OORT[1]: Privacy First, Cost Conscious

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I. EXECUTIVE SUMMARY

1) Who Is OORT:

OORT is a decentralized cloud designed for data privacy and cost savings. By integrating global compute and storage resources, OORT provides AI solutions to enhance business operations

2) Opportunities:

The demand for affordable computing power is skyrocketing in emerging fields such as AI-generated content (AIGC), Web3, and the Metaverse. Computing power is becoming the "oil" of future human society. Meanwhile, with growing concerns about data privacy, applications will increasingly focus on ensuring users' privacy in data storage and processing. Thus motivated, a decentralized data infrastructure with enterprise performance is needed to address the above two demands.

3) Solution Summary:

The OORT solution comprises two essential layers: the decentralized infrastructure layer and the generative AI builder platform. The infrastructure layer encompasses a global infrastructure with an innovative three-tier node architecture. This architecture enables performance comparable to AWS, supporting exceptional data storage, integration, processing, and analytics services. Operating over a decentralized network, this layer ensures privacy and unparalleled cost savings. Meanwhile, running on the OORT intfrastructure layer, the generative AI builder platform allows businesses to incorporate factually accurate, versatile, and secure AI into their operations in minutes. The OORT solution empowers various Web3 applications such as Game-Fi, Social-Fi, DeFi, NFT, and Web2 applications to build and scale their operations effortlessly.

4) Products:

   a) OORT Storage: Decentralized and enterprise-grade object storage with unparalleled privacy and up to 80% cost savings.

   b) OORT Compute: Decentralized compute engine that empowers machine learning and all types of data processing functionalities with remarkable cost efficiency.

c) OORT AI: a generative AI agent builder platform, allowing businesses to seamlessly incorporate factually accurate, versatile, and secure AI into their operations in mere minutes, not months. No coding or AI specialists are needed.

5) Project highlights:

a) Technical advantage: Continuous research and development since 2018. Core technologies backed by academic publications and two U.S. patents.

b) Multi-million revenue since November 2021.

c) Strong execution team with core members from world-renowned organizations, such as Columbia University, Qualcomm, AT&T, J.P. Morgan, etc.

d) World-recognized clients/partnerships: DELL, Lenovo, Tencent Cloud, Alibaba Cloud, Binance, Cardano, etc.

e) Top-notch advisory board: Dave Mollenhoff (co-founder & ex-CTO of salesforce.com), Kevin Henshaw (COO & President of Together Labs), Mitch Kennedy (Dell Global Loyalty Strategy Lead), Steve Liu (Professor at McGill Unviersity, Fellow of the Canadian Academy of Engineering.), etc.

II. INTRODUCTION

The emergence of Web3, Metaverse, AIGC and more cutting-edge technologies marks a historic turning point. Users become more eager for:

1) Low-cost, massive & accessible computing power

   The demand for affordable computing power is skyrocketing in emerging fields like Artificial Intelligence Generated Content (AIGC), Web3, and Metaverse. Computing power is the "oil" of future human society. Projections for global cloud services market growth are $596B by 2027 with 14.6% CAGR. AI/ML market size over the next five years is projected at $200+ by 2027.

2) Data privacy & security

   With the growing concerns about data privacy and regulations, applications will focus on ensuring privacy in data processing and storage. The concentration of sensitive data makes it an attractive target for cyberattacks and data breaches. A single point of failure creates vulnerabilities, potentially leading to widespread service disruptions and data loss.

However, cloud service providers like AWS, Azure, and Google Cloud have many limitations in costs, data privacy, security, sovereignty, and transparency due to the "Nature of Centralization." OORT is leading the change. OORT's decentralized data infrastructure ensures absolute data privacy and significant savings. In addition, OORT provides an AI-powered data interaction experience, redefining the data cloud for the next generation.

A. Technical Challenges

Before realizing our vision of revolutionizing the data infrastructure, we need to overcome a handful of challenging but conquerable obstacles, as discussed below.

1) Not user-friendly

   Usability is a critical prerequisite to mainstream adoption. But the fact of the matter is that Web3 is simply not user-friendly. The vast majority of the world's population would find onboarding alone difficult, annoying, and off-putting – to say nothing of actually using the decentralized web. Web3's complicated user experience has prevented people outside of the crypto community from seeing how Web3 can actually generate revenue, benefit the world, and simply make life easier. We need a set of tools that simplifies the current workflows in the decentralized world and facilitates new workflows, so that Web3 is no longer limited to trading. Web3 should be able to cover all of the needs of all of its users.

