Impossible Cloud Network

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Litepaper
(v1.0)

Impossible Cloud Network:
A Decentralized Cloud Ecosystem

Abstract

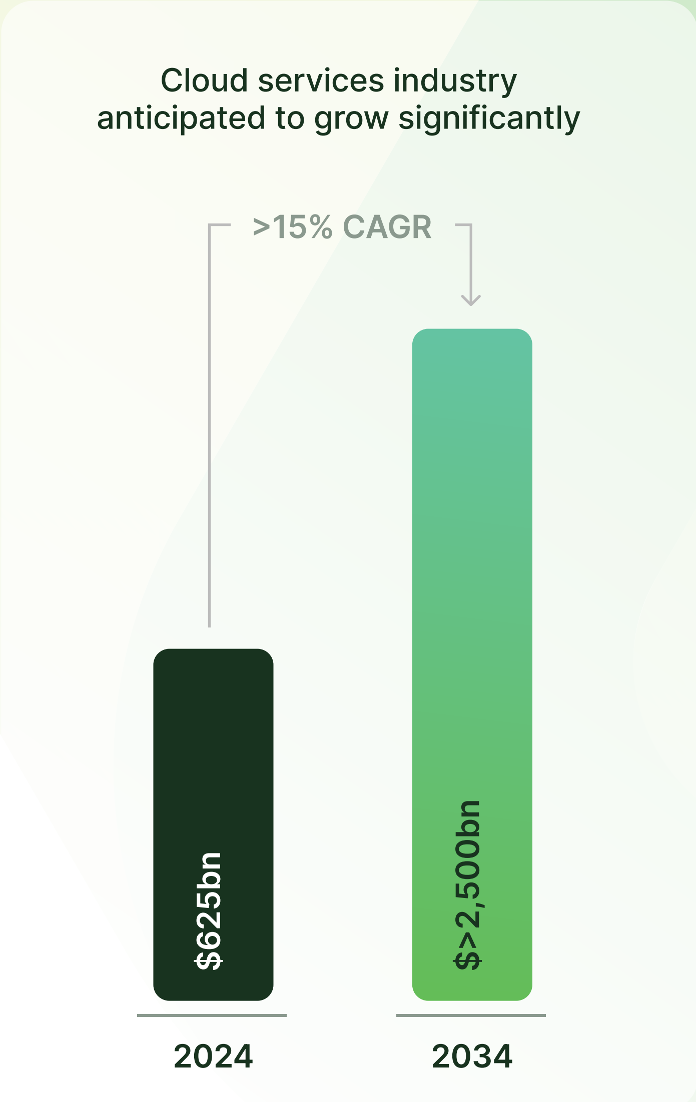
The current cloud services market faces significant challenges, including centralization, high costs, vendor lock-in, and data security concerns. Impossible Cloud Network (ICN) proposes a decentralized solution to these issues by leveraging blockchain and web3 technologies. ICN creates a scalable, decentralized cloud infrastructure where participants - Hardware Providers (HPs), Service Providers (SPs), and SLA Oracle Nodes - collaborate to enhance network integrity and reliability. The Impossible Cloud Network Protocol (ICNP) orchestrates this ecosystem using a token-economic system that incentivizes contributions and ensures balanced resource allocation. ICN tokens (ICNT) reward HPs and SLA Oracle Nodes, enable SPs to access network capacities, and ensure network reliability through collateral requirements. By promoting technical and economic efficiency and reliability, ICN aims to drive the development of a comprehensive suite of decentralized cloud services, offering a flexible, cost-effective, and secure alternative to centralized solutions

Table of Contents

1.0

A Golden Opportunity in the Cloud

The global cloud services market is anticipated to grow significantly, with projections estimating it will reach $2.5 to $2.7 trillion by 2034.



This growth is driven by increasing enterprise adoption of cloud-based solutions across various industries and the rise of transformative technologies such as generative AI, edge computing, 5G, VR/AR applications, and real-time analytics. Despite this potential, the market is predominantly controlled by a few large corporations, leading to concerns about market control, pricing, and innovation. These issues can be categorized into four main areas:

1. General Market Dominance and Centralization Concerns
2. Customer Challenges
3. Technical and Future Challenges
4. Market Entry Barriers

1.1

1 General Market Dominance and Centralization Concerns

The current cloud service ecosystem is partitioned and controlled by well-resourced tech giants such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP). This oligopolistic environment raises significant concerns:

Concentration of Power

The centralization of power among a few companies limits control and ownership by users and developers. This centralization increases cyber risks and data exploitation concerns, particularly under regulations like the US Cloud Act [1] (applying to all of the abovementioned US corporations) or the Chinese National Intelligence Law. The "if you can, you will" principle applies here, as centralized control enables monitoring, espionage, and censoring of communications, financial transactions, and even de-banking individuals or companies, creating significant risks.

Economic Exploitation

Despite the cloud sector's continuing growth, major corporations have entered an oligopolistic cash-cow stage, dominating the market and setting (high) prices. This leads to high costs for businesses and individual users and perpetuates their market dominance.

Stifled Innovation

Dominance by a few large players stifles innovation, making it difficult for smaller companies to compete or introduce new technologies. This reduces market diversity and limits the dynamic progress essential for a vibrant technological ecosystem.

1.2

2 Customer Challenges

Businesses and individuals worldwide rely heavily on cloud services from major providers but face significant challenges affecting their operations and efficiency.

