THE RELEVANCE OF BLOCKCHAIN WITH DEW COMPUTING: A REVIEW

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***Abstract* - Blockchain after its discovery and application to bitcoin has become a vital platform for data validation and verification across diverse sectors such as healthcare, supply chain, governance, and many others. The era of cloud computing has facilitated the access of one's data on the go making it almost impossible to lose data as your work. However, the use of the cloud demands constant aces to the internet warranting the relevance of the dew computing paradigm with terms to give access to one's data locally without the use of the internet and then updating the document on the cloud based on the internet restoration. In this paper, we seek to conduct a review of the above areas of blockchain and dew computing drawing the need for the integration of both technologies.**

Keywords - blockchain, cloud computing, dew computing, public blockchain, private blockchain, proof of work, proof of stake, depreciated proof of stake.

I. INTRODUCTION

Blockchain is one of the advances, which showed up in the most recent decade and carried a great deal of guarantee with it. Numerous sorts of research are being directed effectively to investigate the full capacities of Blockchain. Some accept that Blockchain is key for a decentralized society. [1][2][3][4]

A. *Blockchain Technology*

Blockchain is being lauded as a mechanical advancement that permits changing how society exchanges and connects [5][6]. This notoriety is specifically owing to its properties of permitting commonly doubting elements to trade budgetary esteem and cooperate without depending on a confided in outsider. A blockchain additionally gives uprightness ensured information stockpiling and permits giving procedure straightforwardness. The ongoing increment in revealed occurrences of reconnaissance and security ruptures trading off clients' protection raise doubt about the present model, in which outsiders gather and control gigantic measures of individual information.

Bitcoin has exhibited in the budgetary space that trusted, auditable processing is conceivable utilizing a decentralized system of companions joined by an open record [7][8][9].

Blockchain is an appropriated database arrangement that keeps up a constantly developing rundown of information records that are affirmed by the hubs taking part in it. The information is recorded in an open record, remembering data for each exchange at any point finished. Blockchain is a decentralized arrangement, which doesn't require any outsider association in the center. The data about each exchange at any point finished in Blockchain is shared and accessible to all hubs. This characteristic makes the framework more straightforward than brought together exchanges including an outsider. Likewise, the hubs in Blockchain are for the most part mysterious, which makes it increasingly secure for different hubs to affirm the exchanges [10][11][12].

The architecture below [13][14] shows the structure of the Blockchain formation where we have the genesis block comprising of contents such as the Hash of current block and its transactional data. The subsequent blocks bearing the Hash of the previous block, the Hash of current block and its transactional data then follow this block.

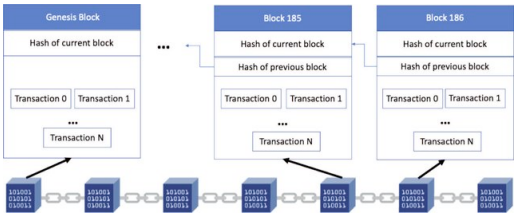

Figure. 1. Blockchain, Data Chain Architecture

B. *Dew Computing Paradigm*

The technological progress of widespread smart devices as well as universal networks, and the associated innovative network services, cloud computing paradigm is having certain challenges based on its centralized storage model as well as processing in adjusting and being applied to various types of applications as well as technological setups [15] [16][17]. Dew Computing architectural image is illustrated in figure 2 below [18].

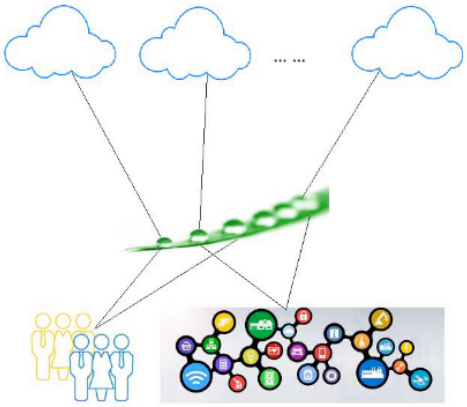

Figure 2. The Architectural Structure of Dew Computing

Advancements such as artificial intelligence, Internet of things and wireless communication devices have caused the significance of the cloud-computing paradigm to either increase slowly or not at all. For this cause, many believe that the era of post-cloud computing is therefore upon us. This era spans across some models related to cloud computing such as Dew Computing, Fog Computing, Edge Computing as well as Cloudlet. [19][20][21]

