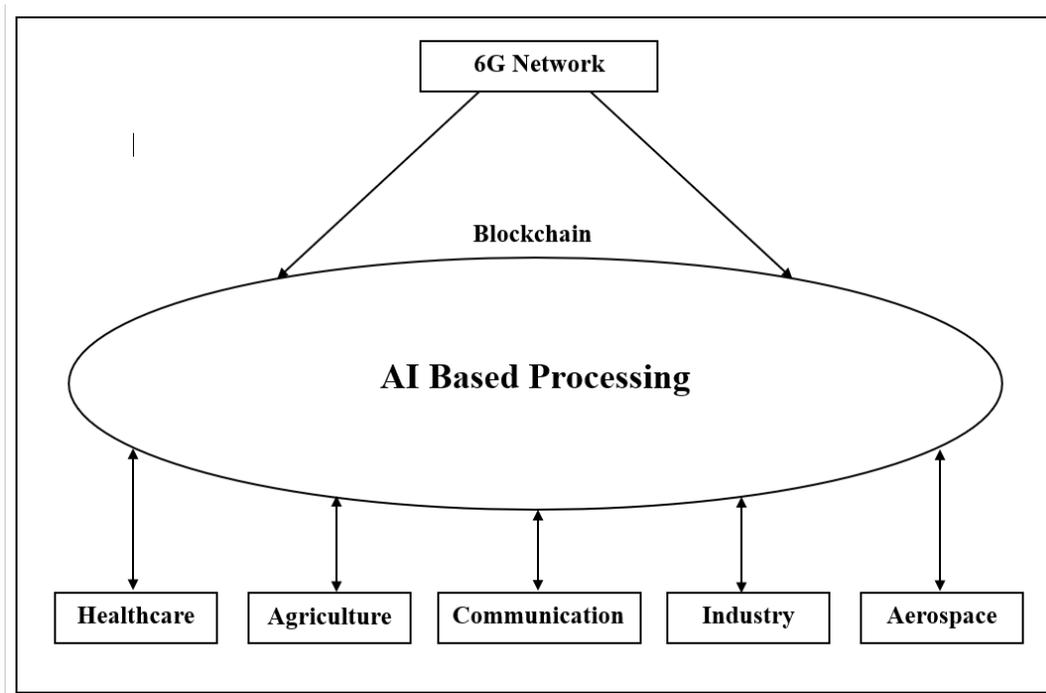
The integration of Blockchain technology with 6G can significantly contribute to seamless environmental and protection. Data Integrity and Transparency, Decentralized Environmental Monitoring, Smart Contracts for Compliance and Incentives, Collaboration among Stakeholders, Carbon Footprint Tracking and Trading, Citizen Engagement and Collaboration, Supply Chain Transparency are some seamless environmental monitoring and protection can be achieved, leading to more efficient and sustainable practices. The combination of these technologies can enable real-time data collection, secure data sharing, transparent compliance verification, and effective collaboration among stakeholders, ultimately contributing to a healthier and more sustainable environment.

- **Smart Healthcare**

Blockchain technology with 6G can have significant implications for the development of smart healthcare solutions. Secure and Immutable Health Records, Patient Consent and Data Privacy, Interoperability and Data Exchange, Clinical Trials and Research, Drug Traceability and Supply Chain Management, Telemedicine and Remote Healthcare, Healthcare Data Analytics and AI however, it's important to consider the challenges associated with implementation, such as scalability, regulatory compliance, and integration with existing healthcare systems, to realize the full potential of Blockchain in 6G-enabled smart healthcare.

- **Decentralized and Trustworthy 6G Communications Infrastructure and Solutions**

The integration can contribute to the development of decentralized and trustworthy communications infrastructure and solutions. Decentralized Network Management, Trust and Security, Peer-to-Peer Communication, Network Slicing and Quality of Service (QoS), Roaming and Billing, Spectrum Management, Incentivization and Tokenization and also it's important to address scalability, interoperability, and regulatory considerations to effectively implement Blockchain in 6G communications infrastructure and solutions.



Comparison between 5G and 6G:

5G technology deliver faster data speed, low latency and high bandwidth and 6G is on development stage and aims to be faster from 5G, low latency and high bandwidth and supporting holographic communication and brain-computer interface with the combination Blockchain technology and 5G/6G can create a powerful solution as Blockchain provide secure platform for large amount of data generated by 5G and 6G networks.

Although there are some differences between the two generations here are some comparison of Blockchain technology in 5G and 6G:

- Blockchain technology can address scalability challenges in 5G networks by providing a decentralized and distributed framework for managing transactions, identities, and data and Blockchain technology in 6G would likely need to overcome the scalability limitations of current Blockchain implementations to support the massive transaction throughput required in highly dynamic and heterogeneous 6G environments
- .In 5G networks, Blockchain technology can enhance security and trust by providing a tamper-resistant and transparent ledger for recording transactions and validating identities. Similarly, in 6G networks, Blockchain technology can play a vital role in establishing trust and enforcing security, ensuring the integrity and confidentiality of data across various layers of the network.
- Privacy and data ownership are important considerations in both 5G and 6G networks. Blockchain technology can empower users to have more control over their data and enhance privacy by enabling secure and direct data sharing between trusted parties without relying on intermediaries. This is relevant in both generations, but in 6G, with more data exchange and integration, privacy concerns become even more critical.

- Network orchestration and management can be improved with Blockchain technology in both 5G and 6G networks. Blockchain can provide a decentralized framework for automating and optimizing network resource allocation, service provisioning, and billing in 5G. Similarly, in 6G, Blockchain technology can enable decentralized decision-making, resource allocation, and service negotiation, allowing for more efficient and flexible network operations.

While there are similarities in how Blockchain technology can be applied in both 5G and 6G networks, it's important to note that 6G networks will likely have more demanding requirements in terms of scalability, security, privacy, and network management. Overcoming scalability limitations and adapting Blockchain technology to the unique characteristics of 6G environments will be a significant challenge.

Conclusion

This research paper will be useful as it explored the potential of the Blockchain technology and Blockchain in 5G and 6G. It is found that the Blockchain technology is playing an incredible role in the technologies and combining Blockchain technology with 5G and 6G can create a powerful solution as Blockchain provides a secure platform for large amount of data generated by 5G and 6G networks. Future research should focus on developing scalable Blockchain solutions, optimizing consensus protocols, and establishing interoperability standards to fully exploit the synergy between Blockchain and the evolving landscape of 5G and 6G.

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