STASpace White Paper

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Abstract

STASpace is a decentralized cloud computing platform built on blockchain technology.

It allows individuals and businesses to rent out their unused computing resources in exchange for cryptocurrency payments, creating a more cost-effective and sustainable alternative to traditional cloud computing services.

STASpace's unique reward system incentivizes node owners to provide reliable services and maintain the network, while also providing benefits to STA coin holders. The platform's staking mechanism allows coin holders to earn additional rewards by locking their coins and participating in network validation.

STASpace aims to disrupt the cloud computing industry by providing a secure, transparent, and decentralized solution that benefits both users and providers.

1   Introduction

The backbone of the internet infrastructure is controlled by cloud compute providers that process and store essentially the entire world's data.

With a handful of providers gaining more share each year, the cost of compute will only continue to rise, reducing the number of services that can operate.

To address this, STASpace takes a distinct approach by utilizing spare unused compute across the globe to build a scalable distributed compute system that presents itself to users as a unified entity.

With centralization, the need for redundancies also spreads, which increases costs and resources. These weaknesses can be avoided by utilizing spare unused compute across the globe.

It's essential to have the system with unified interfaces and coherent behavior, providing a single entry point for the end-users' interactions similar to how cloud providers operate today.

With STASpace, you can harness the power of CPU, GPU, storage, and traffic resources from STA nodes across the world to tackle compute-heavy tasks.

By utilizing your spare hardware, it's possible to generate income by acting as a host and renting out your CPU/GPU or traffic.

The hardware required for this can range from basic, low-performance devices or inexpensive VPS to advanced mining rigs and carrier-grade servers located within data centers.

STASpace's features and goals:

- Utilize a powerful of Hybrid 51% attack proof blockchain to increase transparency.

- Provide easy-to-use interface for describing nodes and executing tasks and marketplace for renting computer focusing on GPU instances

- Provide infrastructure to deploy applications and databases mostly close to end-users

- Implement a VPN marketplace using popular VPN technologies

- Implement distributed data storage and use it as a backbone for CDN service

- Increase STASpace accessibility globally

STASpace's focus:

- Machine Learning

- CGI rendering

- Digital image processing

- Scientific modeling

- Data storing and distributing

- VPN technologies

- Other tasks/fields which require massive computation power to get be solved

2 Architecture

The following picture shows the core components and interfaces
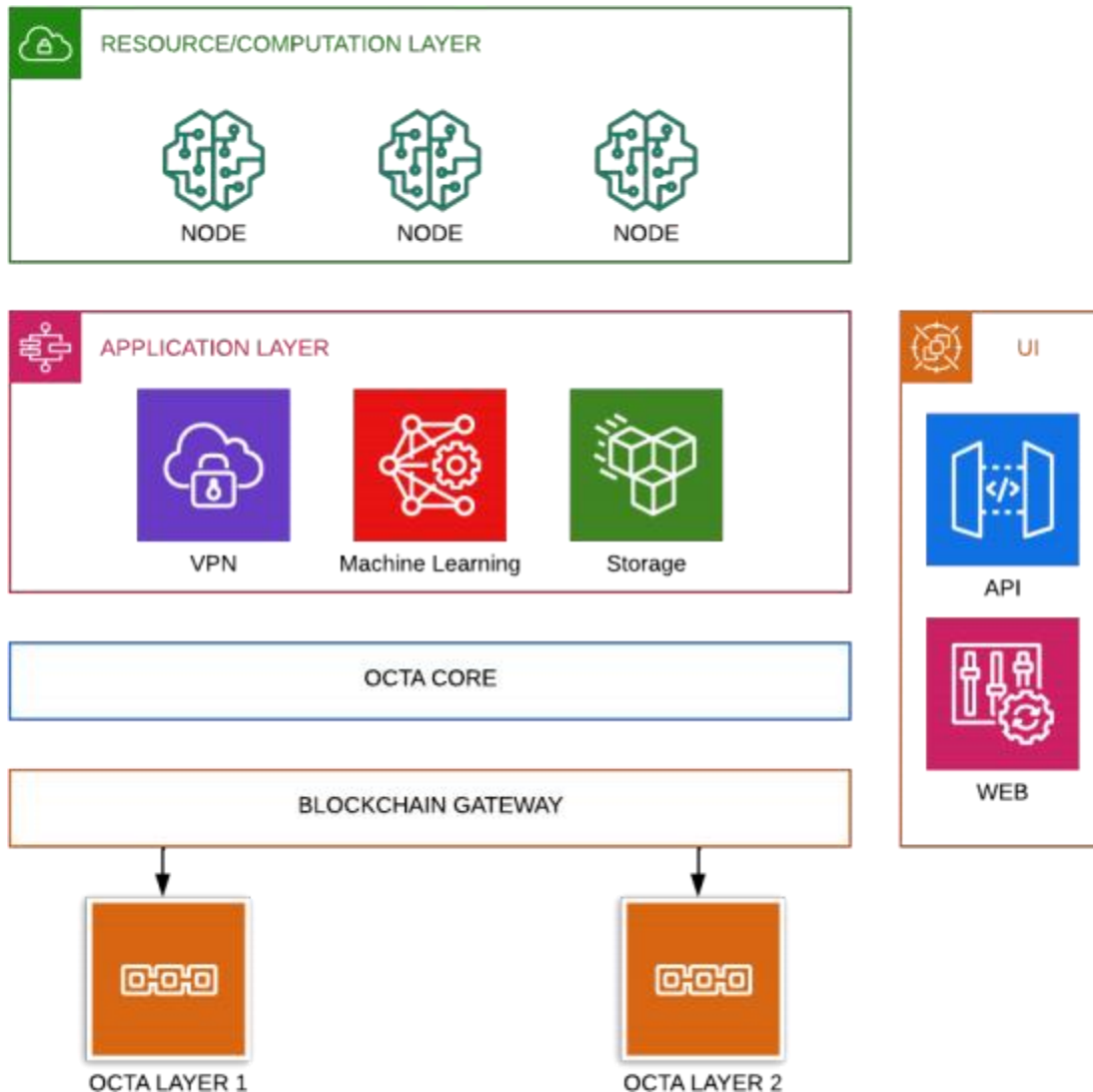
Figure 1: High Level Architecture