II. RELATED WORKS

A. BLOCKCHAIN ALGORITHMS

A.1 *Proof of Work (PoW) Algorithm*

In the concept of blockchain generation, every data added would be tested for its data validity, which is usually referred to as the process of mining or also known as Proof of Work. [22] [23] devise optimal framework based on PoW for adversarial strategies for selfish mining and double-spending while considering real-world constraints such as different block sizes, network propagation, block generation intervals, information and the impact of eclipse attacks. [24] Proposed a PoW based consensus distributed ledger system to prevent malicious attacks utilizing certain variations. In their research [25] created a formalized proof-of-work algorithm by the introduction of a verified primitive called (NIPoPoWs) Non-Interactive Proofs of Proof-of-Work.[26][27]

A.2 *Proof of Stake (PoS) Algorithm*

In the later Proof of State arranges, the arrangement looking is evacuated, and the square chiefs are never again chosen by computational force. The main Proof of Stakes arrange, Peercoin, was created as a PoS consensus mechanism aimed at decreasing the computational conditions of Proof of Work. Members with higher coinage, i.e., a result of system tokens and their holding time, have higher opportunities to be chosen. [28][29][30]

Rather than consuming a great deal of energy in search of the procedure using the Proof of Work method, a primary will be chosen dependent on its stakes to play out the mining procedure and add another block to the chain. [31][32]

A.3 *Delegated Proof of Stake (DPoS) Algorithm*

In their paper [33] established that in 2014, Larimer D proposed a DPoS agreement system that could understand square second-level check, which could meet a wide scope of business needs.

In the DPoS agreement instrument, each hub holding tokens is a competitor hub, and every hub chooses a few operator hubs by casting a ballot, and the specialist hubs alternate to create and confirm the squares as indicated by the setup plan. [34][35]

While the democratic model can clarify the vague set naturally, to make the operator hub determination of the accord system of DPoS like the democratic model, in reality, we proposed the improvement of DPoS agreement component dependent on Vague set.[36][37][38]

B. BLOCKCHAIN CATEGORIES AND CLASSIFICATIONS

B.1 *Consortium Blockchain*

Consortium blockchains are some of the time considered a different assignment from private blockchains. Examples of consortium blockchains include Quorum and R3 Corda. [39]

Regularly, consortium blockchain are related to big business use, where a gathering of associations working together to use blockchain innovation to improve organizations. Consortium blockchain can be comprehended when it is contrasted and open and private blockchain. [40]

A consortium blockchain isn't conceded to a solitary element as a private blockchain; rather, it is allowed to a gathering of affirmed people.

Besides, consortium blockchain is a gathering of pre-characterized hubs on the system. [41]

B.2 *Private Blockchain*

Private blockchains are more concentrated than Public blockchains and are significant for undertakings need to team up and share information however don't need their delicate business information unmistakable on an open blockchain. Examples of private blockchain include Monax and Multichain.[42][43][44]

Members need agree to join the systems Transactions are private and are just accessible to environment members that have been offered consent to join the system. [45][46]

B.3 *Public Blockchain*

Public blockchains are open source applications that intend to be completely decentralized, with nobody individual or substance controlling which exchanges are recorded in the blockchain or the request wherein they are prepared. Examples of public blockchains include Etherum and Bitcoin.

They can be profoundly restriction safe, since anybody is available to join the system, paying little heed to area, nationality, and so forth.