2) Enterprise-grade performance

Enterprise-grade performance is vital to a useful decentralized data cloud. To compete with traditional data cloud services, Web3 data cloud must have Web2-comparable capacity and performance (e.g., scalability, latency, durability, and availability) to handle enormous volumes of data with guaranteed privacy. For instance, video-streaming and other data-intensive applications hosted on decentralized networks will need to store and retrieve cold as well as hot data (respectively, data that's seldom accessed and frequently accessed data stored in a database) to facilitate frictionless user experiences. Currently, decentralized networks can't host hot data at the internet scale. This is a serious problem. Clients and users across industries and domains need on-demand, reliable access to data in real-time. No support for hot data means no video streaming or other kinds of content delivery where speed is everything.

B. OORT overview

Begun as a university research project in 2018, OORT is founded on the conviction that Web2 users will start migrating to Web3 en masse once the above problems are solved.

OORT is a decentralized data cloud platform that maximizes privacy and cost savings by integrating global computing and storage resources. It provides enterprise-grade decentralized cloud-based solutions for generative AI and data-driven businesses. OORT is realizing this goal via its two layers: the decentralized infrastructure layer and the AI builder service layer. The details of the two layers will be presented in the following sections.

The three OORT products are:

1) OORT Storage: Decentralized and enterprise-grade object storage with unparalleled privacy and up to 80% cost savings.

2) OORT Compute: Decentralized compute engine that empowers machine learning and all types of data processing functionalities with remarkable cost efficiency.

3) OORT AI: a generative AI agent builder platform, allowing businesses to seamlessly incorporate factually accurate, versatile, and secure AI into their operations in mere minutes, not months. No coding or AI specialists are needed.

Some sample business solutions that are built upon OORT products are:

1) Decentralized web hosting: make websites resilient to power outages, server crashes, data breaches, and censorship.

2) Intelligent personal cloud drive: Securely store, share and manage files with guaranteed privacy.

3) AI assistant: LLM-powered chatbot tailored to individual and enterprise data, privacy guaranteed.

4) Blockchain data warehouse: unlock the unlimited potential of Web3 data with unified on-chain and off-chain data.

5) Data Availability Layer for Blockchains: store stale blockchain data, layer-2 rollup data, and backup block data.

6) Data market: NFT-based data markets on blockchains.
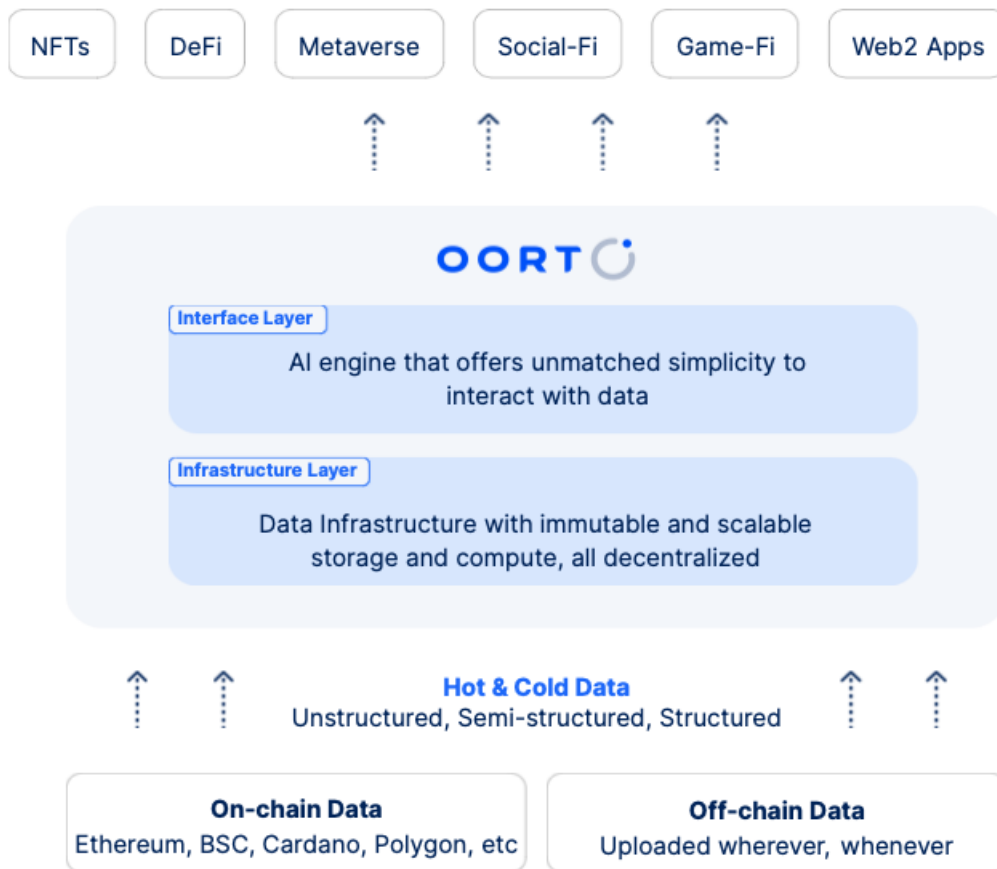
Fig. 1: OORT two-layer architecture: infrastructure layer and AI builder service layer (aka. Interface layer)

