BINANCE RESEARCH

DePIN: An Emerging Narrative

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JieXuan Chua, CFA
Brian Chen

Table of Contents

1 Key Takeaways

- Among various narratives gaining traction in the past few months, the Decentralized Physical Infrastructure Networks ("DePIN") sector has emerged as a prominent focus due to their large total addressable market and extensive potential.
- DePIN refers to infrastructure-related projects utilizing blockchain technology and crypto economics to motivate individuals to allocate their capital or unused resources towards creating a more transparent and verifiable network, with the goal of achieving a more efficient scaling trajectory than their centralized counterpart.
- DePIN is a broad field made up of several sectors, each playing a different role in enabling the decentralization of network infrastructure. In this report, we cover developments in the fields of compute networks, wireless networks, storage, and sensors.
- As the sector continues to develop, we expect a proliferation of DePIN projects in the coming years. However, their long-term viability and success will ultimately be determined through real-world applicability and remain to be battle tested.

2 Overview

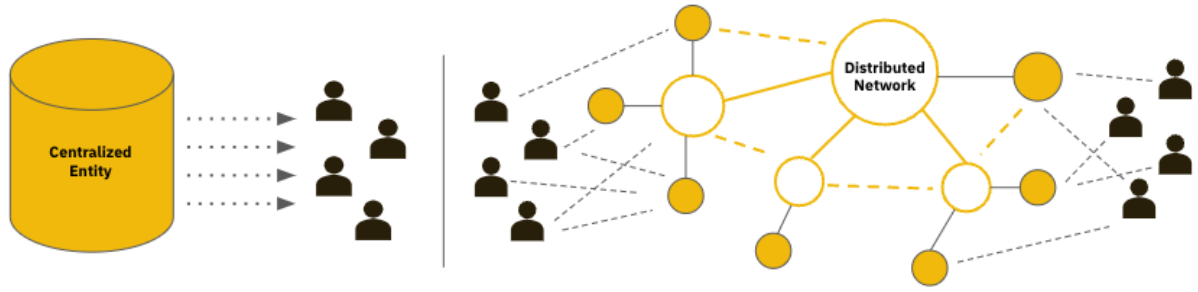
Among various narratives that have gained traction in recent months, the Decentralized Physical Infrastructure Networks ("DePIN") sector has emerged as a prominent focus. The sector is perceived to possess substantial growth potential due to its extensive total addressable market and its ability to scale infrastructure networks in a decentralized manner through bottom-up growth strategies. Some even consider DePIN as a paradigm shift in the global distribution of resources, both physical and digital, and a transformative approach to scaling large-scale infrastructure.

In this report, we explore this emerging narrative. We begin by outlining the basics of what DePIN is, as well as how it works. Our analysis then transitions to a top-down view of the sector, providing an ecosystem map and dissecting the landscape across various sub-sectors. To conclude, we examine the challenges facing DePIN adoption, identify key market themes, and offer insights into the sector's future outlook.

2.1 What is DePIN?

DePIN refers to infrastructure projects harnessing blockchain technology and crypto economics to motivate individuals to allocate their capital or underutilized resources towards creating a more transparent, decentralized, and verifiable infrastructure network. These projects can be broadly categorized into networks of physical or digital resources, each encompassing various sub-sectors. Regardless of their focus, these projects typically operate under similar operating models, emphasizing collective ownership and prioritizing distributed systems over centralized market structures.

Figure 1: Conceptual illustration of centralized and decentralized systems



Source: Binance Research

2.2 How DePIN Works

DePIN projects generally involves several key components:

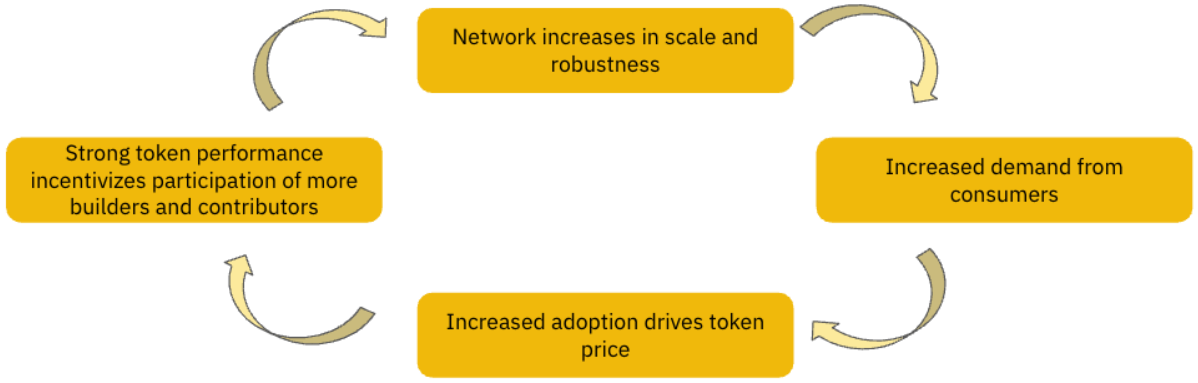
1. **Target Resource:** The specific resource a project aims to provide to consumers. Common types of resources include storage capacity and computing power.
2. **Hardware:** The necessary devices used by network contributors to gather data or resources for the network's operation and products. Depending on the types of resources, the cost, manufacturer, and usage of these devices can vary.
3. **Incentive Mechanism:** Predetermined mechanism that awards tokens to supply-side contributors, thereby incentivizing them to contribute resources and offer reliable services. Some projects may also implement penalties in order to deter malicious activities.
4. **Supply-side Contributors:** Individuals or entities who provide unused or underutilized resources to the network. In return, they are generally rewarded with token incentives.
5. **Consumer:** End users who participate in the network to use the services provided by DePIN projects.