All exchanges that happen on public blockchains are completely straightforward, implying that anybody can inspect the exchange subtleties.[47][48][49]

TABLE I. DIFFERENCES AMONG BLOCKCHAIN CATEGORIES

Consortium	***Private***	***Public***
Multiple Algorithms of consensus	Multiple Algorithm consensus	Consensus by Proof of Work
Recognized participants from multiple organizations	Recognized participants from one organization	Many unrecognized participants
Writes require consensus of several participants	Write permissions centralized	Writes by all participants
Reads may be public or restricted	Reads may be public or restricted	Reads by all participants

C. BLOCKCHAIN APPLICATIONS AND THEIR ARCHITECTURES

C.1 *Blockchain in Internet of Vehicles (BIoV)*

Finding a solitary confided in substance to store and disseminate such messages can be testing, and vehicles may not be slanted to take an interest (e.g., age and appropriation of declaration messages) except if they can profit by such investment. While the vast majority of the vehicular messages just should be shared by close by vehicles, a few messages (e.g., declaration messages) may should be all the more extensively circulated, for instance to vehicles in a more extensive area. To empower/boost cooperation, vehicles that steadfastly communicate the declaration messages and additionally add to the square age will be compensated by some digital currency.[50][51][52]

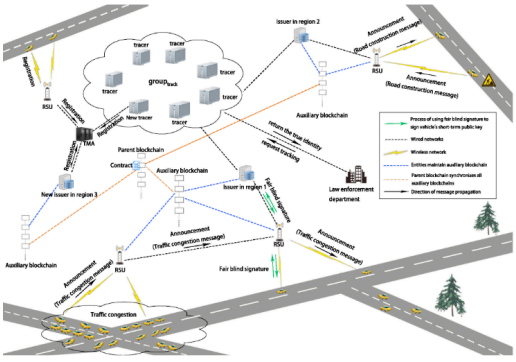

Figure. 3. A Proposed Blockchain Architecture on a Secured Data Sharing System

Figure 3. Illustrates how the proposed blockchain architecture on a secured data sharing system for Internet of Vehicles comprises of backers, vehicles, traffic the board authority, tracers and law authorization office and side of the road units.[53][54][55]

C.2 *Blockchain in the Sphere of Healthcare*

As of late, there have been expanding calls for human services suppliers to give controls to patients over their own wellbeing records. All things considered, security issues concerning how extraordinary medicinal services suppliers trade human services data have caused a failure in the sending of such frameworks. The capacity to trade information safely is significant so new borderless coordinated social insurance administrations can be given to patients. [56][57][58]

Because of its decentralized nature, blockchain innovation is an appropriate driver for the genuinely necessary move towards incorporated medicinal services, giving new bits of knowledge and tending to a portion of the fundamental difficulties of numerous human services regions. Blockchain permits medicinal services suppliers to record and oversee distributed exchanges through a system without a focal power. [59][60][61]

C.3 *Blockchain in Media*

In their paper [62] explored characterizing blockchain within digital subjects such as, media and interactive media as media blockchain. There are numerous examinations about media blockchain. These investigations guarantee the trustworthiness, authentication, or control of digital substance, and are characterized into two classes: One is content security that implies verifying substance utilizing blockchain. The other is the substance accurate data that implies tracking and working with the correct data by applying blockchain. The image in Figure 4 shows a blockchain architecture in the social media environment.[63][64]

Figure. 4. Blockchain in Social Media Architecture

With the execution of blockchain innovation, the technique for correspondence in the business would get decentralized. Under this framework, specialists and their crowds would then have the option to can communicate straightforwardly without the previously mentioned middle people. Since blockchain has the option to track all communications of a specific resource, approved audiences can evidently follow all the relative exercises, for example, utilization of substance, move of proprietorship, and keen agreements related with the substance. Content makers could deal with the rundown of approved watchers for their own needs without being influenced by the principles of an outsider. [65] [66][67]

D. BLOCKCHAIN CHALLENGES

In a blockchain, every node has to perform a comparable task for the verification of each transaction at the same time; thus, obtaining a high computation cost. In their paper [68][69] explained that this complicates the challenge of validation and verification of different methods across the nodes in the diverse networks, as well as moderation of network attacks. Therefore in order to avoid performance degradation, requiring the need to design efficient performance optimization. [70][71][72][73]