High costs are a major concern, as users often face escalating cloud budgets due to complex pricing structures and high fees (up to 10x higher compared to decentralized solutions [2], [3]). Most companies have experienced budget overages and a steady increase in cloud and infrastructure costs, which highlights the financial burden imposed by current providers [4]. This financial strain can limit the ability of businesses to invest in other critical areas, impacting their growth and innovation [5].

Vendor lock-in: Current cloud services impose a strong lock-in effect, restricting users' flexibility [6] and hindering their ability to switch to alternative solutions [7]. Data egress fees and the difficulties in moving data create a lack of flexibility, which can further reduche innovation and adaptability, as businesses may find it challenging to leverage newer, potentially more efficient technologies from different providers.

Data security, privacy, and sovereignty: Clients worry about data security and compliance with local regulations like GDPR and the US Cloud Act [8], [9]. To mitigate these risks, many end users adopt inefficient multi-cloud strategies, distributing data across multiple providers and often running their own on-premises solutions. While aimed at enhancing security and compliance, this approach often leads to increased complexity and management overhead, further complicating the cloud environment for businesses.

These issues underline the necessity for a more flexible, cost-effective, and secure cloud ecosystem to meet the diverse needs of businesses and individuals worldwide.

1.3

3 Technical and Future Challenges

Moreover, current centralized cloud architectures face several critical technical and future shortcomings:

World's Transition to Distributed Networks

Data is growing exponentially and predominantly at the edge [10]. This growth at the edge will change the world, as it will inevitably lead to a corresponding demand for storage, nearby compute power as well as a huge demand for distributed networks overall. The underlying effect is often described as "data gravity", the ability of a body of data to attract applications, services, and other data [11]. The reason is simple: Moving computation to the node where that data resides ("data locality"), instead of vice versa, is way more efficient, as it minimizes network congestion and improves computation throughput [12].

Scalability Issues

Rapid growth and technological advancements in the cloud sector demand scalable and flexible solutions. Storing and computing data in distributed networks is much more scalable and current providers will struggle to offer these capabilities [13]. The Bitcoin network currently operates at approximately 660 Exahashes per second (equivalent to over 80,000 ExaFLOPS [14]), which is orders of magnitude more powerful than the world's most powerful non-distributed computer system, Frontier, with 1.7 ExaFLOPS [15]. It also surpasses the combined computing power of AWS and Google [16].

Emerging Technology Demands

AI computing [17] and real-time data enrichment require immediate localized processing, which centralized systems cannot efficiently support [18]. Single points of failure in centralized solutions risk widespread service disruptions during outages. To address this issue, decentralized networks, such as IPFS, have been proposed as off-chain storage for AI models that can be invoked through smart contracts [19].

Energy consumption

In cities like Frankfurt, Germany, data center operators have reported that limited power availability poses significant planning risks [20]. AWS is already restricting power-hungry instances that make use of GPUs in certain locations like Dublin due to power limitations [21]. To avoid this issue, data center infrastructure is often geographically distributed to reduce peak power demand on the local power grid and reduce the cost of ownership [22].

1.4

4 Market Entry Barriers

Although innovation in the cloud market is overdue, disrupting the cloud industry cannot be achieved by a single company or startup.

Incumbents like AWS, GCP, and Azure have created formidable barriers to entry with extensive investments averaging $20-$50 billion annually in their hardware, infrastructure, and data centers.

The spending power and extensive software ecosystems of the current cloud incumbents, commonly referred to as hyperscalers, create significant barriers to entry, making it nearly impossible for new competitors to directly out-compete them. As a result, successful challengers in the cloud market typically focus on niche segments, such as Wasabi for affordable, high-performance storage, CoreWeave for GPU-accelerated compute resources, and OVH for diverse, cost-effective cloud services with a strong European presence. Regulatory intervention to break up these hyperscaler oligopolies is also unlikely due to geopolitical considerations, particularly the ongoing US-China tensions.

2.0

The Problem: The Need for a Collective Approach

A decentralized cloud ecosystem, built and owned by many, could effectively address the challenges mentioned above.

In recent years, projects such as Akash, Filecoin, Fluence, and Dfinity have started utilizing blockchain and peer-to-peer technologies to manage physical infrastructure in a decentralized manner. These initiatives, known as Cloud DePINs (Decentralized Physical Infrastructure Networks), feature distributed hardware ownership and geographically dispersed infrastructure. They leverage blockchain-based incentives and are designed to operate in a trustless manner.

Web3 technologies offer a framework for open-source development, incentivization, and distributed ownership. They promote composability and innovation at the edge, while maximizing control and incentives. DePINs also offer a practical solution for the substantial hardware investments needed to compete with incumbents. A decentralized cloud ecosystem, developed through a collaborative effort can represent a superior approach. As Bill Joy, co-founder of Sun Microsystems said, “There are always more smart people outside your company than within it.”

Despite the potential benefits of web3 technologies, Cloud DePINs have struggled to compete effectively in the cloud marketplace so far. Their services often fail to meet the demands of the majority of businesses and customers. Simply put, most Cloud DePINs are still searching for product-market fit. A comparison between successful AI compute cloud competitors from both web2 and web3 worlds can illustrate how this lack of product-market fit impacts market acceptance: CoreWeave, a web2 company founded in 2017 reported $465 million in revenue for 2023 and anticipates $2.3 billion in revenue for 2024, whereas the Akash Network, a web3 company founded in 2015 self-reported $0.14 million in Q1 2024 as an all-time revenue record.

