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Augmentation of Blockchain and 5G in Green Computing

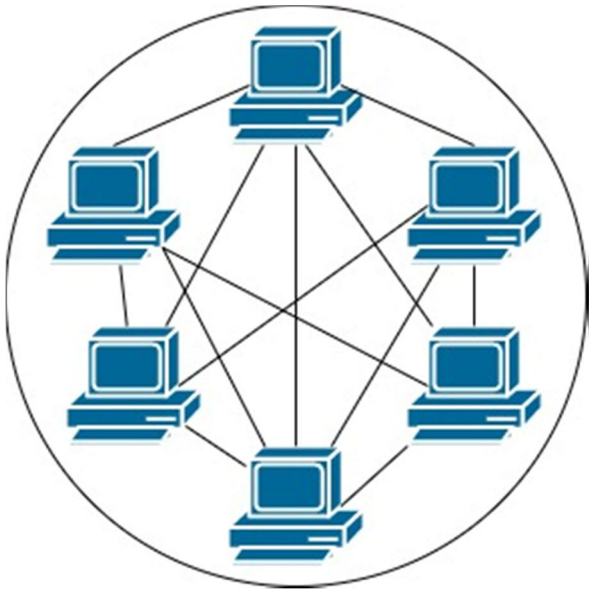
Bhaumik Tyagi[1], Sayyed Ashar Ali[2], Dr. Shree Harsh Attri[3]
[1, 2, 3]*Department of Computer Science & Engineering, Sharda University*

Abstract: ***Green Computing is a step toward environmental sustainability. Green Computing is all about utilizing power to carry out operations in the maximum green manner possible. With rising energy costs & growing environmental concerns, green computing is receiving more & more attention. The Blockchain has emerged as an approving adoption for decentralized, peer-to-peer distributed transparent ledger systems. In recent years, Fifth Generation(5g) Technology is the most latest advancement in an exceedingly wireless communication network. The elasticity of 5G with blockchain enables many applications to become fast, transparent, consequential & safe for transportation of data in this smart era. In this very research paper, we converged the BC and 5G and created a model to integrate it with Green Computing Approaches. We focused on the "Green Use" approach of green computing. We proposed a hypothetical model by converging BC and 5G with GC. We proposed a model which targets the physical hardware services layer of green computing which will directly give eco-friendly solutions to sustainable projects.***
Keywords: Green Computing, Blockchain, BC Sharding, 5G, Network Slicing, P2P

I. INTRODUCTION

Fifth Generation(5G) applications had various necessities in terms of bandwidth, speed, and latency of auto rechargeable gadgets with various factors and energy. A wavelength spectrum with a couple of bands like the high band, mid-band, and low band can construct 5G networks in various ways. The best transmission rate for 5g is nearly 20GB/sec which offers great interconnection with low latency. Autonomous vehicles and many other smart devices are being used in AR with 5g for reliable and rapid communication. To justify this dilemma, BC must be integrated. BC as a decentralized methodology furnished a secure sharing of data, information& resources among 5g areas. 5g requires BC for the tremendous deployment of 5G services.

Transaction data can be easily managed in a Peer-to-Peer network:



BC control green and rapid over unsure networks than 5g. Blockchain isn't best added to conquer the safety troubles however additionally allows for the quicker distribution of actual-time data.

Green Computing is so powerful that it can keep up to 15-200% of energy. Green computing represents various modules of wi-fi communication. GC is a vital characteristic in the context of 5G structures as strength intake from ICT (Information& Communication Technology) elements is anticipated to develop insignificantly via means in 2030. 5g guarantees high-satisfactory of service (QoS) while BC assumes an excessive stage of security & accept as true by many of the peers.

With the help of the Network slicing approach of 5G, we can easily achieve smart vehicles where a user can easily manage the consumption of the network according to his/her needs which will directly lead to cost-effectiveness, and also it would be an eco-friendly approach.

Peer To Peer(P2P) communication peer-to-peer communication refers to the transmission between two peer computers over a network.

Smart Energy has contributed to the introduction of innovative energy initiatives. The Study of 5g applications with green BC identifies multiple issues like power consumption and trust concerns. These strategies can be used to overcome energy issues in different contexts.

With rising energy costs & growing environmental concerns, green computing is receiving more & more attention. Software systems and architectures (in terms of concurrency patterns) play a crucial role in both computing and telecommunication systems and they have been analyzed for performance, reliability, maintainability & security.

Green Computing is a study of designing, manufacturing, using and disposing of computing devices in a way that reduces their hazardous impact on the environment. It is mostly used to promote energy efficiency in different applications. GC helps in using the least amount of computing resources to do the most work. GC reduces the use of hazardous materials, increases energy efficiency during product lifetime, and manages power. Green Computing is all about utilizing energy to perform operations in the most efficient way possible.

Green Computing Eco-Friendly approaches are Green Design, Green Awareness, Green Usage, Green Manufacturing, Green Standards, and Green Disposal.

To fulfill requirements like traffic volume, massive connectivity, high (QoS), and low latency new emerging technologies such as NFV, MEC, and SDN are being deployed. Furthermore,5G networks are expected to connect many heterogeneous devices& machines which will raise several security concerns regarding users' privacy and confidentiality. To work seamlessly & securely in such scenarios, future 5g networks need to deploy smarter& more efficient security functions.

Motivated by the aforementioned issues, Blockchain has been proposed in this paper to overcome issues like immutability and transparency in 5g. We have proposed a 5g and Bc convergence model which will include 5g techniques like Multi-Access Edge Computing, Network slicing, Software-defined network, and network function virtualization. The Security management in 5g networks is complex because it operates in a flexible & dynamic environment where a massive no. of devices are connected.