DePIN projects commence by identifying the specific resource they aim to offer. These resources vary widely, encompassing storage capacity, computing power, bandwidth, hotspot deployment, and more. Central to these projects' operations is an incentive system designed to encourage positive contributions and discourage detrimental behaviors. The system predominantly rewards compliant behavior with native tokens.

For instance, Filecoin, a leading DePIN project in terms of cloud storage, compensates storage providers with it native token FIL. These providers often have to pledge collateral as a security measure. If they fail to provide reliable services or engage in malicious activities, they face penalties like withheld rewards, collateral slashing, or removal from the network. Conversely, consumers use the projects' tokens to pay for services, such as using FIL to pay for storage on Filecoin.

Supply-side contributors are integral to DePIN projects as the networks rely on them to provide services. In Filecoin, they are storage providers; in projects like Helium and Hivemapper, they are individuals who set up the required hardware device to provide wireless coverage or mapping data.

Figure 2: DePIN projects aim to foster a self-reinforcing cycle that can sustain their continued growth



Source: Binance Research

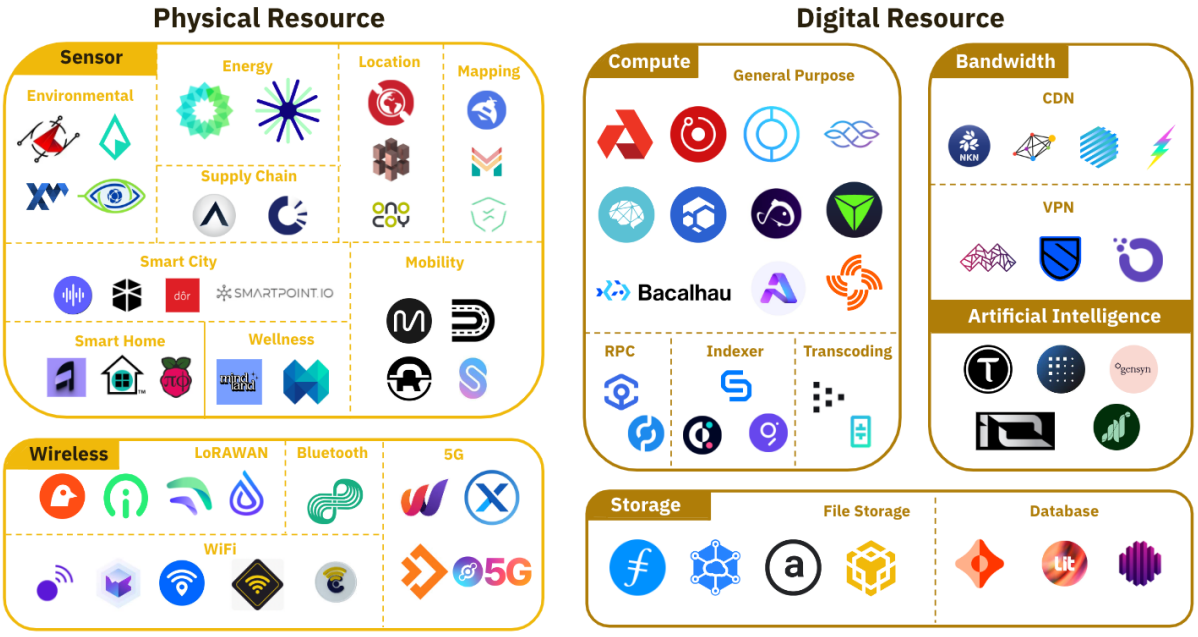
Having a self-reinforcing cycle of growth will contribute to a sustainable development of a DePIN project. Token rewards act as helpful incentives to overcome the "cold-start" challenge of sourcing for supply-side participants. As the network increases in size, demand should pick up as consumers start to utilize the network's services. Given that payment for services are usually made in the form of the network's tokens, the increased adoption should translate into higher token prices, which would further incentivize contributors. With the conconcurrent growth of both demand and supply, this virtuous cycle can perpetuate, sustaining the projects' continued growth.

3 DePIN by Sectors

The origins of DePIN can be traced back several years, even before the term was formally coined. This isn't surprising, considering that DePIN fundamental principles align closely with the ethos of the crypto industry. However, the sector didn't initially garner significant attention or traction like it does now, hindered by factors such as immature infrastructure development, limited public awareness, and a smaller crypto user base. Despite these challenges, projects related to DePIN have been steadily building over the years, leading to the sector's currently diverse landscape as illustrated in the Figure 3 below.

It's important to note that the map only showcases a fraction of the DePIN projects. According to data from IOTeX's DePINscan, there are approximately 160 DePIN projects recorded.[1] The categorization of these projects can also vary based on how one defines a DePIN project. Regardless of these nuances, what remains evident is the sector's continued growth and expansion.

Figure 3: Ecosystem map showcasing sectors and sub-sectors of DePIN projects



Source: IOTeX, Binance Research

As illustrated in the ecosystem map above, DePIN is a broad field made up of several sectors. Each sector plays a different role in enabling the decentralization of network infrastructure and powering different use cases. In this section, we examine each of these in more detail, sharing how they work, and highlighting relevant case studies.

Note that the mention of specific projects does not constitute endorsement by Binance. Instead, projects cited are merely used for the purposes of illustrating conceptual use cases.