III. OORT SYSTEM ARCHITECTURE

OORT's system architecture is shown in Fig. 1. It consists of two layers: decentralized infrastructure layer and AI builder service layer. In this section, we present some technical details about this two-layer architecture. A more technical system architecture is shown in Fig. 2.

A. Decentralized infrastructure layer

The objective of the infrastructure layer is to build a global decentralized infrastructure with AWS-comparable performance (otherwise, no possibility of massive adoption). This layer is the foundation for the data cloud. To achieve AWS-comparable performance, we designed an innovative three-tier node architecture: super nodes, edge nodes, and backup nodes.

- super node: public and private cloud servers which have superior storage and compute power.
- edge node: nodes deployed close to the user that forms a peer-to-peer decentralized edge network (DEN), which is crucial to ensure the scalability of the network.
- backup node: cold-data storage nodes integrated from the existing storage network such as filecoin, storj, crust and arweave.

The OORT Layer-1 Olympus Protocol, operating on the infrastructure layer, seamlessly integrates the three-tier nodes worldwide. Olympus Protocol is an original DAG-based layer-1 blockchain that provides consensus and incentives to geo-distributed infrastructure nodes around the world. One consensus algorithm of Olympus Protocol, the patented Proof of Honesty (PoH), guarantees the authenticity and honesty of these geo-distributed infrastructure nodes, enabling businesses to run applications on a trustless decentralized infrastructure.

In what follows, we briefly discuss the key technologies that empower OORT's superior performance and the growth of OORT ecosystem: *PoH consensus protocol of Olympus protocol*, *interoperability of Olympus protocol* and *advanced coding technologies*.