Blockchain has the capacity to be merged with 5G to provide reliable resource sharing and secure storage. Consequently, BC with its inherent features will provide massive communication in a distributed environment while ensuring high security, data privacy & reliability. Therefore, BC integration with 5g networks will result in self-managing, self-securing &self-maintaining networks without the need for a central authority.5g is expected to provide a connection for a large number of devices with resources and services.

II. BACKGROUND

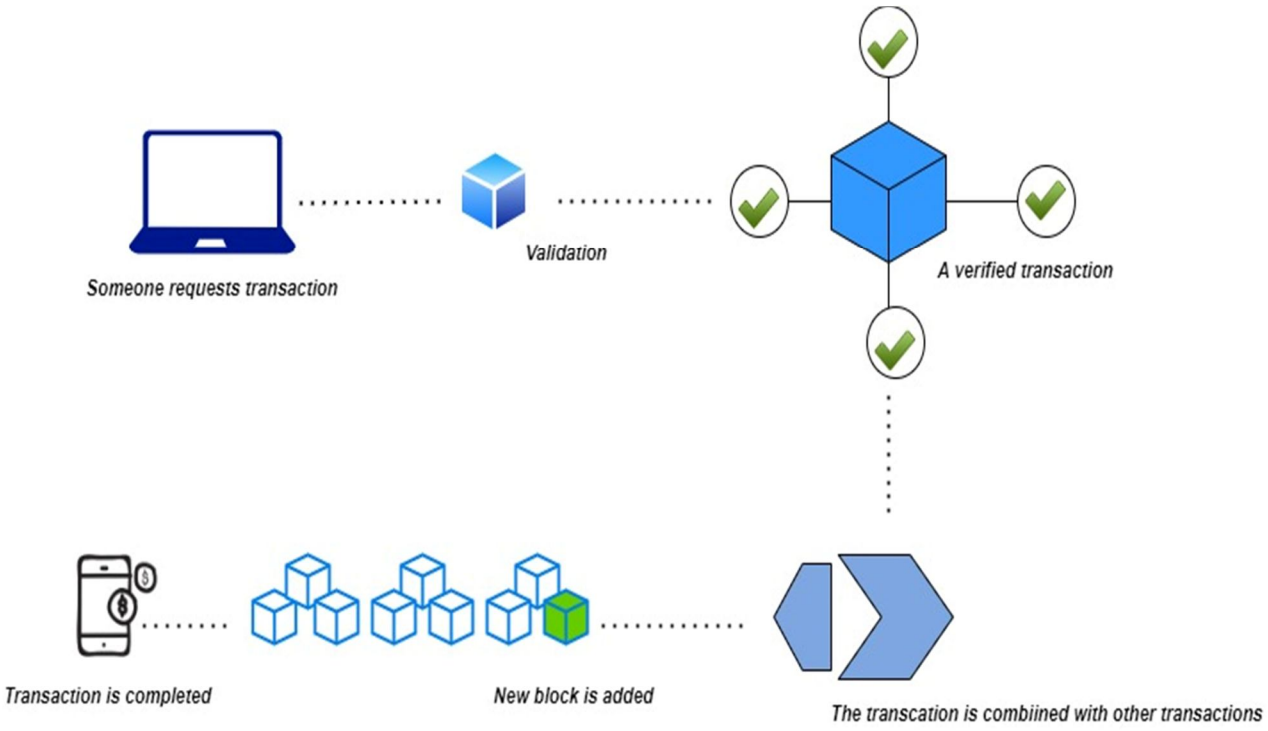
A. Blockchain

Blockchain is a transparent technology that establishes trust among unreliable entities. Blockchain is a distributed ledger that keeps a continuously growing set of data records called blocks. This decentralized technology ensures secure information transmission without the interference of a third centralized party. Each block consists of a group of transactions devoted via way of means of contributors to the blockchain. A transaction could contain technical metadata (i.e., size, timestamp, or transaction id). To update a new block to the chain, all individuals in the chain need to attain an agreement; that is called a consensus. Once a consensus is established among all members, the new block is validated and then added to the chain. Being decentralized, immutable, and having no single point of failure (SPOF) are some of the characteristics of Blockchain. Blockchain can perform in a decentralized environment, each individual of the chain has an integral copy of the ledger, meaning, data is stored in a peer-to-peer environment. Blockchain is designed to be immutable; once a block is added to the chain, any changes inside the block will be extremely difficult. The blockchain includes several technologies like the hash function, the digital signature, and the timestamp. If a malicious user desire to extrude a block, this will cause the hash to change also, meaning he needs to attain a new agreement for this block and other blocks following it. Due to the distributed and shared nature of the blockchain, the ledger can't be managed or manipulated by a centralized entity, meaning, it has no SPOF.

Current blockchain networks can be classified into three types: public, private & consortium blockchain. A public blockchain is permissionless wherein all individuals can the part of a network. It is publicly open for individuals to read, write, and validate a transaction without the approval of third parties. In a private BC, only members can participate in the network, meaning it is centralized.

A blockchain consists of a family of blocks linked together by a hash. The hash does not only depend on the new transaction but on the previous transactions also. To verify a transaction, miners need a digital signature to certify the authenticity and integrity of the transaction. The blockchain uses the Elliptic Curve Digital Signature Algorithm to sign a transaction. Once the blockchain miners approve a transaction, it is written into a block. A block is added to the chain when the consensus is established, and the block has reached a certain number of verified transactions. Each block refers to the previous block and together forms the blockchain.