3.1 Compute Networks

Decentralized compute networks utilize distributed computing resources to carry out intricate computational tasks. These could range from the analysis of large data sets, to running complex artificial intelligence ("AI") algorithms, or any other tasks that require computing power. By connecting idle systems to those that have a need for compute, decentralized compute networks serve as a bridge between demand and supply for computing resources.

Given the importance of compute in the digital age today, and the rise of emerging technologies such as blockchain and AI, there has been a steady increase in demand for computing resources. Additionally, the surge in AI development has led to significant demand for these chips at cloud computing firms. This has resulted in long waiting lists, with wait times stretching up to nearly a year in certain instances.[2] This is where decentralized compute networks come in. They provide an alternative to existing solutions dominated by centralized cloud providers and hardware manufacturers. In this regard, decentralized compute networks are spearheading a power shift away from centralized cloud providers (e.g., Amazon Web Services, and Google Cloud), and introducing competition through an open marketplace run by numerous providers.

Broadly, decentralized compute networks work by establishing a two-sided marketplace that incentivizes suppliers of computing power to provide idle computing resources to those in need of them. Moreover, prices of decentralized compute networks are also competitive as there are no significant additional costs for suppliers to provide computing power to the network.

Case Study: Akash Network

Akash Network enables users to deploy their own cloud infrastructure, or sell idle cloud resources to others. Akash has likened itself to the Airbnb for server hosting - it has established a marketplace that allows users to lease computing resources from others with spare capacity. This allows Akash to tap into the market of underutilized resources sitting idle in the estimated 8.4M data centers globally.[3]

At present, the network offers more than 8.9K central processing units ("CPUs"), 171 graphics processing units ("GPUs"), 45 terabytes of memory, and over 583 terabytes of storage.[4] Effectively, users of Akash can utilize the network for any general-purpose compute functions.

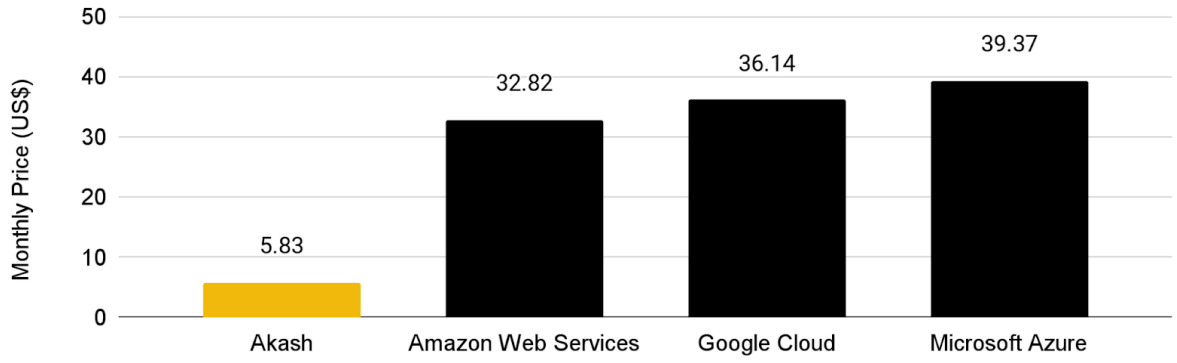
Akash caters to demand for compute from two key markets, bringing underutilized compute resources to market in an open and permissionless manner:

- **High-performance chips:** Critical for complex computational tasks like AI training, but have limited supply in the market.

- **Consumer-grade chips:** For general-purpose tasks, and where there is an enormous supply of unused computing capacity.

Notably, prices to use Akash's services are highly competitive and are usually a fraction of other centralized cloud providers. A key contributor is its "reverse auction" system which allows customers to submit their desired price, and have providers compete for the business.

Figure 4: Akash Network is priced competitively



Source: Cloudmos, as of January 25, 2024
Note: Pricing is for 1 CPU, 1GB RAM, and 1GB Disk

As examined in our recent report on the intersection of AI and Crypto, apart from growth driven by competitive pricing, decentralized compute networks like Akash have also ridden on the wave of AI growth and seen a rise in activity on their platforms. High-performance GPUs are critical in numerous machine learning and AI applications, and the widespread adoption of large language models has led to a surge in demand for them. Active leases on Akash network have increased over the past year, and have more than tripled compared to the start of 2023. A lease represents the renting of compute resources.

Figure 5: Active leases on Akash network surged in Q4 2023

Source: Cloudmos, as of January 25, 2024

3.2 Wireless Networks

Decentralized wireless ("DeWi") networks enable the deployment of networks such as 5G, WiFi, low-power wide area network ("LoRaWAN"), and Bluetooth, using cryptographic incentives.

Considering the substantial capital required to construct wireless network infrastructure, this field has largely been dominated by large telecommunication companies possessing the necessary scale and financial prowess. As a result, the industry has traditionally been controlled by a small number of players. DeWi networks offer an alternative where numerous independent entities or individuals coordinate to deploy wireless infrastructure with the help of cryptographic incentives.

Broadly speaking, there are four types of decentralized wireless networks today:

- **Cellular 5G:** 5G has high download speeds and low latency.
- **WiFi:** WiFi networks provide network connectivity to an area.
- **LoRaWAN:** LoRaWAN is widely used for communication in the Internet of Things ("IoT").
- **Bluetooth:** Bluetooth enables the transmission of data over short distances.