1) PoH consensus protocol of Olympus protocol: The key to implementing a highly scalable decentralized system is a well-designed resource authentication and management system. Resources typically refers to any physical elements (e.g., bandwidth, storage space) that execute tasks. At first, the resource contributed by the nodes has to be authentic, which is the foundation for any decentralized network. For instance, any virtualization technology that forfeit the capacity
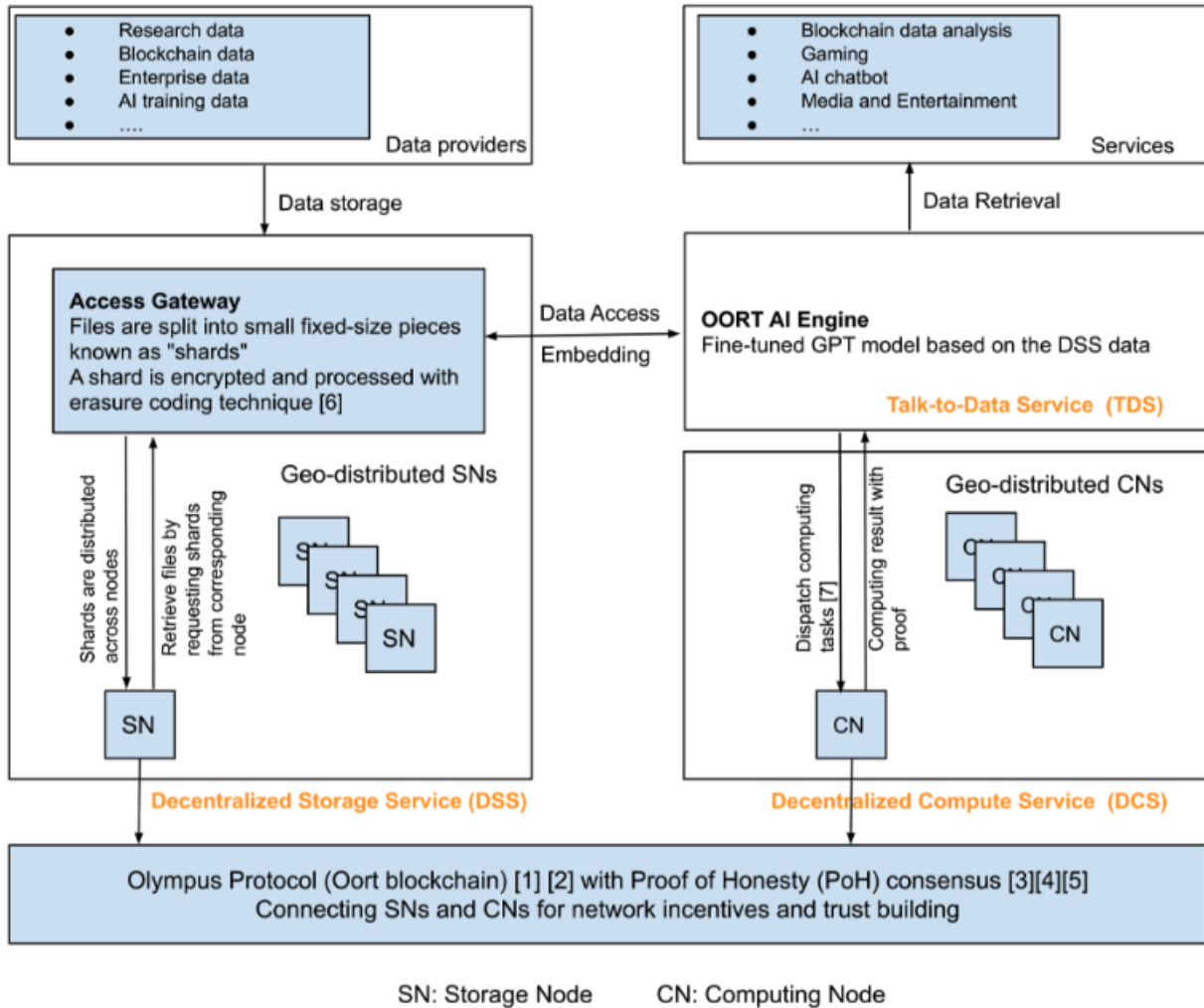
Fig. 2: System architecture. Reference: [1] Open Source: https://github.com/OORT-tech [2] Yellow paper: Olympus Protocol: Consensus and Security [3] Patent: "Methods and Apparatus for Verifying Processing Results and/or Taking Corrective Actions in Response to A Detected Invalid Result", S.N. 16/370,629, April. 6th, 2021 [4] Paper: "Cost-Efficient Hardware Spoofing Detection in Decentralized Shared Computing Network", Submitted to Sigmetrics. [5] Paper: "EntrapNet: a Blockchain-Based Verification Protocol for Trustless Computing", IEEE Journal Internet of Things, 2021. [6] Paper: "Distributed LDPC Coding Scheme for Low Storage Blockchain Systems", IEEE Journal Internet of Things 7 (8), 7054-7071, 2020. [7] Patent: "Methods and Apparatus for Performing Distributed Computing using Blockchain", US16/274,178, Aug. 31st, 2021.

of resources should be disallowed. Secondly, for the sake of efficiency and fairness, resources in a highly scalable system should always be supplied to users with higher utility. However, these are difficult problems in a decentralized environment due to the lack of global information. From a game-theoretic point of view, the nodes will schedule resource based on their local knowledge

and with their best personal interest. Therefore, the outcome can not be socially optimal, thus limiting the network scalability.