How can the promising collaborative approach overcome the barriers posed by current centralized cloud architectures and finally build a robust alternative?

To build a successful decentralized cloud ecosystem, we identified five main principles to adhere to:

2.0

Ecosystem vs. Silo

Many DePIN solutions try to build a vertical slice from top to bottom, focusing on specific hardware or a single use case, such as cloud storage or GPU compute. However, a diverse range of services is necessary to attract a broad customer base and build network effects that can disrupt incumbents. An ecosystem approach is more difficult but essential to create a multi-service offering, which, in turn, unlocks enterprise mass adoption. This ecosystem approach leverages the strengths of web3 in collaboration and open-source resources. Interoperability and standardization are needed in many places of this ecosystem.

Starting with Storage

Data gravity and data locality are crucial. Most services require some form of storage, and it is cheaper and more efficient to run services close to their data. Therefore, starting with a robust storage foundation, similar to Amazon's approach, starting with AWS S3 object storage, is critical for building a comprehensive ecosystem. As data accumulates, it becomes increasingly challenging to move, leading to a concentration of computing resources, analytics, and applications in the same location to minimize latency and improve performance. Starting with storage is essential for the success of the ecosystem and it naturally creates demand for further services.

Enterprise Hardware

The enterprise market for cloud services is significantly larger than the consumer market. To win enterprise customers, issues like security, scalability, decentralization, performance, and compliance must be addressed. This requires enterprise-grade hardware operated in high-tier data centers to form the backbone of the network.

Demand Focused and Customer Access

While web3 projects have proven they can scale hardware supply, the demand side is critical. Cloud DePIN projects must prioritize usability, security, and market complexity while understanding and meeting user needs. A demand-focused, user-centric approach is essential to persuade customers to adopt new technology and to ensure the growth and sustainability of the ecosystem. Offering customer access to other ecosystem participants is the essential ingredient to creating the network flywheel.

DePIN Verification Problem

The "DePIN verification problem" refers to the challenges involved in monitoring the reliability and trustworthiness of DePINs. These networks rely on multiple, independently operated hardware nodes to provide services such as storage and computation. Ensuring that these nodes perform their tasks correctly and consistently is critical for maintaining the network's integrity and performance.h

3.0

The Solution: Impossible Cloud Network (ICN)

Based on these challenges, this Litepaper introduces **Impossible Cloud Network (ICN)**, a decentralized ecosystem designed to capture a significant share of the global cloud market by addressing a wide range of customer needs.

ICN operates in **layers** managed by different **participants**, all connected by the **ICN Protocol (ICNP)** and **incentivized in a blockchain-based marketplace.** This marketplace aims to balance hardware supply and cloud service demand, minimizing subsidies and helping service providers find their product-market fit.

The ICNP is a decentralized, trustless protocol designed to revolutionize the cloud services market by integrating various stakeholders into a cohesive ecosystem. Leveraging blockchain technology and the power of the community, ICNP aligns incentives among hardware providers, service providers, and SLA oracle nodes, creating a secure and efficient cloud service infrastructure. This approach not only addresses the challenges of traditional centralized cloud systems but also introduces a scalable and resilient model essential for future technological demands.

3.1

ICN Participants

The Impossible Cloud Network (ICN) takes a layered approach, consisting of a hardware layer, a service layer, and a monitoring layer:

