Comparative Study of Data Availability Schemes in Various Blockchains

Pranjal Sarode
Chainscore Labs
pranjal@chainscore.finance

Prasad Kumkar
Chainscore Labs
prasad@chainscore.finance

Abstract—We make a Comparative benchmarking study of currently polkadot's ELVES data availability protocol with emerging data availability solutions which includes Avail, Celestia, Espresso's-Tiramisu and NEAR's sharded DA.

We made a comparison in terms of bandwidth, time, latency, block time, block size, robustness degree and cost per megabyte of data availability.

I. INTRODUCTION

The Blockchain technology is a constantly evolving field that has garnered significant attention and value in recent years. However, despite its growing prominence, the decentralized systems are facing challenges in scaling Blockchains in terms of data availability. Data availability is a critically important aspect of blockchain technology. Data availability refers to the ability of a blockchain network to ensure that all necessary data is accessible and retrievable by all its participants. In a decentralized system, Where multiple nodes work together to validate and store data/transactions, ensuring that the data is avaliable, valid and accessible is quite a important factor for maintaing the integrity and decentralized nature of the network [1].

This study provides a Comparative study among the latest avaliable Data availability solutions/models in terms of bandwidth, time and other criteria to provide a bigger overview of pro's and con's of every model.

The Models included in study are as follows:

- Polkadot's ELVES
- Celestia
- Espresso Tiramisu
- NEAR
- Avail

The below is a breif short introduction of the models that will be discussed and analyzed in the study.

A. Polkadot ELVES

We employed a quantitative research design to gather and analyze data systematically.

B. Celestia

We employed a quantitative research design to gather and analyze data systematically.

C. Espresso Tiramisu

Espresso-Tiramisu DA resolves the Data availability scaling issue with a three layred system below is the short overview of these three layers.

- Savoiardi (VID Layer) - Erause codes and stores data across all the nodes [2].
- Mascarpone (DA Committe Layer) - A Small elected Committee stores the full data and guarantees to efficiently recover data [2].
- Cocoa (CDN Layer) - Uploads the data on web2 based CDN solution for seamless and speedy data recovery [2].

Espresso utilizes Hotshot consensus which is a optimistically responsive, communication-efficient consensus protocol in a proof-of-stake setting that is resistant to bribing adversaries and scalable to large number of nodes.

D. NEAR

We employed a quantitative research design to gather and analyze data systematically.

E. Avail

Avail DA helps blockchains scale by providing an abundance of data availability capacity. Its modular design scales data availability capacity with demand, and transaction data can be cryptographically verified quickly by anyone running an Avail light client [1].Avail utilizes Erasure coding, KZG commitments along with light client to ensure its data availability.

As for consensus Avail uses BABE/GRANDPA hybrid consensus used by polkadot for block production and finality. Avail also provides Application Specific Data Retrieval (ASDR) this helps rollups to fetch and decode their own blobs even tho the block might contain many app's data. [3].

TABLE I
SHORT COMPARISON OF ALL DA SOLUTIONS

Feature	Polkadot's ELVES	Celestia	Espresso Tiramisu	NEAR	Avail
Consensus	BABE/ GRANDPA	Tendermint	HotShot	Night-shade	—
Storage	Sharding	Reed-Solomon	Three-layer	Sharding	KZG
Block Time	20s	15s	˜6s	1s	20s
Validation	Light Client	Light Client	Full Node	Chunk-only	Light Client

II. Methodology

In this section, we detail the methods and approaches used in our research. The methodology is structured as follows:

A. Research Design

We employed a quantitative research design to gather and analyze data systematically.

B. Data Collection

Data was collected through surveys distributed to a sample population. The survey included questions designed to assess various parameters relevant to our study.

C. Data Analysis

The collected data was analyzed using statistical methods, including descriptive statistics and inferential statistics, to draw meaningful conclusions.

D. Limitations

We acknowledge certain limitations in our methodology, including potential biases in survey responses and the representativeness of the sample.

Future research may address these limitations by employing a more diverse sample and utilizing mixed methods for data collection.

III. Results

In this section, we present the results of our research. The findings are summarized in the following subsections.

A. Data Analysis

We conducted a thorough analysis of the collected data, which revealed significant trends and patterns. The results are illustrated in Figure .

B. Findings

The key findings from our research indicate that [insert key findings here]. These results contribute to the understanding of [insert relevant field or topic].

C. Discussion

The implications of these results are discussed in relation to existing literature. Our findings suggest that [insert discussion points here]. Further research is needed to explore [insert future research directions].

IV. Conclusion

In this paper, we have explored the significance of [insert key findings or contributions]. The results indicate that [summarize main results]. These findings have important implications for [discuss implications]. Future work could focus on [suggest future research directions]. Overall, this research contributes to [state the broader impact of the work].

References

[1] Avail-Team, "Avail: A unifying blockchain network," *Avail Project Documentation*, vol. 1, no. 1, 2024.

[2] Espresso-Systems, "The espresso sequencer: Hotshot consensus and triamisu data availability," *Avail Project Documentation*, vol. 1, no. 1, 2023.

[3] Avail, "Avail: The data availability blockchain," *Avail Project Documentation*, vol. 1, no. 2.1, 2024.