2.1 Blockchain

STASpace employs a multi-layered blockchain system to provide a secure and efficient platform for users.

At its core is a Layer 1 PoW blockchain, secured using the pirl 51% guard technique, which provides robust protection against network attacks. In addition, STASpace uses a Layer 2 PoA blockchain, based on validators, to speed up transactions for billing operations without compromising the security of the Layer 1 blockchain.

By using this Layer 2 PoA blockchain, STASpace can process a high volume of transactions quickly and efficiently for billing operations such as charging users for the services they have used.

The platform's innovative blockchain architecture demonstrates its commitment to providing a secure and stable platform for its users, while ensuring fast and efficient billing transactions. Overall, STASpace's blockchain infrastructure is a testament to its focus on security and efficiency, providing a reliable and scalable solution for distributed computing.

2.2   Layer 1 network

STASpace's Layer 1 network is Proof-of-Work (PoW[8]) blockchain used for frontend user financial operations using the native coin STA.

Network based on go-ethereum[4] codebase with the following specification:

- Block time is 15 seconds

- Total supply is 48_000_000 coins

- Block reward and halving implemented according to Monenary policy

- PirlGuard is used as protection mechanism from 51% attack

- Transaction fee is 21 Gwei

To ensure a fair and transparent network without any premine or presale, STASpace designed its network with an equitable distribution of rewards. The genesis difficulty was set at 100Gh, preventing the instant allocation of rewards

2.3   Layer 2 network

STASpace employs a Layer 2 PoA network that serves as a side chain for the Layer 1 network.

This PoA network is used for internal transactions related to the node services and is supported by a set of validators.

The Layer 2 network is designed to handle high-frequency, high-usage operations with lightning-fast performance and seamless operation. This translates to reduced operational costs, speedy transactions, and a massive boost in charging operations throughput for STASpace.

By utilizing this Layer 2 PoA network, STASpace can ensure fast and efficient processing of internal transactions, allowing for a smoother user experience and improved overall platform performance.

2.4   Blockchain gateways

STASpace Blockchain Gateways provide a unified API for the STA CORE layer to work with both blockchain networks.

The gateways' API is private and not accessible from outside the STASpace platform.

2.5   STA CORE and Application Layer

The STA CORE and Application Layer serves as the engine of the system, seamlessly handling all requests for compute rentals and providing an interface for creating services on top of resources provided by nodes.

It communicates with the nodes and user applications, making it effortless for users to access and use the resources.

Other core engine operations of the STA CORE and Application Layer include:

- Communicating with nodes, monitoring and low-level interaction

- Handle requests for computing resources

- Provide interface for creating services on a top of resources provided by nodes

- Services usage charging and billing operations

- Provide API for automation or integration with third party systems

- Implementing fraud control

- Generating statistics and telemetry of system usage

2.6   Resource Layer

STA Chain is a powerful blockchain network, but the primary goal of the project is to provide practical applications and to bridge the gap between those who have computational resources and those who need them. This is where STA nodes come in.