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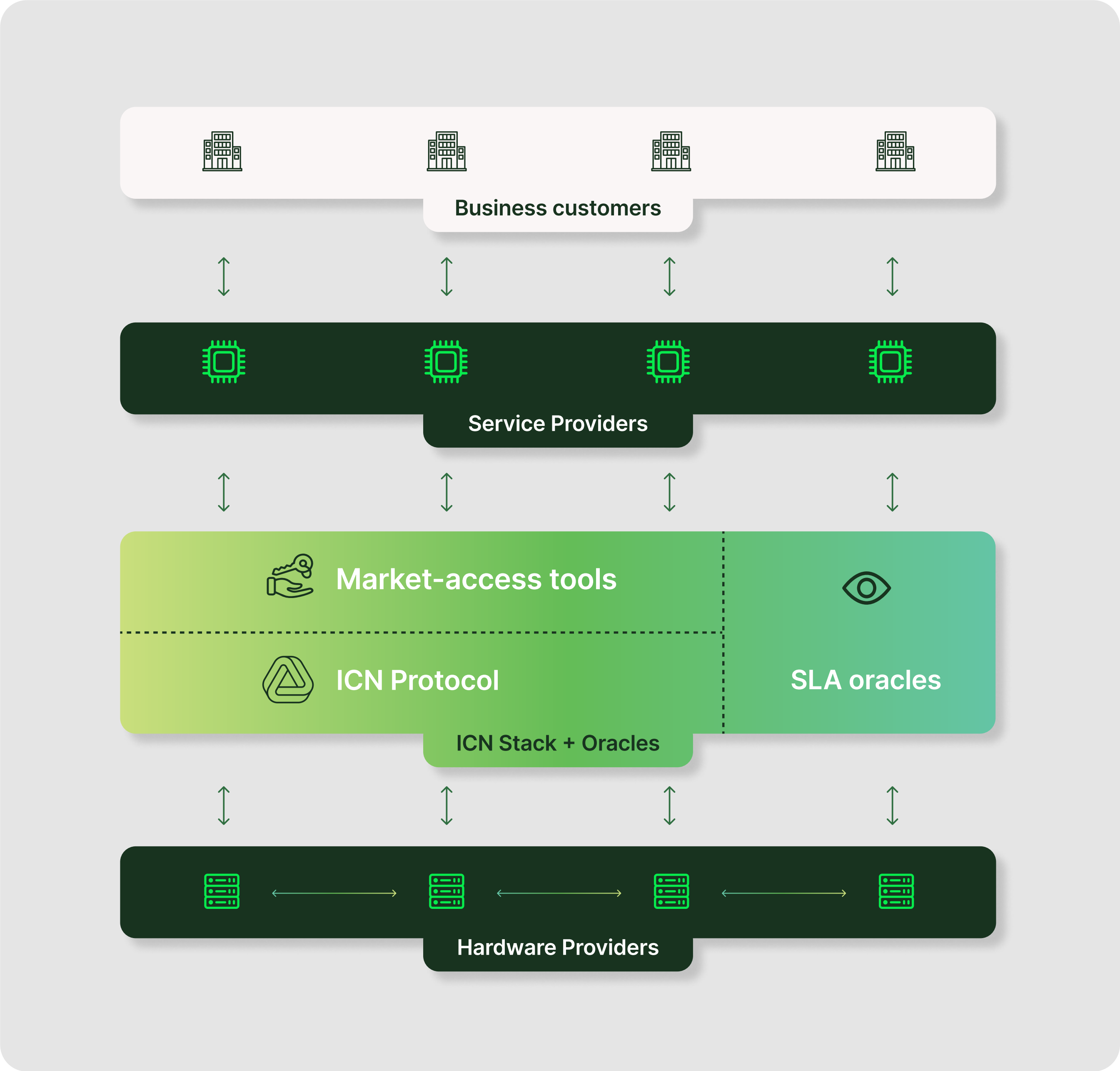
1. **Hardware Layer:** This layer ensures unprecedented **scalability**, with the potential to surpass the combined infrastructure of Amazon, Google, and Microsoft developed over the last 15-20 years. By leveraging decentralized hardware contributions, ICNP can scale its infrastructure efficiently and sustainably.

2. **Service Layer:**The service layer enables **composability**, allowing open-source software to combine into larger constructions, similar to Lego bricks. This fosters a global knowledge store that grows at a compounding rate, enhancing innovation and service diversity.

3. **Monitoring Layer:** The monitoring layer, consisting of SLA Oracle nodes, serves as the **layer of trust**. By implementing a best-in-class set of verifiable proofs, as they become available, ICNP will effectively address the DePIN verification problem. SLA Oracles ensure that hardware performance and compliance are continuously monitored and verified, maintaining the network's integrity and reliability.

Correspondingly, ICN comprises three main participants: Hardware Providers (HPs), Service Providers (SPs) and SLA Oracle Nodes (SLA-ONs). Each participant plays a critical role in ensuring the network's scalability, composability, trust, and overall success. The interaction among these participants creates a powerful flywheel effect, driving continuous growth and innovation:

3.1



1 **Hardware Providers** (HPs) add hardware capacity to the network. Each HP can operate one or more Hardware Nodes (HNs) across different hardware classes, such as Storage, GPUs, and CPUs, at multiple locations. For example, an HP could operate three HNs in two locations with a combination of hardware classes at each site. Contributions from each HN are calculated separately based on resource provision and utilization over specific periods. This decentralized hardware contribution ensures unprecedented **scalability**, leveraging the community's power to surpass traditional cloud infrastructure investments by orders of magnitude.

3.1

2. **Service Providers** (SPs) use ICN's hardware capacity across different hardware classes to build services, offerings, and products for business customers. In some cases, partnering Cloud DePIN projects could directly act as SPs. The composability aspect is crucial here, as SPs can seamlessly integrate multiple hardware resources and software functionalities to create complex, value-added services. This approach allows SPs to combine Infrastructure as a Service (IaaS) and service offerings with their proprietary software, Independent Software Vendor (ISV) integrations, and additional services like support and consulting. By leveraging the composability of the ICN ecosystem, SPs can innovate rapidly and provide highly customized solutions, while not having to build the stack from the bottom up.

3. **SLA Oracle Nodes** (SLA-ONs) monitor, verify, and report network performance and reliability metrics. They establish a critical layer of trust by using verifiable proofs. SLA ONs enforce Service Level Agreements (SLAs) through automated penalties and rewards, ensuring high reliability and performance. This monitoring layer creates a feedback loop that continuously improves network integrity and user trust.

ICN disentangles an otherwise fully integrated network operations 'stack' into separate roles ('hardware', 'service', and 'monitoring'), each focusing on different parts of the network stack, while contributing to the common ecosystem. The system enables SPs that have already found product-market fit to focus on their strengths, specializing in specific services and market development while expanding hardware resources as needed. It allows HPs to compete in a fair, non-monopolized market by specializing in operating and managing reliable hardware that can be offered as a resource to SPs with existing business customers. And it allows SLA-ONs to take on the role of an external, unbiased network 'auditor', ensuring high network performance, contributing to and benefitting from a thriving ecosystem.

3.2

ICN Partner Projects

ICN is built on the principle of composability, a key design element that enables seamless integration across its ecosystem. Much like Lego bricks, each component of the ICN protocol is designed to interconnect at every layer, creating a foundation for limitless innovation and collaboration. This modular approach makes it easier, more convenient, and inherently beneficial for projects to join, contribute, and thrive within the ICN ecosystem.