TABLE II. DISTINCTIONS BETWEEN CLOUD, DEW, EDGE AND FOG COMPUTING

Parameters	**Cloud Computing**	**Dew Computing**	**Edge Computing**	**Fog Computing**
Hardware	Scalable Capabilities	Very Limited Capabilities	Limited Capabilities	Scalable Capabilities
Service Location	Internet Based	Edge Network Based	Edge Network Based	Internet Based
Location Awareness	No	Yes	Yes	No
User Experience	Very Normal	Highly Satisfactory	Good	Normal
Target Users	Internet Users	Purely Mobile Users	Semi Mobile Users	Internet Users
Internet Dependency	Every Access Time	Not Essential	Every Access Time	Every Access Time
Geo-Distribution	Centralized	Highly Distributed	Distributed	Semi Centralized
Synchronization Feature	Not Essential	Always Essential	Not Essential	Not Essential
Deployment Scenario	Large Enterprises	Smartphone, Laptop, Pc	Gateway, Router	Small Medium Enterprises
Latency	Very High	Negligible	Low	High

E. HOW DEW COMPUTING DIFFERS FROM CLOUD, EDGE AND FOG COMPUTING

The below table illustrates the difference between Dew Computing and other computing paradigms such as Cloud, Edge and Fog Computing with regards certain parameters as listed in the table. [74][75][76]

III. THE NEED TO INTEGRATE DEW COMPUTING WITH BLOCKCHAIN

In their paper, [77] explained that blockchain data has to exist in every node and the data amount increases with time. Even though some approaches have been proposed to reduce the data size of blockchain clients, but these clients do not have the status of full nodes. Therefore Dewblock was proposed by [77] bringing a new approach that the data size of a client is reduced and the features of a full node are still kept. With Dewblock, each blockchain user needs to deploy a cloud server to a cloud service. While a client is light-weighted and is appropriately controlled on a mobile device or a personal device, the client works with a distant cloud server to act as a full node. However, a dew client operates independently to perform blockchain activities; it also cooperates with the cloud server to sustain the integrity of the whole blockchain network. Based on the wide use of cloud services and the rise of Internet of things by individual users, including blockchain users, making blockchain in dew computing feasible and affordable from an economical and technical point of view. [78][79][80][81][82]

A. A PROPOSED FRAMEWORK OF DEW COMPUTING AND BLOCKCHAIN INTEGRATION

Blockchains bear the capacity to be implemented across a large scope of, with many transactions being streamlined to accommodate blockchain integration. It is therefore critical to have a universal blockchain that supports user architecture enabling these users to deploy information across mobile platforms as well as personal devices while they possessing the entire capabilities such that full nodes do base on Dew computing architecture as well as principles. [77][83][84]

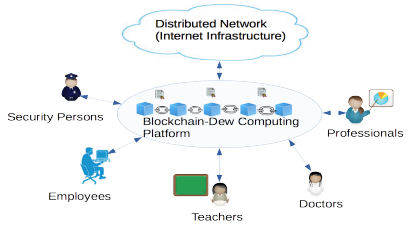

Figure. 5. A Proposed Blockchain Dew Computing Architecture

IV. CONCLUSION

In this paper, the authors reviewed other related and relevant research on the concept of blockchain and dew computing highlighting the importance of blockchain integration with dew computing with areas concentrated on topics such as introduction to blockchain technology, blockchain consensus algorithms, blockchain categories, and classifications, blockchain applications and their simple architectures, blockchain challenges, how dew computing differs from other computing paradigms such as cloud computing, edge computing, fog computing and a proposed architecture representing an integrated environment of blockchain with due computing.

V. RECOMMENDATION

The authors recommend a further independent study be conducted in the fields of blockchain and dew computing to implement proposed integration highlighted in this review study.

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