In terms of mechanics, DeWi networks typically bootstrap the initial phases with tokens to incentivize operators to invest and deploy hardware. These token rewards provide monetary support and a small return on investment for operators, incentivizing them to continue operating even if the network has yet to generate sufficient fees from users. Over time, as the network grows in size and achieves economies of scale, a combination of lower unit economics as well as better coverage will theoretically help attract more users to the network, generating more revenue for operators. The ultimate goal is to achieve a self-sustaining network where user-generated fees can more than cover operating expenses and any additional investments required to grow the network.

Case Study: Helium

Helium is a global, decentralized wireless infrastructure project, enabling wireless coverage for LoRaWan-enabled IoT devices and cellular devices. Its flagship product, the Helium Hotspot was launched in 2019, providing wireless access for IoT devices. Since then, Helium has also expanded its offerings to include 5G coverage.

1. Helium IoT Network

The Helium IoT Network is a decentralized network that uses the LoRaWAN protocol to provide internet connectivity to "Internet of Things" devices. Examples of use cases include

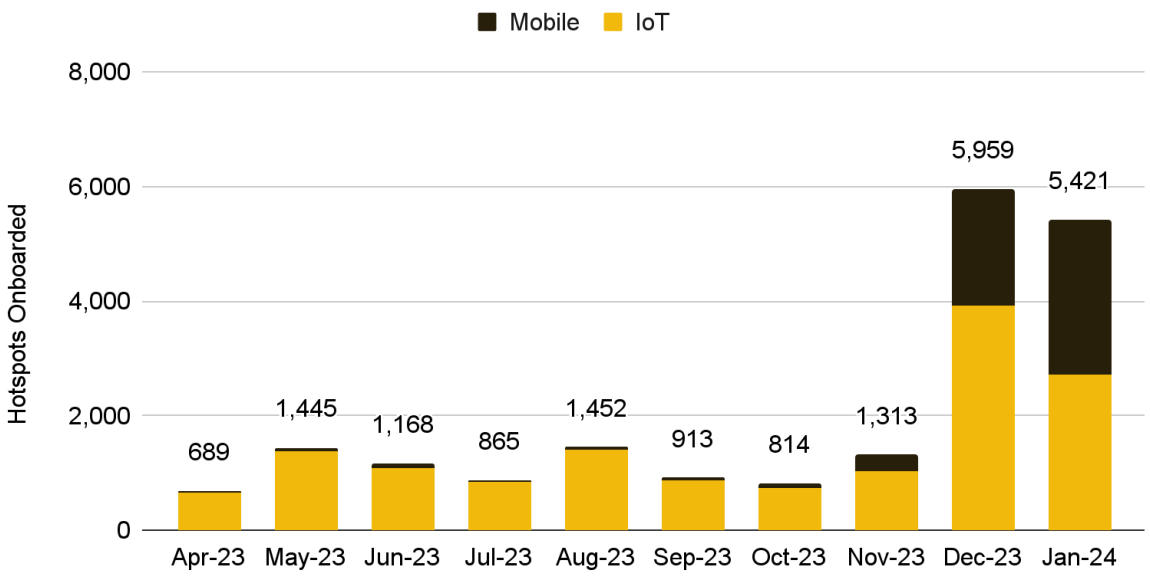
automotive diagnostic tools, environmental monitoring, and energy usage monitoring, among many others.

2. Helium 5G Network

Helium 5G Network is powered by thousands of user-operated nodes. Helium envisions the future of mobile networks to be a combination of large-scale operators and crowdsourced 5G hotspots. This is driven by expectations of higher bandwidth and lower latency demands by consumers, as well as the corresponding need for denser networks with more nodes which increases site acquisition costs.[5] Helium 5G Network's crowdsourced model eliminates site acquisition costs and enables users to participate in providing high-bandwidth coverage. To participate in the network, interested operators can purchase a FreedomFi Gateway hardware which enables them to provide cellular coverage. Operators will receive MOBILE tokens in return.

Following the launch of Helium Mobile's US$20/month unlimited data, text, and talk phone plan nationwide[6], as well as the spike in Solana Saga smartphone sales[7] which comes with a free 30-day subscription to Helium Mobile, Helium Network has witnessed a surge in new hotspots onboarded in recent months.

Figure 6: Number of new Helium hotspots onboarded has accelerated in recent months



Source: Dune Analytics (@helium-foundation), Binance Research, as of January 25, 2024

Helium's ecosystem is powered by several tokens:

- **HNT:** This is the native token of Helium and is key in facilitating the usage of the network as it is burned for "Data Credits" that are used for data transfers. Hotspot hosts can also redeem network tokens (e.g., IOT, MOBILE) for HNT.

- **IOT:** This is the protocol token of the Helium IoT network and is mined by LoRaWAN Hotspots through both data transfer proceeds as well as Proof of Coverage.
- **MOBILE:** This is the protocol token of the Helium 5G Network and is rewarded to those who provide 5G wireless coverage and verification of the Helium Network