1) *Blockchain Sharding:* The sharding consists of splitting a large collection across several servers, enabling the distributed management of the collection, thereby improving the scalability. Blockchain sharding refers to the artificial division of the workload of the transaction procession into a single shard, this way one single transaction can be validated and stored by many members working in parallelism.
2) *Blockchain Oracle:* Blockchain cannot access external data of the network. This is where the blockchain oracle intervenes. It is a service provider (trusted third party) that verifies the data authenticity and attests to facts in an effort to bring outside world data into the chain.



User requests a transaction, the requested transaction is broadcast to a p2p network consisting of computers known as nodes. The network of nodes validates the transaction & the user's status using known algorithms. Also, a verified transaction can involve cryptocurrency, records, constructs, or other information (any kind).

Once verified, the transaction is combined with other transactions to create a new block of data for the ledger. The new block is then added to the existing blockchain, in a way that is permanent& unalterable. After all these steps, the transaction is completed. A block contains metadata like timestamp, user id, transaction id, user sign, Markle root, nonce, and previous hash.

B. Ways BC Can Help the Environment

1) *Energy:* Increasing efficiency with P2P electrical grids improves access to power in areas with poverty or natural disasters.
2) *Recycling:* Encourage recycling by providing a tokenized reward. Track & evaluate the efficacy of recycling programs.
3) *Supply Chains:* Transparently track products from origin to store shelf to reduce carbon footprint& unsustainable practices.

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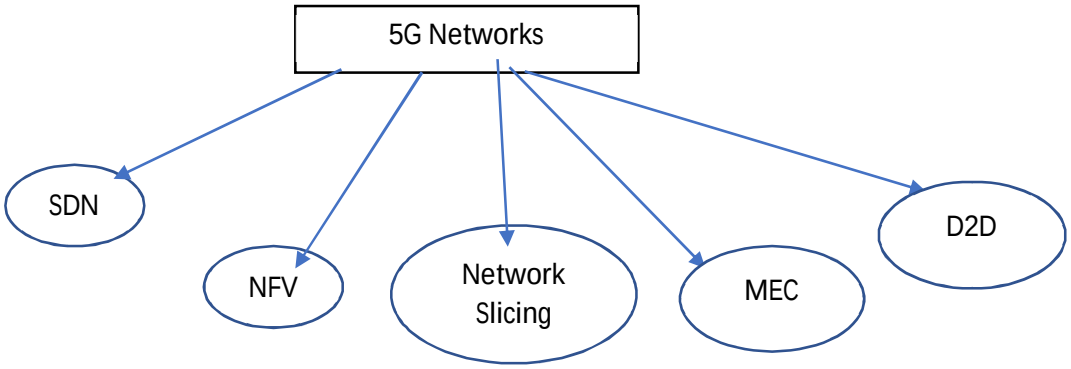
C. 5G (Fifth Generation)

5G Wireless Technology is now the contemporary mobile generation with the intention to significantly grow the velocity of wireless networks among different things. Data speed for wireless connections using 5G, would be approximately 20Gbps.5G will provide more bandwidth & advanced antenna technology which will result in much more data transmitted over wireless systems. 5G also provides various network management capabilities such as Network Slicing using which cellular operations will be able to establish multiple virtual networks using a single 5G network. For example:- If you're are inside a self-driving car, then a virtual network with extremely fast, low latency connections would be required because obviously, the car needs to navigate in real-time. On the other hand, if you are using any electrical device, then a virtual network with low power and a slower connection would be fine. This is how network slicing works.



1) *Software-Defined Networking (SDN):* SDN enables external control of data away from network hardware to software referred to as the controller. The controller manages packet flow to provide intelligent networks. With the controller, users will be able to manage network equipment using software, and thus introducing new services. SDN architecture will provide high flexibility to 5G networks permitting it to be perfect for the dynamic bandwidth nature of 5G.
2) *Network Function Virtualization (NFV):* NFV refers to the substitute of hardware infrastructure via way of means of virtualization software and for distinct network functions (e.g., VPN, load balancers, firewall, routers, switches). It decouples the network functions from physical infrastructure and permits it to run virtually on a cloud infrastructure. The goal of NFV is to transform the way networks are built and services are delivered.
3) *Network Slicing:* Network slicing enables multiple networks to work virtually over one physical network infrastructure. Each network slice is isolated from the physical network to meet the requirements requested of an application. Integrating NFV with network slicing will allow multiple applications/services to be deployed for users. Consequently, applications or services running over a network slice can display a high quality of experience (QoE) and high-quality services (QoS) beneficial for users.
4) *Multi-Access Edge Computing (MEC):* MEC reduces network congestion and thus achieves a faster response. It enables computing capabilities of the cloud to the network edge which allows data to be processed near to the devices and thus users. Furthermore, by enabling the computing locally, MEC reduces the energy needed to process data and storage space. MEC enabled services, applications, and operations to be closer to the users which enhances the QoS for users.
5) *Device to Device (D2D):* 5G networks proposed during D2D communication allow two devices close to each other to communicate using a direct link. The concept creates multi-hop relays among several devices which increase the data rate& improve QoS(Quality of Service).