ICN partners with a wide range of projects from both the Cloud DePIN space and the traditional cloud sector. Each partnership is uniquely tailored to provide mutual benefits. Partners typically function as one of the protocol's defined participants or offer value to these participants in innovative ways.

The underlying principle of ICN partnerships is to advance the ecosystem's evolution by driving more demand than any participant could achieve independently. Composability amplifies this effect by enabling the seamless combination of services, allowing projects to integrate their offerings with minimal friction.

A prime example is partnerships that add new cloud services to the network. For end users, the ability to combine multiple services is often a decisive factor. Impossible Cloud’s object storage service, for instance, serves as a foundational building block for more complex use cases. Many of these use cases require a mix of data storage and GPU-compute capabilities. Through ICN's composable architecture, customers can directly leverage multiple SPs to fulfill this functionality.

3.3

Examples of projects partnering with ICN

- **On the SP layer:** Cloud DePIN projects can use the ICN network for their hardware needs, and enrich the ecosystem with more services en route to a truly decentralized multi-service cloud. As an example, the ICN team and Aethir, a prominent decentralized GPU project, are already working together on a possible cross-operation design. Aethir could act as an SP within the network, benefiting from market access tooling resulting in more demand for their service, and adding GPU computing capabilities to the network. A combination of cloud storage and GPU compute can unlock new use cases and, hence, even more demand.

- **On the SLA-ON layer:** DePIN Verification projects have the potential to offer their services to the ICN Protocol, enhancing the development of an increasingly trustless environment that validates the physical characteristics of connected hardware. For instance, the ICN team collaborates with Witness Chain, a prominent web3 tech stack, to integrate and collectively enhance network trust and reputation.

- **On the HP layer:** OEM Hardware manufacturers could partner with ICN, offering ready-to-order hardware class blueprints that would simplify and speed up hardware provisioning for HPs. The ICN team and Supermicro, a provider of IT solutions and bare metal servers, have struck a partnership aiming to develop the first blueprints.

- **On the Customer- / market access tools layer:**ISV Software companies, such as Acronis, a leading provider of cybersecurity and backup software, integrate Impossible Cloud's object storage solution into their products. This directly benefits the ecosystem by opening up new use cases, markets, and revenue opportunities. This type of integration will also make it easier for other service providers (SPs) to leverage these ISVs.

3.4

ICN Protocol (ICNP)

The Impossible Cloud Network Protocol (ICNP) is a set of rules and standards that facilitate hardware node coordination, formation, monitoring, and access among the network participants.

It plays a crucial role in coordinating the actions of Hardware Providers (HPs), Service Providers (SPs) and SLA Oracle Nodes (SLA-ONs). ICNP is enabling healthy competition both among HPs offering similar classes of hardware and SPs accessing hardware resources. This competition drives up quality and drives down prices over time, ensuring a dynamic and efficient ecosystem. Through its implementation, ICNP not only coordinates the technical aspects but also aligns economic incentives, promoting a robust and scalable decentralized cloud service.

The protocol's design encourages contributions from protocol participants and community members, jointly developing a decentralized cloud ecosystem. To align incentives across protocol participants and to implement the protocol's incentive layer, ICNP relies on a tokenomic system that is described in the following sections in more detail.

3.5

Impossible Cloud Network Token (ICNT)

ICNP relies on a token-economic system to contribute, allocate, and access network resources and to ensure network reliability and performance levels. At the heart of this system lies a protocol-native utility token, the Impossible Cloud Network Token (ICNT).

ICNT has three primary functions. First, ICNT is required to access network resources. SPs therefore have to acquire ICNT to obtain access to ICN's network capacity. Second, the protocol rewards network contributions with ICNT. HPs are awarded tokens for their hardware capacity commitments to the network, while SLA Oracle Nodes are rewarded for monitoring, verifying, and reporting tasks. Third, ICNT is used to secure the overall network. When HPs commit hardware resources to the network, they lock up ICNT collateral, which is subject to a slashing mechanism.

ICNT interacts with ICNP's incentivization layer, which includes smart contracts for requesting and provisioning hardware capacity. These contracts manage reward structures, capacity allocation mechanisms, and a slashing system to ensure network reliability and performance. The incentivization layer will be deployed on the Base network, a smart-contract-enabled blockchain, enabling integration with other DePIN projects and leveraging existing tools and protocols.

3.6

Supply Side: Providing Capacity to ICN

HPs can commit hardware capacity to the network in exchange for ICNT rewards. To onboard capacity, they need to lock ICNT as collateral. Once their capacity is onboarded, the protocol allocates capacity to SPs based on their hardware needs.

The protocol relies on a dynamic reward mechanism that allows rewards to differ across geographic or topological network clusters. In addition, it can adjust rewards based on usage in specific network clusters. This allows the protocol to attract additional hardware capacity in regions that exhibit strong demand and to discourage the onboarding of additional resources in regions that already exhibit idle capacity.

To ensure the continued availability of committed hardware capacity, the protocol requires HPs to lock ICNT as collateral for the time they commit their hardware to the network. As ICNT collateral is subject to a slashing mechanism in case committed capacity is no longer available, HPs are incentivized to keep availability up and are disincentivized to withdraw capacity before the end of their commitment period.