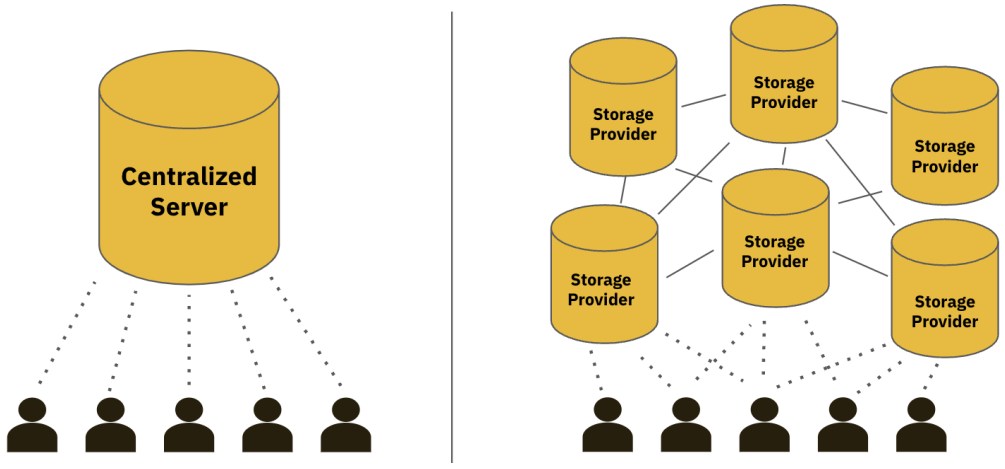
Additionally, Data Credits ("DC") are the only form of accepted payment for data transmission on the Helium Network and are priced at US$0.00001. For example, on the IoT network, users pay 1 DC for every 24-byte packet of data transferred. As more data is transferred and more Data Credits are burned, the subnetwork (e.g., IoT Network) will earn more HNT tokens, rewarding and incentivizing them for the activity.

Overall, the abovementioned tokens act as the utility tokens for services in the network, and provide incentives for operators to maintain and operate the necessary infrastructure. Since its launch, Helium has grown its network to more than 970K hotspots, allowing it to provide coverage to countless IoT and mobile devices in a decentralized manner.

3.3 Storage

Decentralized storage systems operate on a peer-to-peer ("P2P") network model, where user-driven storage providers ("SPs") or miners allocate unused computer resources and earn remuneration in a project's native token. Unlike centralized systems, where a single entity governs data, **decentralized storage encrypts and shards data, dispersing it across the network**. This process enhances accessibility and ensures data redundancy.

Figure 7: Conceptual illustration of centralized and decentralized storage systems



Source: Binance Research

The distinction between centralized and decentralized storage predominantly hinges on two facets: security and cost.

Centralized storage systems store data through a single authority that uses one or a handful of servers, presenting the risks of a potential single point failure. This can lead to issues such as data breaches and potential system paralysis, jeopardizing client data. Additionally, user privacy is at risk too. The infamous "Facebook–Cambridge Analytica data scandal" stands as a stark reminder of these concerns. In contrast, by dispersing data across a global network of nodes, decentralized storage systems mitigate security risks and enhance data resilience.

Cost emerges as another critical factor in the comparison. An analysis published in May, 2023 highlighted that decentralized storage, on average, is approximately 78% cheaper than its centralized counterparts.[8] This price differential is even more pronounced in enterprise-grade data storage, where costs can be up to 121x higher. This disparity can be attributed to factors such as the significant capital investment required for centralized storage infrastructure and associated overhead expenses. Conversely, decentralized storage capitalizes on the availability of surplus computing resources worldwide. Moreover, while the centralized storage market is oligopolistic – with a few tech giants influencing pricing – the decentralized storage market is largely driven by open market forces.

In spite of its potential security loopholes and elevated costs, centralized storage still excels in certain areas, notably user experience and product maturity. These systems often offer interfaces that are more user-friendly for general users, complemented by a comprehensive product suite catering to various computing needs beyond mere storage. The amalgamation of user-friendly design and all-encompassing solutions has contributed to its continued dominance.

Figure 8: Centralized vs. decentralized storage

	Security	Privacy	Cost	Ease of use	Maturity
Centralized	Lower	Lower	Higher	Easy	Higher
Decentralized	Higher	Higher	Lower	Medium - High	Lower

Source: Binance Research

Case Study: BNB Greenfield

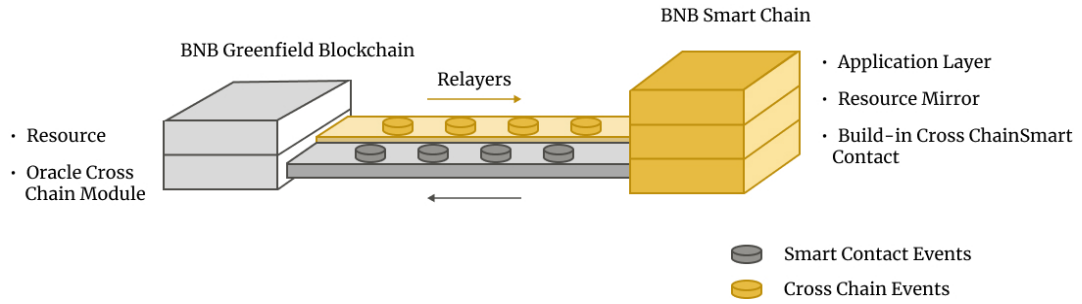
BNB Greenfield, the third blockchain in the BNB Chain ecosystem, is a storage-centric blockchain supported by an array of SPs. Designed to serve as the foundational storage for both the BNB ecosystem and EVM-compatible addresses, Greenfield distinguishes itself through its innate integration with the BNB Chain. This unique linkage allows it to capitalize on BNB Chain's expansive DeFi ecosystem and its substantial developer community.

BNB Greenfield operates on a dual-layer architecture: a PoS-based blockchain safeguarded by BNB-staking validators and a storage network maintained by storage nodes. The role of the validators is to store meta-data on-chain, validate data availability, and secure the

Greenfield chain. In contrast, SPs handle the actual storage of data and offer various storage services.

