Blockchain Scalability

Ethan Moore

Department of English, Western Kentucky University

English 300

Dr. Gibbons

Sept. 10, 2021

Blockchain Scalability

Solutions to Scalability of Blockchain: A Survey by Qiheng Zhou is an excellent peer-reviewed article detailing and outlining what makes a blockchain able to scale in a myriad of ways. Dr. Zhou is a suitable and trustworthy source due to his professorship within the computer science department at Sun Yat-Sen University, aswell as being cited over 35 times from different researchers. The author's quantitatively holistic approach to this topic can be best demonstrated through the thesis in his journal article. In summary, Dr. Zhou and his team analyzed different blockchains with contrasting implementations to scale, compared them, and stated several approaches from these different technologies that could be utilized based on their compromises. This article was chosen due to his superb aggregation of scalable solutions from a plethora of blockchains. The purpose of this article and research is to further distill the interesting points the research team garnered.

Summary

The condensed report of Solutions to Scalability of Blockchain: A Survey by Dr. Zhou and his team starts with an introduction to the revolutionary blockchain technology. The paper then continues to describe how the increased use of blockchain systems require a solution to effectively scale the technology. This scaling would improve the number of transactions that go through the unconfirmed transactions queue into the confirmed block. It would also improve the latency from a transaction being unconfirmed to being confirmed. Dr. Zhou then outlines a framework for thinking about a blockchains most important attributes called the Blockchain Trilemma. These attributes include decentralization, security, and scalability. After the paper details the blockchain trilemma, the author explains the layers of a blockchain and how the

different layers allow for there to be specialized solutions. These solutions are then explained from layer one to layer two techniques.

Assessment

The thesis or central idea of the text is focused on looking at the different blockchains they have tried to implement with some form of scaling technology, compared those different technologies, and named different ways to solve the scalability problem in the blockchain. The intended audience of this peer-reviewed article was blockchain architects, developers, and computer scientists. The questions that the author addressed are what technologies are used to scale blockchains and how are they implemented in different blockchains. The author started his article with an abstract, which then went into the introduction in section one. Section two explains the scalability issue, and then went into section three which discussed the approaches to solving the scalability issue; Section four described the future of blockchain scalability, and the conclusion of the article was in the section five. The key parts of the text included discussions over on-chain solutions, different consensus strategies, sharding, non-on-chain solutions, sidechain solutions, off-chain computation, and cross-chain techniques. The key parts are interrelated because consensus strategies are what allows the structure of the blockchain to be formed, and the difference in sharding techniques relies on the consensus mechanism in place. The network graph's structure and it's function relies on the different implementations of blockchain layer one technologies. Layer two technologies like cross-chains or off-chain computations rely on the existing layer one network to exist. The key parts relate to the thesis because they are different techniques for improving scalability that can be compared and contrasted. The author generates interest in the argument by inserting the buzzword

cryptocurrency. Which is arguably more well-known than the core technology of blockchain which is distributed ledger technology. The abstract also contained a statement addressing the attention that has already been garnered by the field. The author convinces the readers of his arguments merit by providing sources for the facts he presented in the article. The evidence the author included is that "Layer 1 (on-chain) solutions such as Bitcoin-Cash [9] increasing the block size, Compact block relay [10] compressing the blocks, Sharding techniques [11]–[12][13][14], and various improved consensus algorithms [15]–[16][17][18][19], in which the transaction throughput is increased and transaction latency is decreased, respectively." and another example from the text is that "In EOS, a block is generated by one producer every three seconds on average, and the average confirmation time for each transaction is about 1.5 seconds. Compared with other mainstream blockchain platforms, EOS can reach an overwhelming million-level TPS." (Zhou, Huang, Zheng, and Bian, (2020), p. 2). The author in these pieces of evidence is addressing the different scalability techniques and how it compares to a more traditional transaction system like Visa. The evidence is convincing because the usage of terms and processes in relation to one another is consistent with my understanding of the core of blockchain technology. The author has anticipated opposing views by noting issues with different technologies. For example, the cryptocurrency EOS has an exceedingly fast transaction per second statistic, however, he notes that its decentralization is lacking since the majority of coins are within only 10 wallets/addresses. The consensus mechanism Delegated Proof of Stake makes EOS more centralized. This centralization, however, is a compromise on the spirit and essence of blockchain, its decentralization. The author's reasoning is sound since he is comparing through the blockchain trilemma framework. This idea states that the most important attributes of a

blockchain system is its decentralization, security, and scalability. These attributes cannot coexist equally without giving up one or the other, therefore, creating a need to weigh the different technologies in providing the best benefit to throughput and latency without compromising too much of the spirit of blockchain.