A HP's collateral requirement consists of two components: a node-specific component that is roughly proportional to the HP's capacity, as well as a network-specific component that additionally scales collateral requirements with the circulating supply of ICNT. While the node-specific component has to be provided by the HP itself to ensure that the HP has 'skin in the game', the network component can be provided by external ICNT delegators in exchange for a share of the HP's rewards.

The delegation mechanism allows HPs to effectively reduce the upfront cost of entering the network while providing for a decentralized quality filtering mechanism: as delegators partly share the slashing risk with the HPs, only HPs with sufficient reliability and performance levels will be able to attract delegated collateral.

3.7

Demand Side:
Requesting Capacity from ICN

ICNP allows SPs to access ICN hardware capacity through a fully integrated capacity request and allocation mechanism, in which SPs have to acquire ICNT to access network resources.

In this procedure, SPs request hardware capacity from the protocol across all supported network clusters. For example, an SP could request 6 months of storage capacity in a certain geographic region. The SP provides the necessary amount of ICNT and the protocol selects suitable hardware capacity in the network based on a combination of technical and economic parameters. Once an SP secures capacity through this procedure, the SP can integrate the secured capacity into its service offerings.

The capacity is in turn provided by the network of connected HPs. An HP can increase the chance of being selected by the protocol by offering lower fees or by increasing their commitment period. This market-based mechanism ensures that cost advantages on the hardware layer are passed through to the service layer while maintaining a high degree of network reliability.

3.8

Network Monitoring: SLA Oracle Network

A common problem within DePIN networks is ensuring the authenticity and integrity of resources and participants within the network, where traditional centralized validation methods are not applicable.

This ‘DePIN verification problem’ includes verifying the availability, performance, and reliability of distributed resources, as well as maintaining trust among numerous independent and potentially anonymous entities.

For ICN to offer competitive service levels, HPs must operate at peak levels and consistently meet required SLA standards to maintain high network performance. ICNP therefore includes a network of third-party SLA Oracle Nodes (SLA-ONs) that constantly monitor, verify, and report network health metrics, verifying availability, capacity, or specific service-level metrics. Due to their independence and the transparency of all data they obtain, SLA-ONs create a layer of trust and objectivity within a network that is trustless by design.

SLA-ONs will perform a variety of tasks, ranging from monitoring (collecting and processing service performance metrics) to proof generation (producing verifiable proofs using local hardware metrics), to aggregation (collecting and aggregating reports, interfacing with smart contracts logic). In exchange for performing those tasks, SLA-ONs are rewarded with ICNT.

The functionality available to SLA-ONs will evolve from permissioned to trustless and from measuring simple metrics to applying DePIN proofs. Initially, SLA-ONs will focus on verifying the availability of hardware nodes.

3.9

Network Reliability and SLA Enforcement

If the SLA-ONs detect a network anomaly (i.e. a significant and persistent deviation from expected network performance and availability levels), ICNP can trigger a slashing mechanism.

The definition of a network anomaly can vary depending on the hardware class. An anomaly can be triggered by multiple trigger events (e.g. committed capacity no longer available, bandwidth below threshold, etc.).

In case of an anomaly report, HPs must restore their faulty node within a limited time window before the slashing of the locked ICNT collateral starts. When the slashing process begins, the HP's collateral is gradually reduced and rewards are put on hold until the anomaly is resolved. SPs can claim back unreleased rewards as compensation for loss of uptime.

3.10

ICN network growth cycles

ICNP is at the heart of the ICN decentralized cloud ecosystem. ICN is built in layers composed of different participants, all connected by the ICNP and co-incentivized with a common set of rules.

These rules are conceived to balance hardware offered in the network and cloud services consumed by design. Unlike many other DePIN projects which rely on an initial and, at times, sustained surge in token supply distributions to kickstart network capacity (e.g. to build out cellular network coverage), ICN does not require extensive overcapacity and can follow demand more closely. Consequently, ICN becomes commercially viable at a lower threshold, allowing for a more utilization-based token distribution schedule closely tracking network capacity demand.

To further explain this point, let's consider ICN's token economy dynamics in a typical network growth cycle. To incentivize the initial supply of capacity in a certain network region and for a certain hardware class, the protocol subsidizes HP rewards to a limited extent. As additional capacity is added to the network, subsidies in the particular region are decreasing, making capacity expansions only economically viable for HPs if going hand in hand with increasing SPs' demand in that region. This protects the network from building up and overspending on idle capacity.

On the other hand, if SPs' demand is strong enough to sustain growth in a network region, HPs have, through increased usage rewards, an ongoing incentive to add capacity to serve the increasing number of capacity requests. In this stage of network growth, HPs' rewards in the network region are self-sustaining on a protocol level and protocol subsidies can be used to kickstart a new network region or hardware class, initiating a new growth cycle.

4.0

Roadmap

Phase
1

Phase
2

Phase
3

How we got here

Impossible Cloud has successfully developed a fully functional and robust enterprise-grade object storage service as the foundation of the ecosystem. This service is supported by several hardware providers and caters to numerous business customers, who collectively upload, download or otherwise interact with objects above 1 Billion times per week (and growing exponentially). The system is designed for scalability, capable of handling many billions of object interactions daily and beyond.

Founded by entrepreneurs who generated over a billion dollars in total revenue followed by a successful IPO, Impossible Cloud has accomplished what many web3 projects find challenging: creating a successful enterprise-grade cloud service. This accomplishment positions Impossible Cloud as a leader in the DePIN space today, offering a highly usable and reliable enterprise-grade product. With a growing network of hardware providers meeting real-world demand, the launch of ICN will now expand the suite of available decentralized services.