To deal with this problem, the OORT team invented PoH consensus protocol, a collection of decentralized algorithms, for resource authentication and allocation. In particular, as one of the first practical solution to the long-standing computer science problem "verifiable computing", the PoH consensus protocol first verifies that no nodes are cheating on the resource they contribute. Next, the PoH consensus incentivizes the selfish nodes to act as to optimize the social goals. For example, in the case that a node receives a file downloading task, a block (a group of transactions) in the PoH consensus protocol is generated once all the pieces (one transaction for each file piece transfer) of the file are received by the node. The reward will be proportionally shared by the nodes who contributed the pieces. With PoH consensus, the nodes are incentivized to cache frequently accessed files in proximity and to be deployed in a zone with high and reliable bandwidth. If all nodes were independently working towards this goal, the network topology and the scheduled contents will be optimized in a decentralized manner.
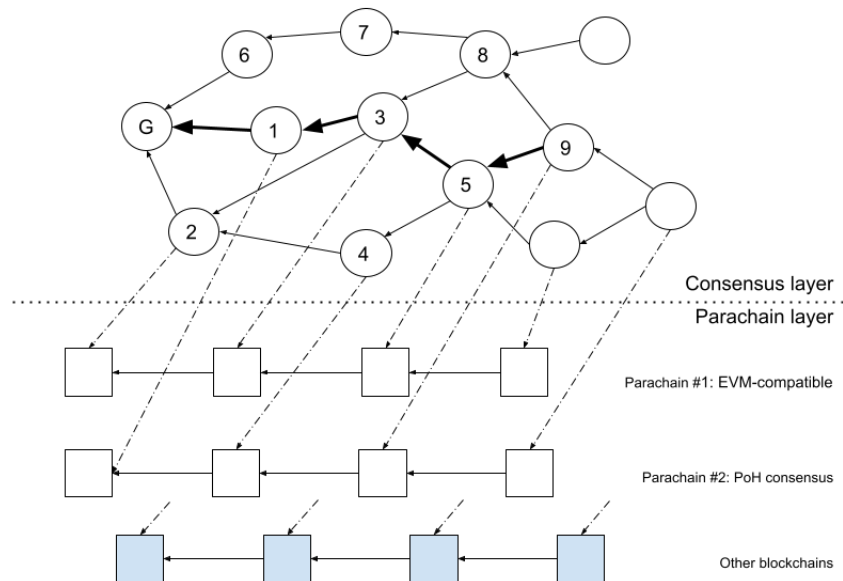
Fig. 3: Chain interoperability in Olympus

2) Interoperability of Olympus protocol: Olympus protocol is designed to support chain interoperablity, which enables OORT to integrate Layer 1 Web3 storage protocols such as Filecoin and Arweave easier, and partner with most of the Layer 1 public blockchains for freely data

transfer in applications.

Chain interoperability in Olympus protocol is achieved by its unique data structure of the ledger, as shown in Fig. 3. Olympus protocol is split into two layers - the *Consensus layer* and the *Parachain layer*. The consensus layer runs the top consensus of Olympus, which is a low-complexity and low-latency type of BFT consensus. The reader should read the Olympus yellowpaper to learn more about the consensus layer. For now, the parachain layer contains two Olympus' native chains, one is an EVM-compatible chain to allow developers migrating and deploying Ethereum smart contracts in OORT with zero learning curve, and the other is a chain implementing the PoH consensus protocol. Blockchains with different consensus algorithm, such as Binance Smart Chain, Solana, Filecoin, Arweave etc., can be added to the parachain layer.

The messages in the consensus layer are called *blocks*. A block connect to previous blocks and forms a DAG. The Olympus consensus determines a linear order of the blocks, though they are tangled. The order of the blocks are marked on Fig. 3 as an example. Each block in parachains is linked from a block in Olympus, and then the order of the transactions among the parachains are subsequently determined, which is the fundamental step of implementing chain interoperability.

To understand how the chain interoperability can benifit OORT, on one hand, the cross-chain feature allows OORT to adopt any popular payment methods in the crypto space. OORT users don't have to be aware of the existence of different tokens in different Layer 1 protocols. The tokens will be automatically purchased and consumed by the cross-chain protocol in Olympus. On the other hand, the cross-chain feature enables the developers to build applications on Web3 data in a much broader scope. Data as an important asset in Web3 can be easily transferred or exchanged across different blockchains in OORT. Many novel applications, such as Web3 data marketplace and data warehouse, will be built by developers as they explore the infinite opportunities brought by OORT.

3) Advanced coding technology: When a user wants to upload a file to OORT, the file is split into small fixed-size pieces known as "shards". The total number of "shard" is determined by the size of the file. Each shard is encrypted using client-side encryption AES-256, ensuring that only the file owner can access the content. After encryption, the file is processed using a technique called erasure coding such as polar code and LDPC code. This process generates additional "parity" shards, which provide redundancy and allow the file to be reconstructed even if some shards are lost or unavailable. These shards (both the original and the parity ones) are

then distributed across OORT decentralized infrastructure nodes. The shard IP-based distribution is recorded in the decentralized database system in OORT. When the user wants to retrieve their file, the client-side application requests the shards from the corresponding nodes by querying the database. As the result of the erasure coding technology, the file can be reassembled and decrypted even if some shards are not available due to node failure or network congestion. This significantly improves the reliability and availability in a unstable decentralized network.