A key feature of BNB Greenfield is its cross-chain programmability, which allows users to integrate their data with financial applications in the BSC ecosystem. The bedrock of this cross-chain function is the native cross-chain bridge, coupled with a relayer system, bridging Greenfield and BNB Chain. These components collectively facilitate the interaction between the two ecosystems.

Figure 9: BNB Greenfield's cross-chain architecture



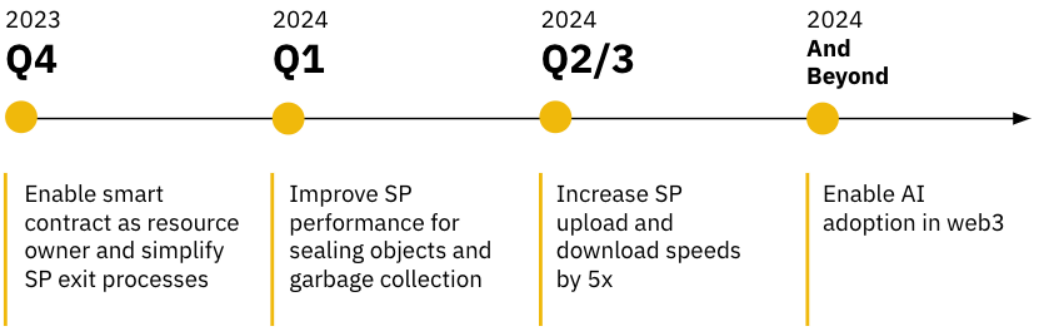
Source: BNB Greenfield

Decentralized storage services like BNB Greenfield have a broad spectrum of applications. Their use cases are not confined to only blockchain-related scenarios, but also extend to include a variety of real-world applications. Examples include:

- **Blockchain data storage:** Layer-1 blockchains contain extensive historical data. Such data can be efficiently stored on BNB Greenfield to reduce latency on the L1 and enhance data accessibility. Additionally, BNB Greenfield provides a cost-effective solution for storing Layer-2 transaction data.
- **Decentralized social:** BNB Greenfield can be utilized by decentralized social networks, allowing creators to maintain ownership over their content and data.
- **Personal cloud storage:** Users can transfer encrypted documents, images, and videos across devices. Access to these files is maintained via personal private keys.
- **Website hosting:** BNB Greenfield can be utilized by users as a tool in their toolkit for website deployment.

Looking ahead, there are several ongoing developments for BNB Greenfield, with plans to improve user experience and advance the utility of decentralized storage. In the recently published roadmap, users can look forward to enhanced performance, cross-chain support, and enablement of AI adoption, among others.

Figure 10: BNB Greenfield roadmap



Source: BNB Greenfield, Binance Research

For more information on decentralized storage networks, and BNB Greenfield, check out our previous report "Traversing Decentralized Storage."

3.4 Sensors

Decentralized sensor networks facilitate the monitoring and capturing of data from diverse environments in a secure and transparent manner. These networks consist of grids of devices fitted with sensors that can collect a range of data, from traffic and weather conditions, to the map of local streets. By employing a decentralized and bottom-up approach, decentralized sensor networks enhance data integrity, reliability, and reduce the potential for data manipulation or censorship.

In a world where a myriad of devices around us constantly generate data, decentralized sensor networks optimize the utilization of our data-abundant surroundings through the collection of such data.

There are several sub-sectors within this field, each involved in the collection of different forms of data:

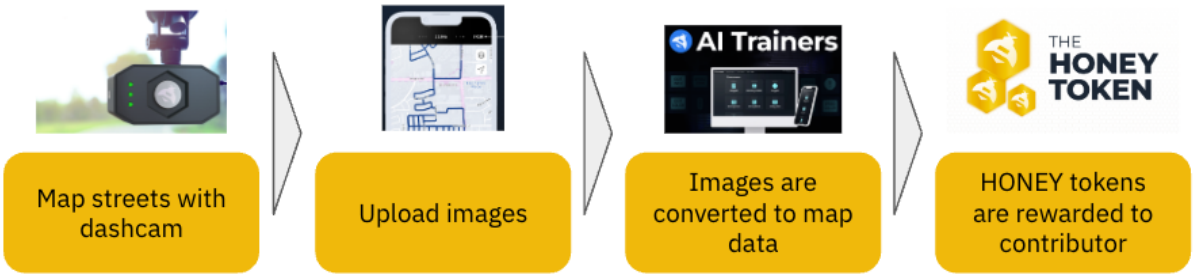
- **Environmental:** Monitoring and analysis of environmental conditions such as air quality, weather conditions, and water levels.
- **Energy:** Measurement of energy-related data such as production and consumption amount.
- **Location and Mapping:** Collection of geographic information that can be used for urban planning, navigation, and other location-based services.
- **Supply Chain:** Collection and verification of information such as sustainability claims, sources of production materials, in order to increase transparency of supply chains.
- **Smart Environments:** Monitoring of data such as traffic patterns, pollution levels, or foot traffic.
- **Mobility:** Collection of traffic-related or vehicle-related data.

Case Study: Hivemapper

Hivemapper is building a global decentralized mapping network that collects up-to-date, high resolution data in a permissionless manner. Hivemapper relies on a community of contributors to collect 4K street-level imagery with vehicle dashcams. These range from rideshare drivers, to delivery drivers, and hobbyists. Additionally, a group of people called "AI trainers" work with Hivemapper's Map AI engine to participate in the analysis of the images and turn them into valuable information customers require.