Response

I think this article is an excellent exploration of the topic of blockchain scalability. The reason this article is exemplary is that Dr. Zhou and his team give a thoroughly descriptive explanation of the who, what, and why of scaling blockchains. The who is best shown through the author's introduction into the general knowledge of the topic. An example is the quick informative description of the core of blockchain in the introduction stating "Such a ledger intends to achieve decentralized transaction management, which means that any node joining the ledger can initiate transactions equally according to rules, and the transaction does not need to be managed by any third party. All transactions in the system are stored in blocks, which are then linked as a chain and organized in chronological order. Moreover, transactions that have written in blocks are immutable and transparent to all peers." (Zhou, Huang, Zheng, and Bian, (2020), p. 1). In the author's explanation, he first brings up the term 'ledger' as a starting point to understand what a block of data is. Too often, there is confusion over how the ledger function is implemented in a blockchain. This clarification by first stating the ledger term is an excellent introduction for people who are initially interested in its general function. The explanation continues with rules and the function of a node, which is critical to understand the techniques for layer one scalability. Dr. Zhou does not go into the actual technology of linking these blocks together because I believe it would be too complex for a quick and effective introduction. The

what portion can be best exemplified with an excerpt from the article on a scalable solution applied in layer 1 like sharding. The article states “Sharding [78] is a traditional technology first proposed in the database field mainly for the optimization of large commercial databases. This method is to divide the data of a large database into a number of fragments, and then store them in separate servers to reduce the pressure of a centralized server, thereby improving the search performance and enlarging the storage capacity) of the entire database system.” (Zhou, Huang, Zheng, and Bian, (2020), p. 7). In the authors explanation of sharding, he tells the historical roots of the technology, what it is responsible for, and what positive effects from its use we can extract like lookup performance. The why portion is shown under his initial piece on sharding below his what portion. He states “The basic idea of sharding technology is divide-and-conquer. Therefore, applying sharding technology to blockchain is to divide a blockchain network into several smaller networks, each contains a part of nodes, which is called a “shard”. Transactions in the network will be processed in different shards, so that each node only needs to process a small part of arriving transactions. Different shards can process transactions in parallel, which can boost the concurrency of transaction processing and verification, thus increasing the throughput of the entire network. While partitioning the whole system into different shards, it is critical to protect the decentralization and security of the system. Several aspects required to particularly take into account: (a) How to reach a consensus in each shard and prevent each shard from suffering some common risks such as 51% vulnerability and Double-spending. (b) How to handle cross-shard transactions quickly while ensuring the consistency of these transactions.” (Zhou, Huang, Zheng, and Bian, (2020), p. 7). Why sharding works is because by breaking and creating shards of the network, we can produce a higher rate of concurrent processes which

fosters greater processing power for the network and increased transaction thoroughput. Dr. Zhou and his team of researchers do not stop there, since he continues to talk about the considerations for implementing sharding. This gives the reader an excellent overview and set of considerations for architecting a blockchain with this scalability solution.

Conclusion

The future scalability implementations that are known and unknown are hinged on fantastic papers like the one shown from Dr. Zhou and his team of researchers. The paper itself is consistent in its explanations, and is not suffering from broken or inexplicable problems. Since the blockchain space is so new, it cannot get enough good, solid, and critically explorative research for furthering development and interest in this field. The future of the blockchain spaces' development requires fresh developers and architects, whose knowledge will be built on top of journal articles like Dr. Zhou's. Truly the blockchain revolution is not a fad, trend, or scam. It is an exciting venue into the possibilities of decentralized distributed computing.

References

Q. Zhou, H. Huang, Z. Zheng and J. Bian, "Solutions to Scalability of Blockchain: A Survey," in IEEE Access, vol. 8, pp. 16440-16455, 2020, doi: 10.1109/ACCESS.2020.2967218. https://ieeexplore.ieee.org/document/8962150/authors#authors

ResearchGate. (n.d.). Qiheng Zhou. Retrieved from https://www.researchgate.net/profile/Qiheng-Zhou.