# Picolo: Fast, Decentralized Globally Distributed Database Network[☆]

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**Abstract**

Picolo is a fast, scalable, verifiable, fully-decentralized, globally distributed transaction oriented database for blockchain-based Applications. Picolo uses a probabilistic replication framework on top of DHTs to achieve a O(1) lookup latency for most queries. Its the first and so-far only system of its kind to distribute data at a global scale will full-decentralization and externally-consistent distributed transactions.

- Allows for verifiable transaction logs.
- Token economics that gamify honest participation from nodes over malicious intent.

*Keywords:* Decentralization, Blockchain, Crypto economics, Database, Distributed, SQL

## 1. Introduction

- What are Dapps. Dapps will grow, but need to store data.
- Solutions today provide file storage semantics which might not work for all application types.
- Introduce the database problem on the blockchain. What are the requirements for a decentralized database.

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- Overview of current approaches and limitations (details in the Background and Related work section).

### *1.1. Picolo's Features*

- Network layer Scales with O(log N) overhead for N nodes.
- Network lookup using O(1) amortized lookup cost for DHT.
- Horizontally scalable
- Automated data sharding
- Transactions can be applied across rows, columns and tables across machines
- Client controlled replication and data placement
- Synchronous replication and external consistency, the strongest form of consistency any database can support
- SQL like interface
- Supports storage of typed data
- Supports semi-relational structure for tables
- Configurable backups and restore mechanisms
- Verifiable legder for transactions.

## 2. Background and Related Work

- Illustrate existing approaches and their shortcomings.
- FileSystems or file-level semantics: IPFS, FileCoin. Storj.
- Bluezelle.
- Blockchains that offer faster transactions.
- Storing data on the cloud. AWS. GCE.

## 3. Overall Design

- Overall Picolo architecture.
- Token economics.

## 4. Network Subsystem

- DHT layer for lookup. Replication and caching for O(1) lookups for popular items.
- Token economics for incentivized participation.
- Building with BFT.

## 5. Database Subsystem

*5.1. Cluster*
*5.2. Versioning*
*5.3. Consensus, Replication and Token economics*
*5.4. Handling Failures*
*5.5. Recovery from failures*
*5.6. Clients*
*5.7. Query execution*
*5.8. Sharding*
*5.9. Transactions and hybrid time*

| **Treatments** | **Response 1** | **Response 2** |
|---|---|---|
| Treatment 1 | 0.0003262 | 0.562 |
| Treatment 2 | 0.0015681 | 0.910 |
| Treatment 3 | 0.0009271 | 0.296 |

Table 1: Table caption

$$e = mc^2 \tag{1}$$

Some factors that affect prices of cryptos are listed below. These factors are by no means exhaustive but provide a framework within which mechanisms to analyze them can be discussed. See the sub sections where some techniques are presented. [1] Factors affecting the prices of crypto assets:

## 6. Verifiable data structures, encryption, data sovereignty

## 7. Attacks on the system

## 8. Conclusion

Initial implementations of AI algorithms that analyze structured and unstructured data are discussed. Unstructured data is analyzed in two steps: first, at a unit level and second as a sequence by feeding it to an LSTM. Structured data consisting of live feed from exchanges, current and past bets on the platform amongst others is represented as a game state where an independent decision making agent learns to take actions that maximize its game score. A method of determining payouts to platform users is discussed where they are determined by the magnitude as well as the category of contribution.

## 9. References

[1] Adi Kancherla and Arunesh Mishra. Picolo: Fast, decentralized globally distributed database network. `https://picolo.network/Whitepaper.pdf`.