As payment for the consumption of data, the network's native HONEY tokens are used by consumers of map data (e.g., companies). Contributors are also rewarded with HONEY tokens for their services, thereby incentivizing them in scaling the network. Effectively, a contributor shares in the value created by demand for mapping data.

Figure 11: An illustration of how contributors participate in Hivemapper

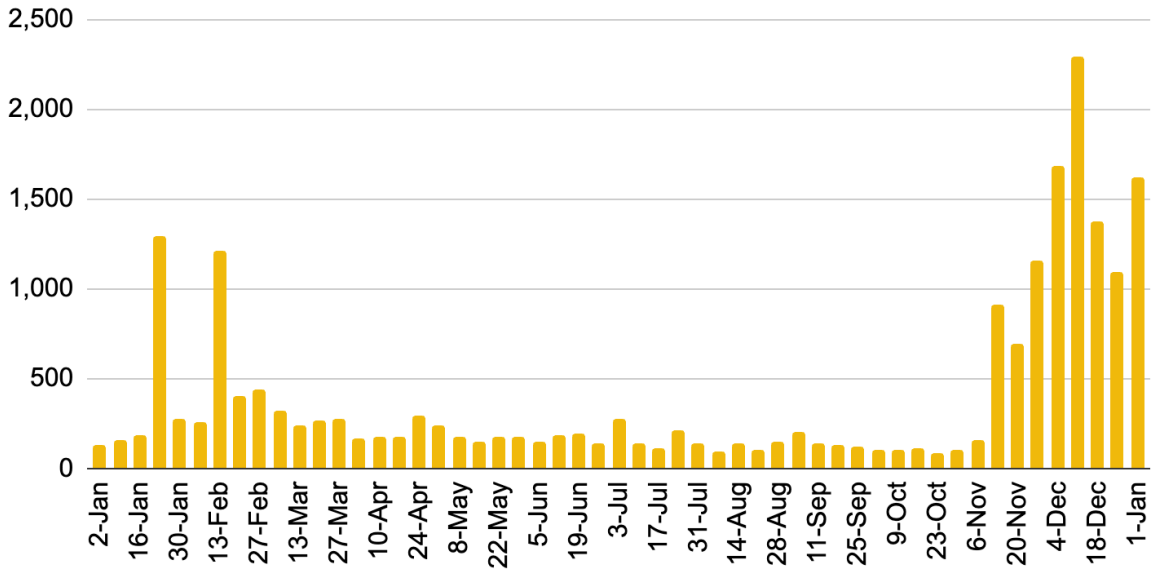


Source: Hivemapper, Binance Research

Hivemapper has a coverage of more than 1,920 regions, with roads mapped across all continents except Antarctica today. Specifically, it has over 112M road kilometers mapped, including more than 7.2M unique road kilometers. The ratio of total road kilometers to unique road kilometers indicates the frequency of coverage and translates into greater accuracy due to repeated data collection. Hivemapper claims that the network sees a location 24 to 100 times more frequently than other services like Google Street View.[9]

Hivemapper's widespread coverage has been made possible by a global network of 38.5K contributors across different countries.[10] Similar to trends since in other DePIN projects, we have also observed an increase in activity on Hivemapper in recent months. For example, the number of weekly new contributors has picked up recently.

Figure 12: Number of weekly new contributors has increased in recent months



Source: Dune Analytics (@murathan), as of January 17, 2024

The opportunity for the digital map market is huge - it is estimated to be a US$18.3B market in 2023 and is expected to reach US$73.1B by 2033.[11] While it is likely that large technology companies like Google and Apple will remain the dominant players considering their scale and ubiquitous reach, Hivemapper offers an alternative that leverages on crowdsourced resources to provide more precise data through frequent data collection.

By providing up-to-date maps, Hivemapper has also unlocked new use cases not possible with existing solutions. This ranges from using Hivemapper to access fresh data on exterior home conditions for home insurance companies, to gaining access to up-to-date road information and awareness of construction zones for autonomous vehicle developers. Hivemapper's Bursts feature also allows consumers of map data to request for fresh data on demand, further increasing the utility of the network.

4 Key Themes and Challenges

In this section, we explore potential future trajectories for DePIN projects and discuss some of the challenges they must overcome to achieve broader adoption.

4.1 Key Themes

Looking ahead, we expect several developments that are worth watching.

- **DePIN to coexist alongside traditional infrastructure players:** It is unlikely that DePIN can replace traditional networks in the near term, considering that the latter has significant capital resources and established infrastructure. Nonetheless, the ability to enable a sharing economy powered by idle resources, and allowing for last mile coverage in instances where it may not be financially viable for traditional players, DePIN offers a viable solution that augments the current landscape. As such, a more likely scenario is one where DePIN networks coexist with the traditional infrastructure players, supplementing any last mile coverage and providing a solution that allows smaller entities or individuals to participate in the building of infrastructure.

- **DePIN powering Web2 front-ends:** It is undeniable that interacting directly with DePIN may be technically too complex for the general public, and is likely a contributing factor for the relatively slow pace of adoption compared to existing Web2 services. Apart from a focus on improving user experiences and user interfaces, we also expect DePIN projects to work together with traditional players or web2 companies to expand their reach. In effect, users may interact with a Web2 front-end, unaware that the underlying back-end leverages DePIN and blockchain technology. This could lower the steep learning curve and perceived risks tied to crypto, making the use of DePIN products as user-friendly as those in the Web2 domain, but with the added advantages of cost-efficiency and transparency.