B. AI builder service layer

OORT AI revolutionizes the way individuals interact with their data, particularly targeting non-technical users. Similar to the GPT model, OORT AI provides a user-friendly conversational AI builder platform that simplifies data management and interaction. By integrating OORT AI into the business, the user experience of using generative AI is redefined to a straightforward process: "upload your data, converse with your data."

OORT AI is constructed based on its own fine-tuned large language model, derived from the open-source Large Language Model (LLM). Extensive research and implementation efforts have been dedicated to optimizing OORT AI, ensuring both cost-effectiveness and high-performance scalability. The scalability of OORT AI addresses potential concerns related to cost and performance.

The three key features of OORT AI are as follows:

1) Customization: OORT AI takes customization to new heights, using your data to cater to your unique needs. This breakthrough approach opens up fresh possibilities to extract the most value from your data, aligning with our vision of a decentralized data economy.

2) Data Sovereignty: With OORT's unique decentralized infrastructure, we prioritize data ownership. Here, your data isn't just securely stored, it's rightfully yours, driving our mission to revolutionize human-to-data interaction.

3) Community at its core: Experience the power of community. Empower your business by drawing on high-quality data from your users to elevate OORT AI capabilities. Incentivize community contributions and build a secure, customized chatbot for your business.

IV. COMPETITIVE LANDSCAPE

So far, no company has positioned itself as a decentralized data cloud while offering the same services as OORT. OORT's offerings overlap with both Web2 and Web3 cloud infrastructure

companies. Web2 companies include AWS, Google Cloud, Azure, and others. Web3 companies encompass Filecoin, Dfinity, and more. However, OORT distinguishes itself as an AI-focused decentralized cloud. Its services are highly concentrated on cost savings and privacy. OORT provides enterprise-grade decentralized cloud-based solutions specifically tailored for generative AI and data-driven businesses. Below is a table illustrating the competitive landscape

V. BUSINESS MODEL

A. Who are the clients?

OORT offers comprehensive data cloud solutions that cater to a wide range of clients, both in the Web2 and Web3 domains, regardless of their size. As the Web3 community is still in its early stages, we have identified two primary client segments that can swiftly generate revenue for us.
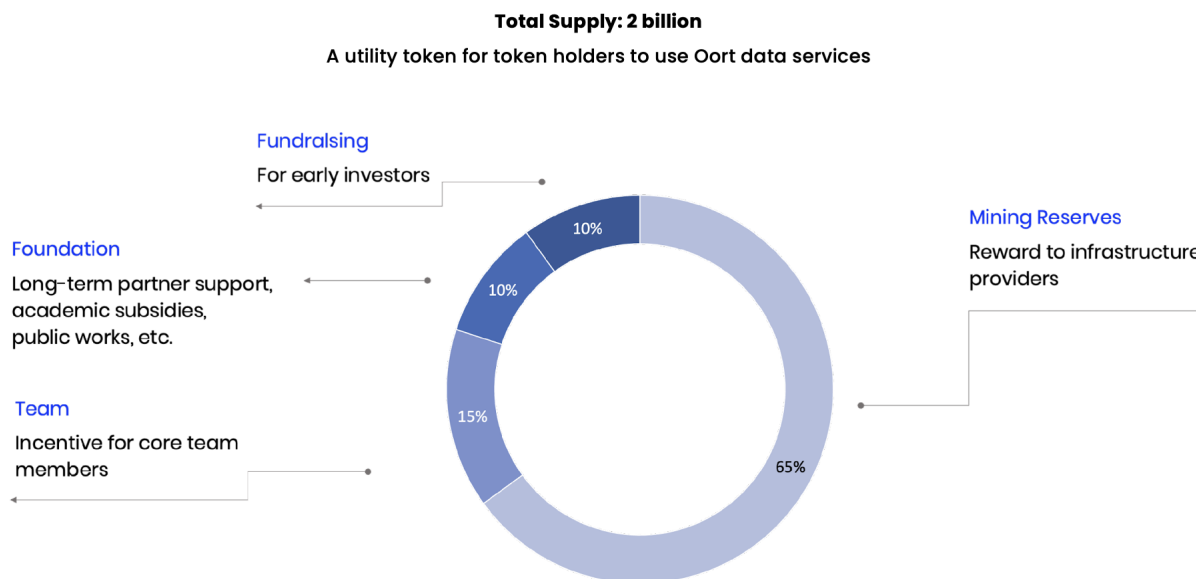
1) Web3-native projects: This category encompasses projects inherently built for the Web3 ecosystem, requiring decentralized data solutions for their web3 products, including project websites and databases. Our experience in acquiring clients from this segment has revealed that the client acquisition cost is exceptionally low, and the onboarding process is rapid and efficient.