4.0

Why Storage is fundamental

Storage leverages data gravity and locality, foundational principles for any cloud service ecosystem. Data storage is a critical component as it is required by nearly all other services, such as AI GPU compute and data processing.

By enabling a robust storage foundation, ICN ensures that customers can run their main services close to where their data is stored, enhancing performance and efficiency. From this solid base, the ICN Protocol will support more and more services, gradually building towards a fully decentralized cloud offer. This approach allows seamless integration and composability, creating a comprehensive and scalable cloud ecosystem.

Next steps

This section outlines the building and anticipated evolution of the ICN Protocol. The first production release of the protocol will support the existing object storage solution and HPs. Subsequent steps will include supporting demand-based incentives, enhancing the SLA engine, and integrating partnering projects and software.

Eventually, ICN will automate hardware and software provisioning and deployment, and SLA enforcement will be an integral component in creating trust and reliability in the system.

4.1

Phase 1: Launch Phase (2024)

Phase
1

Phase
2

Phase
3

This phase focuses on the foundational activities necessary to bring ICN to mainnet and prepare for token listing. Key milestones include:

Economic Layer Design: Finalizing the economic incentive layer, protocol logic, SLA Oracle network, and system architecture.

Litepaper Development and Community Feedback: Writing, releasing, and iterating on this Litepaper to ensure alignment with community input.

ICN Passports Distribution: Launching and distributing ICN Passports as NFTs that serve as collateral. Passports can ensure honest behavior among Oracle Nodes and act as a hardware quality guarantee for Hardware Providers.

Protocol Development:
- Defining features for the first ICN protocol release on testnet.
- Open-source development of the protocol and initial testing.

Testnet Deployment and Refinement:
- Sequentially releasing and refining ICN protocol functionalities on testnet.
- Conducting public testing with community and partners, alongside security audits and optimization of execution costs.

Network Bootstrapping: Engaging and onboarding Hardware Providers to establish an enterprise-grade hardware network.

Mainnet Launch: Deploying the ICN protocol on Base, including:
- Daemon software for onboarding Hardware Providers.
- Full staking mechanics for ICN Passports as collateral for both Oracle Nodes and Hardware Nodes.
- Reward claiming, availability challenges, and controlled slashing mechanics.

By the end of this phase, the ICN protocol will be live on mainnet, with its token listed and the foundation laid for long-term ecosystem growth.

4.2

Phase 2: Growth Phase (2025–2026)

Phase
1

Phase
2

Phase
3

This phase focuses on scaling the ICN ecosystem, expanding the network on both the demand and supply sides, and enabling external contributions to the protocol. Key initiatives include:

Demand-Side Expansion:

- Supporting SPs with protocol features for configuring and managing new services.
- Expanding support for SPs to define and bundle composable, multi-service offerings (e.g., storage, compute, networking).
- Enhancing SLA compliance mechanisms with expanded SLA Oracle Nodes proofs and challenges to monitor the cloud service and not just the hardware.

Supply-Side Scaling:

- Onboarding new server classes beyond storage (e.g., GPU, CPU, and networking-focused hardware).
- Implement demand-driven incentives to optimize geographical and hardware-type distribution.
- Automating hardware provisioning and service integration for seamless scaling.

Composability and Developer Ecosystem:

- Refining protocol logic to enable service definition and bundling, facilitating integration with diverse projects.
- Growing the developers' community, empowering it to extend ICN's functionalities.
- Collaborating with partner projects to add new services and tools, driving network utility and adoption.

This phase sets the stage for a vibrant, decentralized ecosystem with growing demand, an expanding supply network, and active contributions from external developers and partners.

4.3

Phase 3: Optimization Phase (2027 Onwards)

Phase
1

Phase
2

Phase
3

The phase focuses on optimizing the ICN protocol for long-term sustainability, efficiency, and the realization of permissionless composability across all layers. Key focus areas include:

Permissionless Composability: Achieving a fully decentralized model where all participants can seamlessly interact and compose services without requiring trust or permission.

Optimization and Efficiency Gains:
- Streamlining resource allocation and scaling mechanisms.
- Enhancing protocol performance and reducing operational costs.
- Continuous security audits and improvements to ensure robustness.

Governance Evolution: Transitioning to a fully community-driven governance model, with proposals and voting conducted transparently in the public domain.

Ecosystem Resilience: Strengthening the ICN network to adapt to changing demands, ensuring it remains sustainable and innovative.

This phase represents a significant milestone in ICN's journey, establishing a permissionless, trustless, and highly efficient decentralized cloud system as a foundation for the future. With a robust and open ecosystem in place, the path forward will be shaped by the community, positioning ICN to challenge centralized giants and drive innovation in the cloud industry.

5.0

Get Involved

You can follow our progress on X **<@ICN_Protocol>**.

We are open to partnerships at all layers of our ecosystem to fuel its growth. If you're interested in contributing hardware resources, using the network for various cloud services, or collaborating with us, please send us a message on X or via email **<web3@impossiblecloud.com>**.

Whether you're a hardware provider, service provider, or simply enthusiastic about decentralized cloud technology, we'd love to chat and explore how you can be part of the Impossible Cloud Network's journey towards decentralized cloud services.