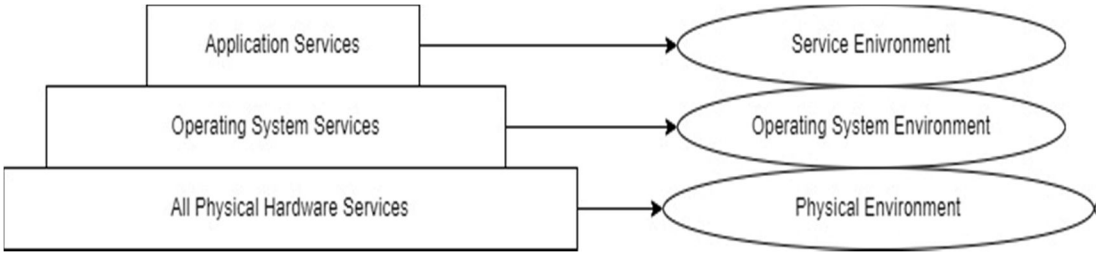
D. Green Computing

Green Computing is the study & practice of using computing resources efficiently. We can reduce overall power consumption by the use of green computing.

1) *Goals of Green Computing*

- Implementing Technology that Reduces the use of hazardous material.
- Avoiding hard copies.
- Lowering resource and energy consumption during the hardware manufacturing.
- Maximize energy efficiency.
- Promote Recyclability.

2) Layers Of Green Computing



All Physical Hardware Services focuses on green computing by optimizing O.S and scheduling Hardware resources. The green computing architecture for optimized O.S enables computer power management features in OS for various techniques like Virtualization, Terminal Servers, Shared memory, etc.

Operating system services focus on minimizing the no. of system services to reduce energy consumption. Resource allocation and energy saving are key resources.

In Application Services, Client application virtualization such as Microsoft Application virtualization can be used to reduce the number of resources used by clients in order to run a fully installed application & architect.

Techniques to make Green Computing feasible are Nano data centers, Virtualization, and Dynamic Voltage. In this paper, we focused on the Virtualization technique of green computing by replacing hardware devices.

The main focus of this research is to integrate our model with the Physical hardware service layer of green computing.

3) Blockchain And Its Potential to 5G

Characteristic	Decentralization	Immutability	Transparency	Security& Privacy
Description	No central authority is needed to perform any kind of transaction.	Difficult to modify the data recorder in the blockchain.	All information on transactions on the blockchain can be viewable to all network participants.	Employees asymmetric cryptography for security with high authentication.
Potential application	Eliminates single-point failures, and ensures data availability.	Large-scale human-centric interconnections can be achieved via peer-to-peer networks of ubiquitous BC nodes without being modified.	Offer transparent ledger solutions for truly open 5G architectures (i.e Decentralized network virtualization)	Provide high security for 5g Networks involved in decentralized ledgers.

III. LITERATURE REVIEW

A. Case Study 1: "5Green: Towards Green 5G Mobile Networks"

This paper talks about the enormous challenge of meeting the forthcoming requirements and opportunities of Mobile networks in a sustainable and reasonable way, they specified the solution to this is over the use of low and efficient energy usage. Presently, the energy bill for mobile operators, particularly in Nigeria, where we face a severe power challenge, is an increasing component of their operating expenditure and mobile communication demands in the future, the expenses will tend to rise at an alarming rate, if not undertaken properly, this is also major from a sustainability point of view, to decrease the percent of global CO2 gas is an organization of partners linked to the "METIS" project portraying telecom vendor view, top academic institutions, and mobile operative viewpoint, it was stated in the paper that it is a company that majorly focus on efficient energy of the 5G mobile network and will enhance to the designing and building of low energy usage devices, due to that this paper highlighted vital areas when

designing a low 5G mobile network architecture, it depicted the major challenges and drawn the potential solutions to it. One of the major encounters is High data traffic volume, this is the exponential progress percentage of mobile wideband operators and it is anticipated to constantly rise every year and it has been forecasted to increase by a thousand times the current users of mobile broadband users in the world beyond the year 2020, which will consequently lead to high demand in data capacity. The amount of connected devices would also assume another major challenge. This kind of evolution would bring about different characteristics of the traffic in the networks, that is, the availability of machine-to-machine communication devices requiring very little amount of data, but consequently needing a high amount of data in terms of signaling. Over this, it will still be appropriate to provide the network nodes with the option of being inactive after no traffic periods in lieu of effective signaling handling. From this view, machine-to-machine- traffic will present extra energy-efficient network design problems. The numerous connected devices in 5G network with a large scope of features including requirements, part of them will be greatly dissimilar, some may need low latency, some may need high reliability, some low reliability, and some may take a high amount of data, meanwhile others very minute to send.

The cellular community device structure has a massive consequence on how a power-efficient system is supposed to be. An energy-efficient machine demands one can conserve energy, while info is being transmitted as well as while the system is in idle mode. While the system is in idle mode the transport of receiving the right of access to figures, paging, and idle mode mobility demands to be progressive.

Augmentations for low-strength consumption through network deployment strategies were reviewed in numerous initiatives for state-of-art technology. The development of heterogeneous community deployment techniques with low power consumption for diverse distributions and environments will offer records ability wherein its miles in reality wanted and could bring optimum use from the introduced tractability formed by way of the new architecture. It is going to be noted that future network will take each day into consideration to efficaciously lessen the overall strength intake and now not most effective consider the busiest hours.

B. Case Study 2: "Sustainable Green 5G Networks"

This specific case study analyses the latest research on green techniques for 5G network and reaping energy for green communication looking for solutions to meet up with the needed requirement, due to that three concepts have emerged, these technological concepts improve throughput from a different perspective which is:

1) Mitigate the (transmitter-receiver) range and boost rate reuse to machine communications via ultra-dense networks as well as the machine.