2) Web2 enterprises transitioning to Web3: These companies are highly motivated to expand their business operations into the Web3 realm. The educational cost associated with these clients is relatively lower compared to those with little knowledge of Web3. Our focus is primarily on small to medium enterprises (SMEs) that often face challenges in receiving adequate support from traditional cloud service providers like AWS. SMEs, being cost-sensitive, are unable to benefit from the same level of discounts offered to larger enterprises by AWS. Leveraging our founding team's established track record and reputation, we are in a favorable position to secure these clients.

B. The Revenue Model

1) Service Fee: Our primary business is to provide a comprehensive data cloud and one-stop generative AI solutions to meet the specific needs of the clients. We will offer pay-as-you-go and subscription pricing in the suite of OORT products to our clients. The price is on average $50\% - 80\%$ off compared to that of AWS. The big savings come from

leveraging under-utilized resources in the infrastructure layer and the optimized utilization of the three-node architecture for any application.

2) Licensing Fee: The providers, nodes in our decentralized network, are charged an annual licensing fee for their connection to OORT. Note that the benefits they earn from providing their resources to our network will be far greater than the licensing fee.

Total Supply: 2 billion
A utility token for token holders to use Oort data services

Fundralsing
For early investors

Foundation
Long-term partner support, academic subsidies, public works, etc.

Team
Incentive for core team members

Mining Reserves
Reward to infrastructure providers

10%

10%

15%

65%

Fig. 4: Token Allocation.

VI. THE TOKENOMICS

OORT utilizes the utility token native to the OORT ecosystem. The utility token is used for service payment, staking, governance. The token allocation is illustrated in Fig. 4.

1) Service Payment: Users can always pay fiat currency (via credit card) for different services in the OORT ecosystem. However, a discount is usually given to the users who use OORT utility tokens for service payments.

2) Staking: OORT offers two ways for token holders to stake tokens:

    a) Stake tokens with staking pools. One can delegate tokens to node providers via OORT bonding pools. Node providers will use staked tokens as mining collateral. As a result, you will receive a share of mining rewards from the provider.

    b) Become a node provider. Stake tokens as mining collateral.

3) Govenance: Governance is one of the primary functions of the OORT ecosystem. Users submit proposals and vote on topics like network parameters, slashing mechanisms, and service fees. A proposal must be submitted with a certain amount of deposit, which is fully refundable once the proposal passes. If the proposal fails to pass, deposits will be distributed to the mining rewards pool for node providers.