This layer consist of hardware(nodes) connected to the STASpace cloud.

These hardware nodes are connected to the STASpace cloud and form the foundation of our compute and services marketplace, providing the necessary computational power to meet the demands of various tasks and services.

The nodes are equipped with a blend of CPUs, GPUs, memory, and disk space that allows them to handle distributed workloads with ease. STASpace seamlessly connects these nodes together to deliver optimal performance and efficiency.

Machines with powerful GPUs can perform AI/ML tasks, while common machines can act as VPN gateways or provide disk storage for services like file sharing or host applications deployed by users.

2.7   API and UI

The following interfaces are available for interacting with the system:

- Web applicaton with user-friendly interface accessible at https://cube.STA.space

- RESTful API

- An **STActl** command-line utility that provide user friendly interface to RESTful API

3 Nodes

A node is a Linux machine with special software installed, called ORC, which enables STA CORE to establish a secure communication channel with the node.

The communication between **STA CORE** and **ORC** is done in an RPC[9]-like manner, and a secure channel is implemented using the HTTPS[5] protocol, with each request being validated using a security token.
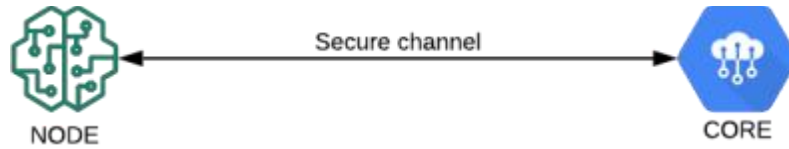

Figure 2: Secure communication channel

ORC is responsible for the following activities:

- Detecting installed hardware suchas CPU, GPUs, RAM, volume of disk storage

- Collecting metrics about hardware usage, suhc as free/used disk/ram space, CPU and GPU load, temperature and fans speed

- Manage Docker[2] containers and Firecracker[3] microVMs

There are two types of nodes: **blockchain** and **service**

The blockchain node supports the STA Layer 1 blockchain by running network node software, which makes the network more stable, distributed, more latency fair, and speeds up synchronization.

The service node provides resources that are used to implement services for end-users.

3.1 Hardware and software requirements

To cover a wide range of supported hardware, node software can be installed on any machine with x86_64[11] or ARM[1] architecture.

In order to run the node, the hardware must meet the minimum system requirements, which are as follows: 1 CPU, 1 Gb of RAM, and 10Gb of free disk space.

However, the requirements for hardware may vary depending on the intended purpose of the node. For instance, a node that provides only VPN services may only need to meet the minimum requirements. Conversely, nodes that are designed to perform AI/ML tasks will require powerful GPUs connected with a high bandwidth PCIe interface, as well as ample disk storage.

It's worth noting that both NVIDIA and AMD GPUs are supported by the system.

To determine the performance of a node, the following measurements are taken:

- Network upload/download speed

- Disk write speed

- GPU performance using AI benchmark (only for NVIDIA)

These performance metrics help users to choose the hardware they need for their tasks.

The node software can be installed on any Linux distribution; however, we primarily focus on Ubuntu LTS or Debian as the recommended operating systems.

Windows Subsystem for Linux (WSL) has limited support.

3.2   Security

Security is of utmost importance to us, and we take various measures to eliminate possible security risks for users running our software ORC on their machines.

We follow a set of rules and guidelines to ensure the security of our system, which includes:

- Open-sourcing **ORC**, which allows for audits by other people to ensure that the software does not have any malicious code

- Keeping code base of **ORC** as small as possible for ease of auditing

- Running node software under anon-privileged user and not granting any permissions that are not needed for its operation

- Regular software updates to ensure that the latest security patches are applied. Along with comprehensive testing of software to detect and address any potential security issues

These measures are in place to ensure that our users can have peace of mind when using our system, and their data and resources are secure.

We take the security of our users very seriously and are continuously working to improve our system's security features.

3.3   Verification

Verification is critical to ensuring that the node infrastructure operates smoothly and reliably, which is essential for providing high-quality services to end-users. Every new node that joins the STASpace cloud must be verified and confirmed to meet the necessary requirements to provide services.

Periodic re-verification checks are conducted on verified nodes. It is therefore essential to monitor the status of your nodes to avoid them being changed to an unverified status.

The checks performed to ensure that the node is properly configured may include, but are not limited to:

- Meeting minimum hardware requirements

- Synchronized system clock

- All necessary network ports are open

- Correct installation of the GPU driver

The list of checks will be expanding in the future to ensure even greater accuracy and reliability.