2) Taking advantage of an inactive and unregistered frequency spectrum in the unlicensed spectrum via millimeter-wave communications as well as long-term evolution.

3) Improve spectral efficiency by making use of a massive amount of antennas. All the above new ideas instituted drain a lot of power, which would be vital in developing energy-efficient 5G networks, in this light low energy consumption may no longer be viable. In this light, a new figure of metric for the wireless communication system, which is now accepted for green design metric known as energy efficiency and is measured in bits-per joule. In the meantime, it has to additionally be famous that strength efficiency can't be progressed via best applying spectral green technologies in wireless communication due to obstacles enacted by means of Shannon potential sure and also non-negligible circuit energy consumption. Energy-efficient enhancements can most effectively reduce the electricity intake issue to a sure volume and isn't always enough for sustainable 5G communications. Subsequently, electricity harvesting technologies, which permit Base stations and gadgets to harvest energy from renewable assets or even radio frequency indicators received good enough attention lately. Power harvesting technologies provide green energy and deliver answers for walking diverse components of wireless communication networks. Consequently, the importance of integrating electricity harvesting generation in the destiny wireless networks can't be overstated.

5G offerings offer the possibility to launch, electricity inexperienced and fee-effectively gadgets developing an environment for technical and agency innovation. While providing dependent community answers constructed to assist vertical markets consisting of driverless automobiles, clever grids, clever homes and agriculture, and healthcare. Moreover, it's far very important to speed up the carrier shipping fee to all of the concerned events. It is exactly the needed help for numerous kinds of vertical industries and makes their provisions so smooth that it calls for new advanced architectural structures for the processing and transmission of facts. Contrary to the evolution of preceding generations of cellular networks, 5G will require not most effective advanced networking answers but also the advanced integration of big computing and storage structures.

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IV. WORKFLOW

1) *Research Approach:* This research is approached through a qualitative framework which means that non-numerical data will be collected in order to sense the research topic. Qualitative research is also focused on collecting experiences, opinions & ideas related to the topic.
2) *Data Collection:* The primary source of data collection for this study is secondary which means that published literature on the topic will be studied. The published literature will be academic work that has been conducted all over the world by different academics and scholars also survey data is used for achieving solutions and creating a model.

A. *Survey*

Villages survey	EVM machines waste	Local banks with hardware waste	e-wastage	High charges of using network facilities(3g,4g)
Village 1	30%	32%	45%	45%
Village 2	25%	22%	53%	34%
Village 3	27%	24%	55%	39%

We did a survey in 3 Villages, where we found that EVM machines that are not in use are in huge numbers. Harmful practices such as the defacing of EVM property during the poll campaign and curbing the use of plastic and other environmentally hazardous materials. Current voting systems like EVM suffer from various security threats such as DDoS attacks, vote alteration, manipulation, etc, and also require a huge amount of paperwork hence less eco-friendly and time-consuming. Security breaches like data leaks and vote tampering are common in villages. The difficulty of differently-abled voters to reach the polling booth. Using Blockchain and green computing voting process can be made more secure, immutable, transparent, and reliable.

Local banks with hardware waste are in huge numbers, there were local banks in villages with approximately 20-25 computers and other electrical devices and workers are only 2-3. Putting your computer on standby or letting your monitor go into sleep mode also creates energy waste, as these modes still require power. This energy waste translates into greenhouse excess gases that contribute to pollution and global climate change.

Green Cloud computing (GCA) is a way of redesigning the architecture of data centers compatible with environmental sustainability. GCA tends to provide a long-term solution to both private and public cloud-based services by removing the unsustainable part in the cloud architecture & making the services more ecologically friendly. We need Green Cloud Computing solutions that can not only save energy but also reduce operational costs & enrich environment sustainability.

High data charges can easily be solved by switching towards 5G networks as with the help of the 5g network slicing feature, users can manage their network according to their needs.

To solve all these issues we used Green Computing. GC involves reducing the environmental impact of technology. That means using less energy, reducing waste, and promoting sustainability. Green Computing aims to reduce the carbon footprint generated by the IT industry.

B. *Some Green Computing Approaches*

1) *Green Design:* Designing energy-green computers, servers, printers, projectors, and other e-devices.
2) *Green Manufacturing:*Minimizing waste during the engineering of computers and different sub-systems to decrease the environmental impact of these activities.
3) *Green Use:* Minimizing the energy intake of computers and their peripheral devices and using them in a green manner.
4) *Green Disposal:* Recycling of e-gadgets.