The OORT team will use a certain amount of net revenue to regularly buy back and burn its utility tokens to reduce the total token supply on a quarterly basis and thus gradually and continuously increase token value. The token burning cap is 40% of the total token supply.
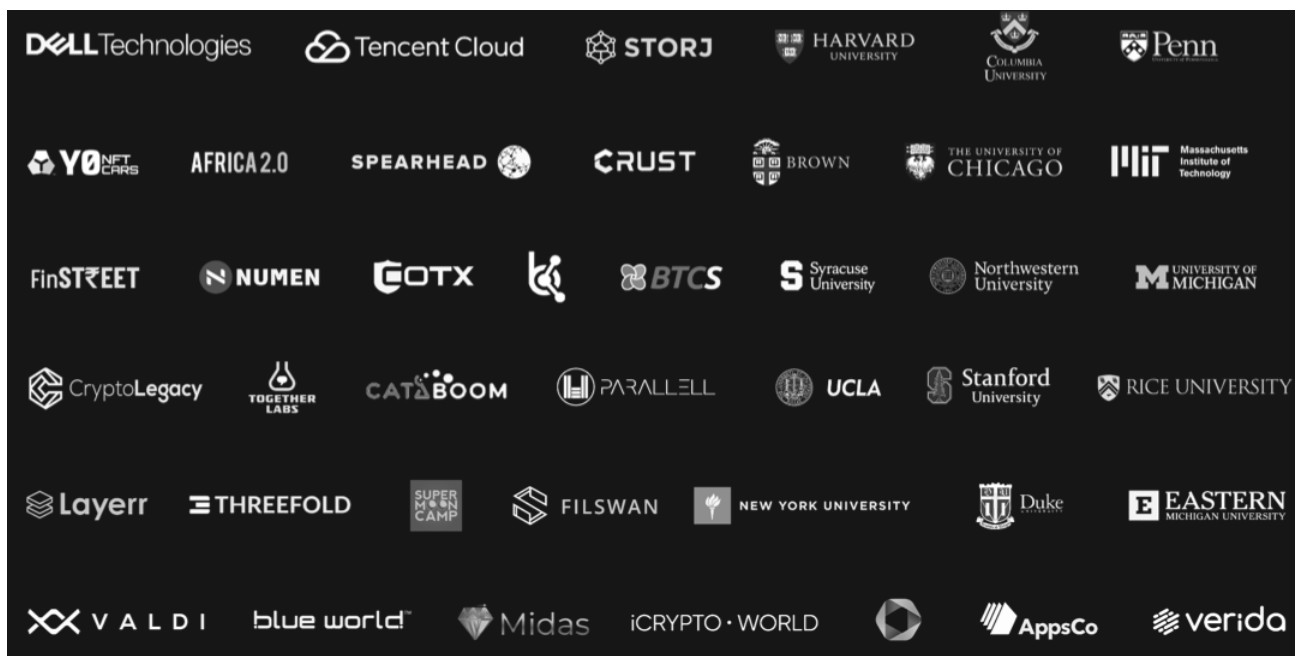
Fig. 5: Selected partners and collaborators.

VII. PARTNERS AND CUSTOMERS

Our team's track record and reputation have helped us build a very strong ecosystem of partnerships and secure world-reputable customers. These partners and customers include top universities in the U.S., legacy Internet giants, innovative Web3 projects, data centers, and media platforms around the world. Our partnerships and early customers have significantly enhanced our branding, user acquisition, fundraising, and system development. Below are some samples of our partners and customers:

1) Lenovo (Customer)

Lenovo Image has integrated OORT TDS solutions into its products to enhance its customer service. OORT solution will be extended to Lenovo's core PC business very soon. Annual PC sales are 60 million units.

2) Dell Technology (Partner/Distributor)

DELL & OORT loyalty program launched on July 7th, 2023. This program will promote OORT products to 10+ million small and medium companies.

3) Tencent Cloud (Partner/Distributor)

Tecent Cloud data center has joined OORT infrastructure network as OORT's super nodes. OORT products have been promoted to the Tencent Cloud ecosystem.

4) Alibaba Cloud (Partner/Distributor)

Integrate OORT products into AliCloud marketplace for their 4+ million customers in Asia.

5) Binance BNB Chain (Partner/Distributor/Customer)

Binance BNB Greenfield (a decentralized storage protocol) has integrated OORT decentralized cloud solution, as a service provider, to empower BNB ecosystem projects. In addition, OORT has been a cloud service provider for BNB ecosystem.

Fig. 5 shows the ecosystem of OORT partnership.

VIII. Publications

Academic Papers:

1. C. Li, L. Zhang and S. Fang "EntrapNet: a Blockchain-Based Verification Protocol for Trustless Computing", IEEE Journal Internet of Things, 2021.

2. H. Wu, A. Ashikhmin, X. Wang, C. Li, S. Yang and L. Zhang, "Distributed LDPC Coding Scheme for Low Storage Blockchain Systems", IEEE Journal Internet of Things 7 (8), 7054-7071, 2020.

3. "Cost-Efficient Hardware Spoofing Detection in Decentralized Shared Computing Network", Submitted to Sigmetrics.

Patents:

1. C. Li, L. Zhang and S. Yang, "Methods and Apparatus for Performing Distributed Computing using Blockchain", US16/274,178, Aug. 31st, 2021 (Granted).

2. C. Li, L. Zhang and S. Yang. "Methods and Apparatus for Verifying Processing Results and/or Taking Corrective Actions in Response to A Detected Invalid Result", S.N. 16/370,629, April. 6th, 2021 (Granted).

Built by innovators, for innovators.