The following restrictions are applied for the unverified nodes:

- Unable to provide services

- Unable to participate in staking staking

4 Services

At STASpace, we are committed to providing innovative and practical services to address the needs of end-users. Our range of services includes solutions for everyday problems, from simple file sharing between friends to performing complex calculations, and more. Our team is continually striving to bring new and cutting-edge services to our users, and we are excited to share some of our existing and upcoming services with you.

Our services have been designed with end-users in mind, and we believe they will have significant practical applications in their daily lives. We are constantly improving and evolving our offerings to meet the changing needs of our users. Our goal is to provide our users with an exceptional experience and to offer services that make their lives easier and more efficient.

4.1 GPU marketplace

STASpace offers a unique GPU marketplace where users can rent or rent out GPU compute power. Our GPU rental service provides users with the ability to leverage powerful GPUs for tasks in AI/ML, CGI rendering, and other fields that require high-performance computing. Our support for both NVIDIA and AMD GPUs expands the range of tasks that can be tackled.

Users can securely access their rented GPU instances through the SSH protocol, and also have the option of using Jupyter[6]and LiveBook[7] systems for interactive access. By combining rented GPU instances into a cluster, users can develop and execute distributed programs. For instance, users can use TensorFlow or PyTorch for distributed training of ML models.

Our aim is to empower users with the resources they need to solve complex problems and accelerate their projects by providing powerful and flexible GPU rental options.

4.2 VPN

STA VPN[10] offers a variety of key benefits to its users. One of the main advantages is its ease of setup, which is made possible by utilizing non-modified and open-source software that is compatible with a wide range of platforms.

Additionally, users have the flexibility to choose from a variety of VPN technologies to suit their needs, including:

- WireGuard
- ShadowSocks
- OpenVPN

There are also no limitations on the number of devices that can be connected simultaneously.

To add to that, the billing model is pay-as-you-go, which means you are billed only for the amount of data you use. This gives you complete control over your usage and costs.

Service don't any logging of the user traffic or DNS requests.

In the future more VPN types will be added, including some to bypass China's golden shield (Great Firewall of China).

With STA VPN, we aim to provide users with a reliable, flexible, and cost-effective VPN solution that meets their specific needs and preferences.

4.3 HashCache

HashCache is a powerful password recovery service that can perform cracking operations on a large scale. The system utilizes multiple nodes that work together in a coordinated way to speed up the cracking process. By dividing the cracking workload among the nodes, HashCache can efficiently crack passwords and perform other related operations much faster than a single machine ever could.

HashCache is highly configurable and can be optimized for different types of cracking operations, including dictionary attacks, brute force attacks, and others. This flexibility enables users to tailor the service to their specific needs, making it an excellent tool for both security professionals and individuals who want to recover lost or forgotten passwords.

Overall, HashCache provides a powerful and efficient solution for password cracking that can help users save time and effort. By harnessing the power of multiple nodes working together, HashCache provides a highly scalable and customizable service that can meet the needs of a wide range of users.

4.4 Distributed Rendering

STASpace offers a distributed rendering service that enables content creators and studios to render massive video edits quickly and economically. This service utilizes the power of multiple nodes working together in a coordinated manner to accelerate the rendering process. By dividing the workload among the nodes, they can work in parallel on different parts of the rendering task, significantly reducing the time and cost required to complete the process.

Our distributed rendering service is highly configurable and optimized for different types of rendering tasks, whether it is video editing or CGI rendering. Our team continually strives to improve the service to meet the changing needs of our users. With STASpace's distributed rendering service, content creators and studios can produce high-quality content faster and more cost-effectively.

4.5 Instant File Sharing

STASpace offers a secure and convenient solution for file sharing through its Instant Secure File Sharing service. This service provides a user-friendly interface for uploading files and generating a short link that can be easily shared with others.

Once the file is downloaded, it is completely deleted, ensuring the confidentiality of your data.

Key benefits of our Instant Secure File Sharing service include:

- Encryption of all files to protect the confidentiality of your data

- The ability to set an expiration date, after which the file will be automatically deleted to ensure your data remains secure

- Simple RESTful API for seamless integration with your existing systems

With our Instant Secure File Sharing service, you can easily and securely share files with others, without worrying about the privacy and security of your data.

5 Monetary Policy

STA is the primary payment instrument and the currency used to pay for the services provided by STASpace, as well as rewards to node owners and dividend payments for STA holders.

In order to maintain stable inflation levels, STASpace implements a finite monetary policy.