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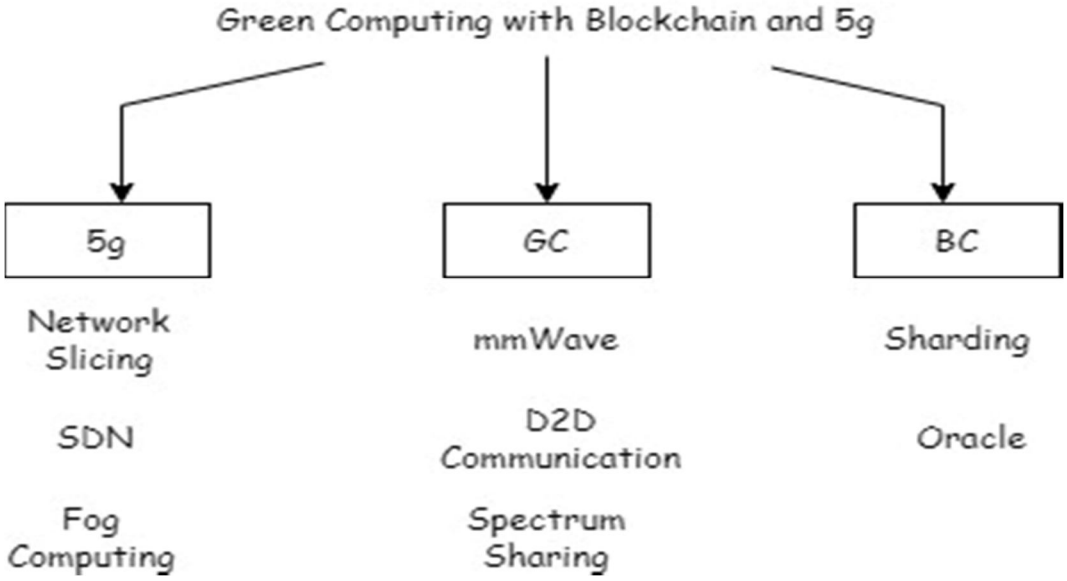
C. Green Computing with Blockchain and 5G



V. PROPOSED MODEL

A. Convergence of Blockchain and 5g with Green Computing

Blockchain strategies can support 5G to allow features such as decentralization, immutability, and transparency. On the other hand, 5G networks are exceedingly distributed and require new technologies such as NFV, SDN, D2D, and MEC. These technologies are complex to arrange and accomplish. Furthermore, 5G networks sharing services, and operations amongst numerous participants could be dishonest. Therefore, blockchain will allow future 5G networks with a high level of security, direction, and manageability required among 5G users.

The motive behind the amalgamation of blockchain with 5G networks comes for the most part from the prominent features of blockchain that could solve the challenges in 5G networks in terms of safety, secrecy, management, and transparency.

Furthermore, By using the immutable ledger of blockchain, we can secure shared services and operations. Certainly, as soon as data is stored inside the blockchain ledger it cannot be changed or fabricated, blockchain uses a cryptographic signature and hash function to secure data.

After converging blockchain with 5G, we can directly integrate the model to GC in order to use less computing hardware resources by using green computing's all physical hardware devices layer.

Blockchain features will advance 5G networks in terms of access control, security, and data privacy For example, blockchain Byzantine Fault Tolerance (BFT) consensus can support 5G networks to attain trust in a distributed network even when some of the stakeholders in the network reply with inappropriate info. Also, blockchain can decentralize network management without the need for a third party.

For instance, the use of blockchain-based cloud computing can enable the decentralization of MEC 5G networks which take out the control from the core network, provide decentralized management, eliminate SPF issues, and improves trust in the network. In addition, blockchain can assist to steady D2D communication by constructing a centralized peer-to-peer blockchain network, which considers each device as a blockchain miner that holds a replica of the ledger, validates the authenticity of a transaction, and monitor transactions for improved system reliability.

Following our presentation of merging blockchain and 5g with Green Computing, decentralization of the voting system, banks and other models like Environmental treaties can be put into this architectural model in order to get secure, trustworthy, and eco-friendly services.