References

1. CLOUD Act" (2024, October 21). In Wikipedia. https://en.wikipedia.org/wiki/CLOUD_Act
2. 2. Storj, "Save up to 90% on your cloud storage costs." https://www.storj.io/pricing (accessed Jul. 15, 2024)X
3. Impossible Cloud, "Pricing - Transparent, competitive pricing for cloud services." https://www.impossiblecloud.com/pricing (accessed Jul. 15, 2024)X
4. Emeras, Sébastien Varrette, and Pascal Bouvry, "Amazon Elastic Compute Cloud (EC2) vs. In House HPC Platform: A Cost Analysis," International Conference on Cloud Computing, Jun. 2016, doi: https://doi.org/10.1109/cloud.2016.0046X
5. A. Prabhakaran and L. J., "Cost-Benefit Analysis of Public Clouds for Offloading In-House HPC Jobs," IEEE Xplore, Jul. 01, 2018. https://ieeexplore.ieee.org/abstract/document/8457783. (accessed Nov. 29, 2022)X
6. B. Satzger, W. Hummer, C. Inzinger, P. Leitner, and S. Dustdar, "Winds of Change: From Vendor Lock-In to the Meta Cloud," IEEE Internet Computing, vol. 17, no. 1, pp. 69–73, Jan. 2013, doi: https://doi.org/10.1109/mic.2013.19X
7. Seyed Majid Razavian, H. Khani, N. Yazdani, and F. Ghassemi, "An analysis of vendor lock-in problem in cloud storage," Oct. 2013, doi: https://doi.org/10.1109/iccke.2013.6682808
8. P. Silva, E. Monteiro, and P. Simoes, "Privacy in the Cloud: A Survey of Existing Solutions and Research Challenges," IEEE Access, vol. 9, pp. 10473–10497, 2021, doi: https://doi.org/10.1109/access.2021.3049599X
9. R. Ducato, "Cloud computing for s-health and the data protection challenge: Getting ready for the General Data Protection Regulation," IEEE Xplore, Sep. 01, 2016. https://ieeexplore.ieee.org/abstract/document/7580803?casa_token=PDR_Q5vL0VEAAAAA:Ldte6tN8n3sF8j8NmPz9bfTdPRgLKNZJCRc9fOt9ByIRjDlRuU03lZBjinvU5tNyb5OIl7PlNQ
10. Duarte F. (2024, June 13). "Amount of Data Created Daily". Exploding Topics. https://explodingtopics.com/blog/data-generated-per-day
11. Fritsch and C. Walker, "The Problem with Data," Proceedings of the 2014 IEEE/ACM 7th International Conference on Utility and Cloud Computing, Dec. 2014, doi: https://doi.org/10.1109/ucc.2014.115X
12. W. Shi, J. Cao, Q. Zhang, Y. Li, and L. Xu, "Edge Computing: Vision and Challenges," IEEE Internet of Things Journal, vol. 3, no. 5, pp. 637–646, Oct. 2016, doi: https://doi.org/10.1109/jiot.2016.2579198X
13. Eng Keong Lua, J. Crowcroft, M. Pias, R. Sharma, and S. Lim, "A survey and comparison of peer to-peer overlay network schemes," IEEE Communications Surveys & Tutorials, vol. 7, no. 2, pp. 72–93, 2005, doi: https://doi.org/10.1109/comst.2005.1610546X
14. Bitcoincharts, "Bitcoincharts | Bitcoin Network," Bitcoincharts.com, 2022. https://bitcoincharts.com/bitcoin/ (accessed Jul. 15, 2024)X
15. TOP500, "June 2024 | TOP500," www.top500.org. https://www.top500.org/lists/top500/2024/06/ (accessed Jul. 15, 2024)X
16. Illis L. (2022, December 31). Medium. https://medium.com/@leviillis/tech-giants-vs-the-bitcoin-network-a-comparison-of-computing-power-for-artificial-intelligence-b029e05e08a4

17. R. Merritt, “What Is AI Computing?,” NVIDIA Blog, Jan. 20, 2023. https://blogs.nvidia.com/blog/what-is-ai-computing/ (accessed Jul. 15, 2024)X
18. Z. Zhou, X. Chen, E. Li, L. Zeng, K. Luo, and J. Zhang, “Edge Intelligence: Paving the Last Mile of Artificial Intelligence With Edge Computing,” Proceedings of the IEEE, vol. 107, no. 8, pp. 1738– 1762, Aug. 2019, doi: https://doi.org/10.1109/jproc.2019.2918951.
19. W.-S. Lee, A. John, H.-C. Hsu, and P.-A. Hsiung, “SPChain: A Smart and Private Blockchain Enabled Framework for Combining GDPR-Compliant Digital Assets Management With AI Models,” IEEE Access, vol. 10, pp. 130424–130443, Jan. 2022, doi: https://doi.org/10.1109/access.2022.3227969>
20. CBRE, “Europe Data Centres Figures Q1 2024,” Dec. 2022. https://www.cbre.de/-/media/cbre/countrygermany/data-centre/2022-q4-cbre-europe-data-centres.pdf (accessed Jul. 15, 2024)>
21. D. Robinson, “AWS resource restrictions point to datacenter power issues,” Apr. 04, 2024. https://www.theregister.com/2024/04/09/aws_resource_restrictions/ (accessed Jul. 15, 2024)
22. M. Pedram, “Energy-Efficient Datacenters,” IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, vol. 31, no. 10, pp. 1465–1484, Oct. 2012, doi: https://doi.org/10.1109/tcad.2012.2212898.

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