The policy consists of a series of eras, each with a set duration and total coin supply. The block reward for each era is gradually reduced, as shown in Table 1, to decrease inflation and ensure a controlled supply of STA tokens.

In summary, the finite monetary policy ensures that the supply of STA tokens remains stable and controlled, while also providing rewards to those who contribute to the network through mining and staking. The gradual reduction of block rewards in each era helps to decrease inflation and maintain a healthy token economy for the long-term benefit of the STASpace community.

Era	Start block	Total	Miner	Staking	Dev
STA	1	8	6.5	0	1.5
Arcturus	650_000	8	5	1.5	1.5
Oldenburg	1_000_000	7.5	4	2	1.5
Zagami	1_500_000	7	3.5	2.5	1
Springwater	2_000_000	6.5	3	3	0.5
Polaris	2_500_000	6	2.8	2.8	0.4
Mahasim	3_000_000	5	2.3	2.3	0.4
Dnepr	4_000_000	4	1.85	1.75	0.4
Blackeye	6_000_000	2.5	1.2	1	0.3
Vega	8_000_000	2.25	1.10	0.85	0.3
Triangulum	10_000_000	2	1	0.7	0.3

Table 1: Reward distribution according to era

This policy should decrease inflation by changing amount of block reward dependents of era.

Era	Start date	End date	Total coins	Duration
STA	Jun 19 2022	Sep 26 2022	5_200_000	≈69 days
Arcturus	Sep 26 2022	Nov 11 2022	2_800_000	≈53 days
Oldenburg	Nov 18 2022	Feb 01 2023	3_750_000	≈75 days
Zagami	Feb 01 2023	Apr 16 2023	3_500_000	≈74 days
Springwater	Apr 16 2023	Jun 29 2023	3_250_000	≈74 days
Polaris	Jun 29 2023	Sep 12 2023	3_000_000,	≈74 days
Mahasim	Sep 12 2023	Feb 08 2024	5_000_000	≈149 days
Dnepr	Feb 08 2024	Dec 03 2024	8_000_000	≈298 days
Blackeye	Dec 03 2024	Sep 27 2025	5_000_000	≈298 days
Vega	Sep 27 2025	Jul 23 2026	4_500_000	≈298 days
Triangulum	Jul 23 2026	May 18 2027	4_000_000	≈298 days

Table 2: Approximate calculation of era timeline and reward distribution

Figure 3: Supply and Daily emissions

6 Staking

STASpace introduces astaking mechanism to incentivize holding of the STA currency. This mechanism allows users to lock a certain amount of coins and run a node to receive rewards. To activate staking, the following requirements must be met:

- Collateral - 100_000 STA

- Node reliability for the last 30 days ≥ 75%

- Node must be verified

To begin staking, you need an address wallet with sufficient funds and link it to an existing node. Rewards will be sent to the provided wallet. However, if the system detects a balance lower than the collateral, staking will be disabled for that wallet-node pair for several rounds.

By staking, users help secure the network and promote its stability. Additionally, stakers have the potential to earn passive income through rewards and dividends.

6.1 Reward distribution scheme

The project's billing period lasts for one week, or seven days.

Assuming that block time is always 15 seconds, the amount of blocks mined would be:

- 1 minute - 4

- 1 hour - 240

- 1 day - 5760

- 7 days - 40320

- 30 days - 172800

We will use the reward amount for the Arcturus and Oldenburg eras to calculate; 1.5 STA from each block goes to the staking fund.

In total, 60480 STA will be mined in 1 week.

Let's say 10 nodes are in operation; the 60480 STA will be shared between them in the following proportion:

- 60% (base reward) - 36240 STA, 3624 for each node

- 20% (gpu reward) - 12080 STA, 1208 for each node which provide renting service with GPU

- 10% (vpn reward) - 6040 STA, 604 for each node which provide VPN service

- 10% (rent reward) - 6040 STA, 604 for each node which provide renting service

If there are no nodes to which 40% of coins (except for the base reward) can be distributed, the coins will remain in the staking fund for the next round.

The most profitable scenario is to have a node with a GPU that provides both services. Such a node will receive 6040 STA per week, as well as additional payments for service usage.

Using the current scheme, we can calculate a minimal monthly return on investment (ROI) as follows:

$$ROI = \frac{MonthReward/Collateral * 100}{N} = \frac{M}{100} * 60$$

Where **MonthReward** is 172800 blocks multiply by staking reward according to current era.

N is amount of nodes participated in staking, for example 10.

Therefore the minimal ROI for Arcturus and Oldenburg eras will be:

$$ROI = \frac{172800/100000 * 100}{10} = \frac{17.28}{100} * 60 = 10.36\%$$

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