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B. Architecture

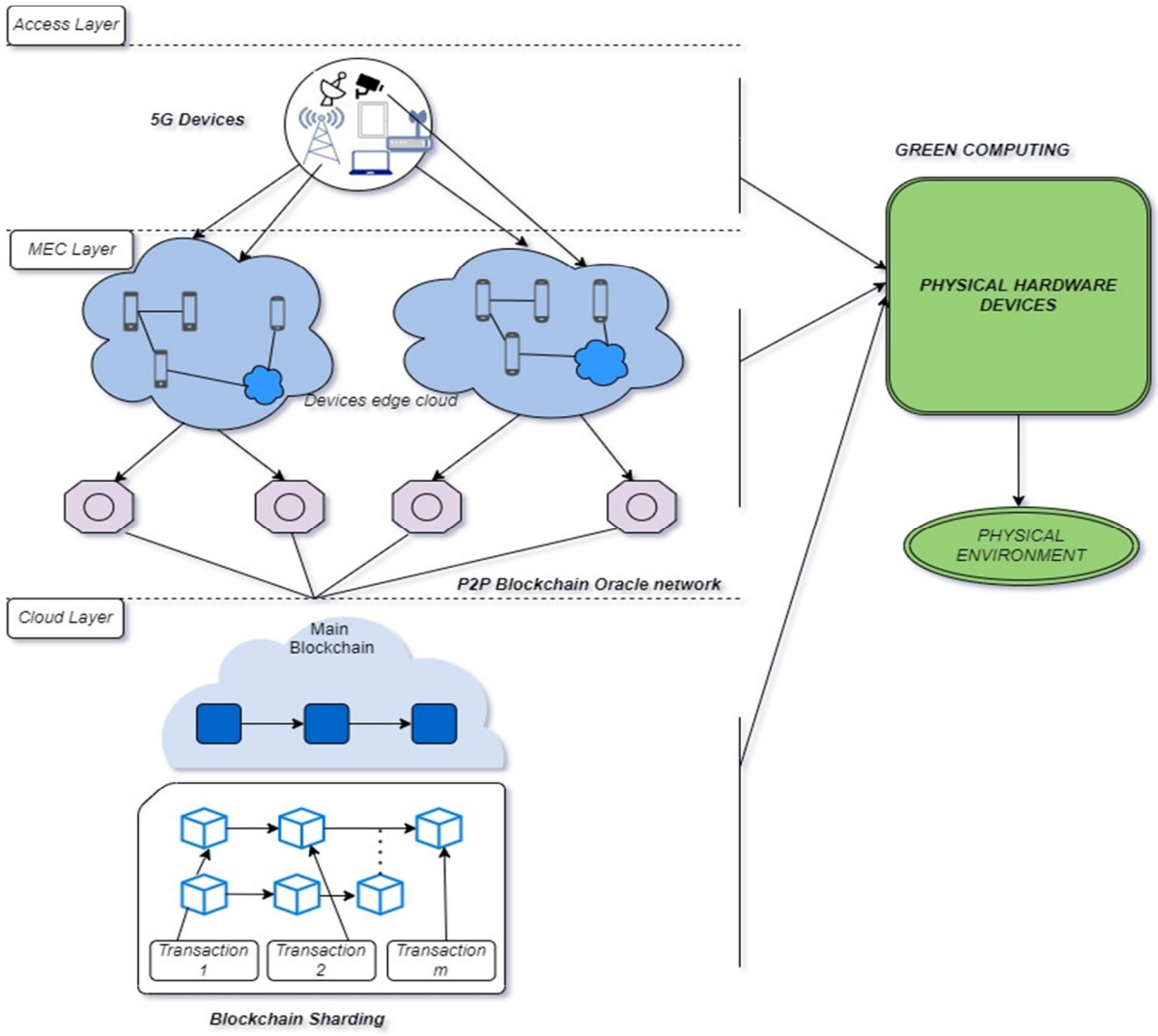

Fig: Convergence of Blockchain and 5G with Green Computing

In this model, a large number of unreliable users are connected through D2D communication. We proposed a scalable and secure blockchain architecture composed of three layers, which are directly integrated into the green computing physical hardware devices layer. The access layer contains 5G devices that send and receive data. The edge layer is responsible for forwarding packets and verifying their legitimacy using a blockchain consensus and blockchain oracles. Cloud layer stores the data and scales the blockchain while keeping security agreements. By the use of 5G devices a user at Access Layer can easily manage his data usage by Network slicing feature, MEC layer includes devices edge to cloud with P2P Oracle network and Cloud layer represents the main blockchain with the facility of Blockchain Sharding which basically provides the feature of partitioning each transaction into several shards and independently processing it. This convergence model of 5g and Blockchain will directly establish a relation with GC's Physical Hardware services layer which will directly impact the physical environment. We can model any kind of eco-friendly project in this aforementioned model.

As 5G includes a huge number of devices and users that interconnect at a high frequency leads to the generation of big data which leads to scalability issues in the addition of blockchain with 5G. To attain horizontal scalability, blockchain sharding was projected, it consists of partitioning each transaction into several shards and processing it independently. We proposed Blockchain sharding to achieve horizontal scalability as BC sharding comprises of partitioning each transaction into numerous shards and processing it independently.

In this paper, we propose using a Peer-To-Peer(P2P) oracle network to authenticate the data queries and validate their source. Blockchain cannot access the external information of the network. This is where the blockchain oracle interferes, it is a service provider (trusted third party) that verifies the data legitimacy. Nevertheless, trusting a single third party may lead to providing dishonest or erroneous data. To this conclusion, we propose using a P2P oracle network that confirms the truth value of 5G data. We assume each received data sent from a 5G device could be either valid T or False F. There is an 'r' oracle in the P2P network, only 't' oracle verify the data. For each oracle o ∈ [r,t] has a q probability that data d is correct about a given proposition.

C. Design

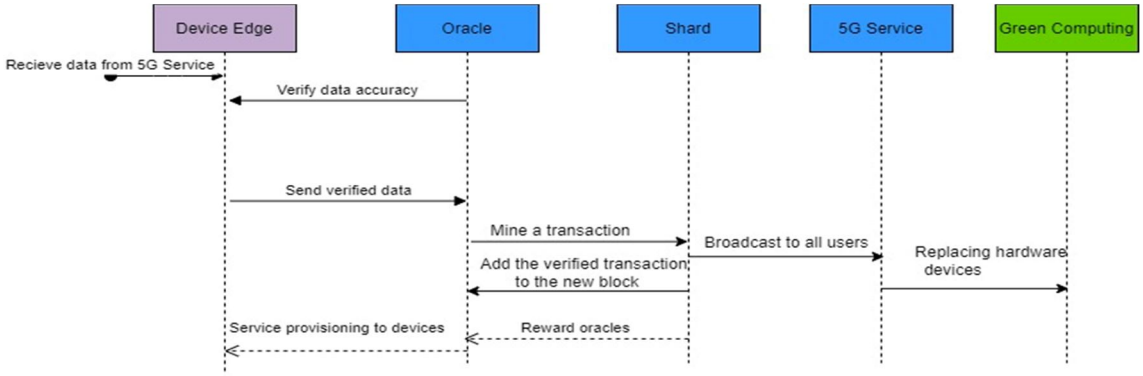

Fig: Sequence diagram of utilizing shards and oracles with Green Computing

This sequence diagram explains the order in which processes are executed in our proposed model. The device edge module states the data which is received from the 5g service and Oracle will first verify data accuracy and then transfer that verified data to Shard, which will further mine a transaction and add the verified transaction to the new block. Here, transaction of any kind of data is stated not just cryptocurrency. This sequence diagram explains how our model will work in real world scenario for decentralizing any centralized process and also targeting the Physical layer hardware service of green computing. Shard will broadcast to all the users via 5g service and as our model should be eco-friendly from the start it will directly replace hardware devices with green computing. The concept of reward oracles could be used in approaches like Environmental treaties, Supply chains, and tracking mechanisms to reduce waste.