- **Increased token utility and composability:** Most DePIN tokens serve primarily as a medium of payment for accessing project services. While this provides fundamental utility, one of the most compelling aspects of blockchain technology is its composability within the broader on-chain ecosystem, particularly in DeFi. The ability for users to earn additional yield or explore diverse use cases with the tokens they earned could further enhance the appeal of participating in DePIN projects.

  Notable examples illustrating this potential are Filecoin's Filecoin Virtual Machine and BNB GreenField's inherent integration with the BNB Chain. These projects expand beyond the basic utility of using FIL and BNB solely for data storage,

offering users opportunities to engage their tokens in a wider ecosystem. Even though it's early days for these expanded uses, they hint at a potential future direction that could spur the growth and popularity of DePIN projects.

4.2 Challenges

DePIN projects, despite their transparent and verifiable systems, aren't devoid of challenges that impact their mass adoption.

- **Price volatility affects supply-demand dynamics:** The inherent price volatility of tokens may deter some from participating in DePIN projects. Given that supply-side contributors receive compensation in the form of the project's native token, price fluctuations introduce elements of uncertainty that can impact their profitability. Even though hedging strategies could potentially mitigate this issue, this may not be feasible for the less sophisticated network participants or tokens that are of smaller market capitalization.

  This also affects the demand side of the equation, considering that tokens are used to pay for network services. A rapid surge in token prices without a corresponding adjustment in the prices of services could deter potential users. Therefore, a well-designed tokenomics and operating model will be crucial in contributing to reduced price volatility.

- **Users are largely profit-driven:** Despite the clear value proposition of DePIN projects, the performance of their native tokens still plays a crucial role in attracting and retaining users. When token prices are on an upward trajectory, it is generally easier to attract more users that are interested in participating in the upside. Conversely, in a bear market, falling token prices and profitability could cause network participants to exit the project. This situation can be particularly challenging for tokens with smaller market caps and thinner liquidity, potentially leading to a vicious downward spiral.

  Overcoming this challenge is not an easy task, but projects that are able to provide services of value, and have a product-market fit will appeal to a wider range of audiences besides those that are profit-driven.

- **Lack of public awareness:** Awareness is crucial for the adoption of DePIN products. While these projects typically offer services that are more transparent and sometimes more cost-effective than centralized alternatives, they are not well-known outside the crypto industry. This limited awareness can be attributed to the general population's unfamiliarity with blockchain technology and the complexity of digital assets. As a result, only a small segment of the population currently appreciates the merits of these decentralized services.

5 Closing Thoughts

DePIN projects leverage a distributed and transparent system to enhance infrastructure scalability and efficiency. This approach aligns with the principles of the crypto industry. By utilizing token economics, DePIN projects crowdsource resources like storage capacity and computing power, eliminating the need for large initial capital investments. Their potential application across various sectors signals a huge addressable market.

Yet, challenges remain in achieving widespread adoption. In the short run, fully replacing centralized counterparts is unlikely, and we will most likely see a middle ground where DePIN and traditional infrastructure providers co-exist. Looking ahead, achieving a more seamless user experience and expanding the on-chain use cases for DePIN tokens are key trends to monitor. While we anticipate an increase in the number of DePIN projects as the sector grows, their ultimate long-term viability and success hinge on real-world applicability and have yet to be thoroughly battle tested.

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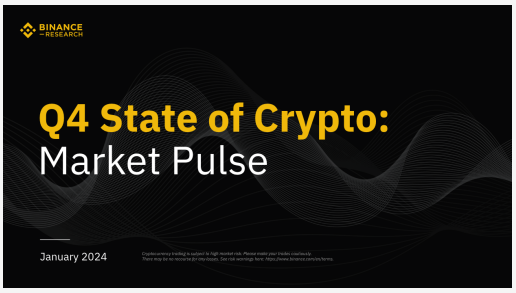
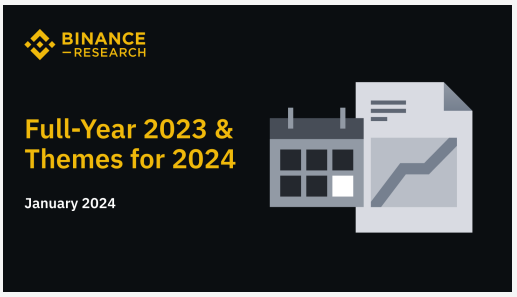


Q4 State of Crypto: Market Pulse

A compilation of key charts and insights on the market



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A summary of the most important market developments, interesting charts and upcoming events

About Binance Research

Binance Research is the research arm of Binance, the world's leading cryptocurrency exchange. The team is committed to delivering objective, independent, and comprehensive analysis and aims to be the thought leader in the crypto space. Our analysts publish insightful thought pieces regularly on topics related but not limited to the crypto ecosystem, blockchain technologies, and the latest market themes.

Jie Xuan Chua, CFA

Macro Researcher

Jie Xuan ("JX") is currently working for Binance as a Macro Researcher. Prior to joining Binance, he worked as a Global Investment Specialist with J.P. Morgan and had prior Equity Research experience at various fund houses. JX is a CFA charterholder. He has been involved in the cryptocurrency space since 2017.

Brian Chen

Macro Research Intern

Brian is currently working for Binance as a Macro Research intern. Prior to joining Binance, he worked as a DeFi researcher at a financial service startup and a Web3 education organization. He holds a Master of Finance degree from the University of California, Irvine ("UCI"), and has been involved in the cryptocurrency space since 2021.

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