VI. FUTURE WORK

To make the aforementioned model more scalable and secure, more studies need to be done. In, order to connect all the services of GC (including application services and operating system services) with Bc and 5g more experimental work should be done to reach a strong conclusion. e-Voting and e-banking systems should be practically imposed for achieving decentralization with data security and user privacy. By considering our proposed model as a baseline, Green computing approaches can be easily merged with Blockchain and 5g. Also, immutability is a factor that can work as a barrier to the scalability of blockchain as due to the immutability feature, the recorded data cannot be changed. Once, the data is recorded in a block it cannot be changed. Some centralized processes will require some change in data at any point in time so there should be some solution to overcome this immutability feature without replacing it, as this feature also helps in securing data manipulation in case of any malicious attack.

VII. CONCLUSION

Blockchain technology was initially proposed for the cryptocurrency context, though, this technology has moved beyond its realm. In this context, blockchain was proposed by several researchers as a solution to 5G inherent challenges. Certainly, several studies have shown the benefit of using blockchain solutions to meet the requirements of 5G networks such as transparency, immutability, security, and decentralization. Green computing with its green approaches will directly impact the physical environment with help of BC and 5g. In this paper, we have proposed a model with blockchain integration with 5g and convergence of both with GC that can lead to a healthy environment by reducing the use of hazardous hardware devices. Our main aim was to find a solution for the physical hardware services layer of green computing by integrating it with Blockchain and 5G. Moreover, we concise some open challenges and provides some research directions that need further investigation for the safe deployment of blockchain in 5G networks with Green Computing.

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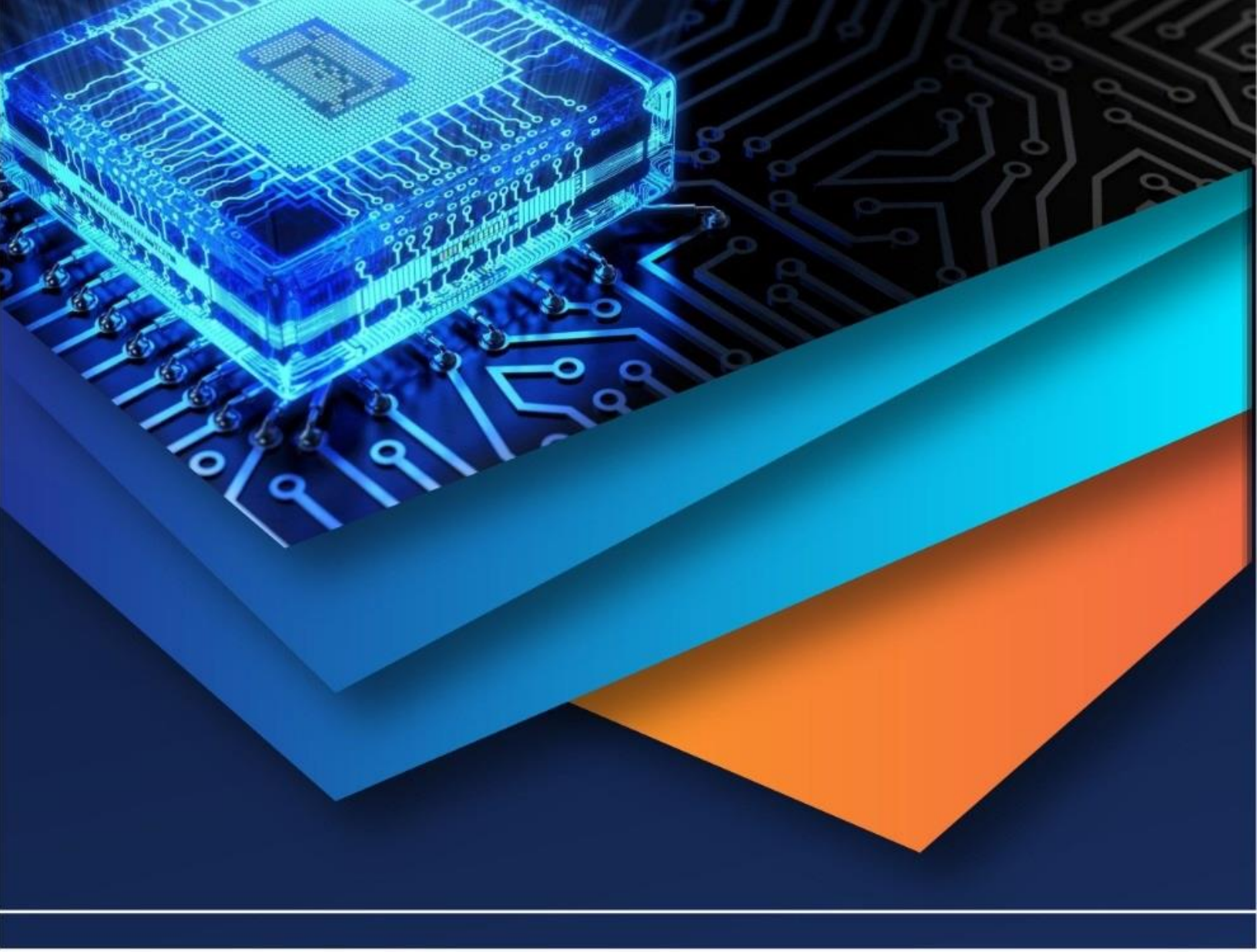

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