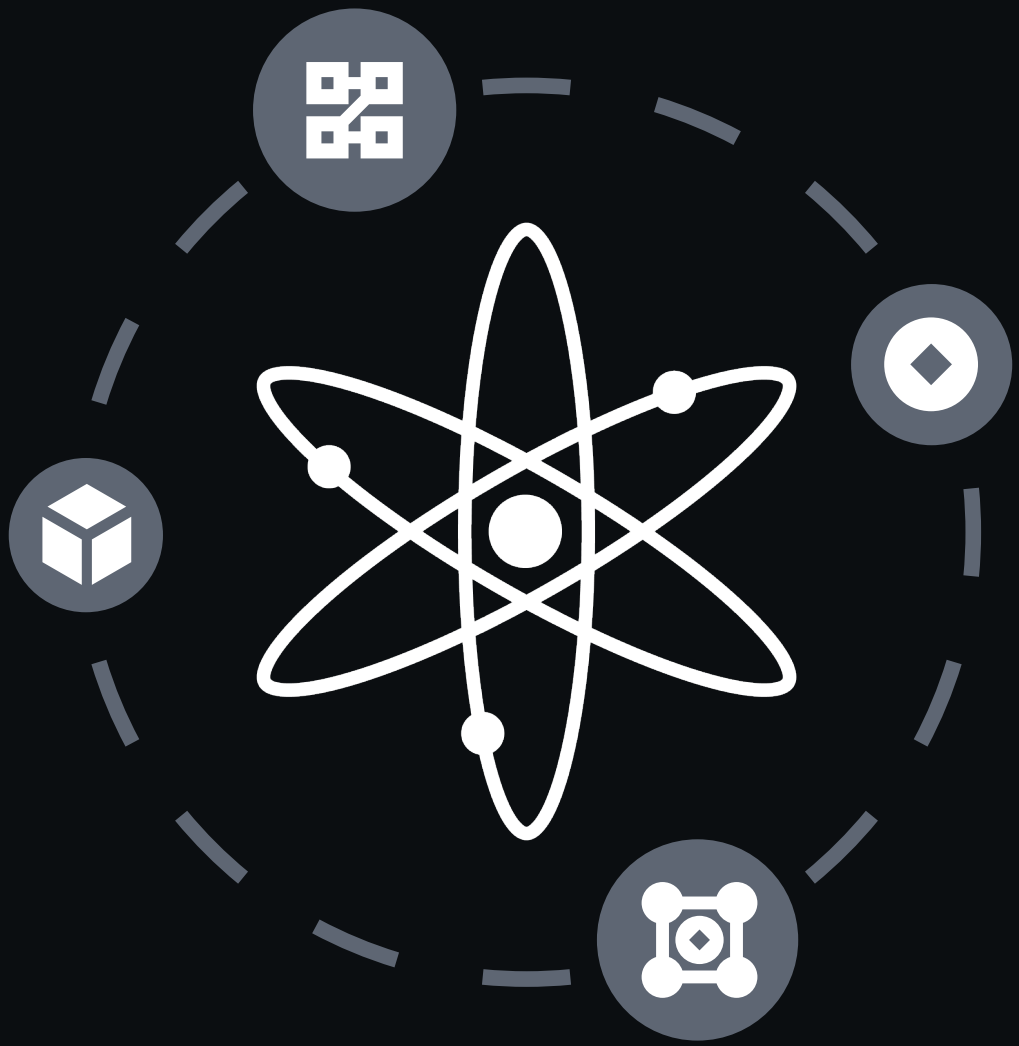
BINANCE RESEARCH

Orbiting the Cosmos Ecosystem

March 2024



Brian Chen

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1 Key Takeaways

- Cosmos is a network of sovereign blockchains, each powered by Cosmos's technological stack, known as the Interchain Stack. This framework offers a parallel scaling solution for projects requiring high levels of customization while aiming to be part of an interoperable ecosystem.
- The Interchain Stack consists of CometBFT, Cosmos SDK, and Inter-Blockchain Communication ("IBC") Protocol, with each component addressing different layers of a blockchain, including consensus, networking, and application.
- In the Cosmos ecosystem, a blockchain enabling the Inter-Blockchain Communication Protocol, a messaging protocol for blockchain interaction, is identified as a "Zone." Prominent Zones with many IBC connections become known as "Hubs," such as the Cosmos Hub and Osmosis.
- In this report, we cover several key projects within the Cosmos ecosystem, including the Cosmos Hub, Osmosis, Injective, Sei Network, Stride, Axelar, Celestia, and Dymension.
- Cosmos' growth speaks to its vision of an internet of blockchains. Its success derives from versatile technology and the dedicated team behind it, resulting in a thriving ecosystem. Its steady advancements over the years underline Cosmos' status as a fundamental industry player.

2 Introduction

In the evolving blockchain ecosystem, the shift towards a multichain landscape appears inevitable. Yet, the journey toward this future has been impeded by challenges such as limited interoperability, constrained customizability, and scalability issues. Cosmos emerges as a notable player, aiming to address these persistent hurdles. Unlike conventional blockchains such as Ethereum and Solana, Cosmos is not a single blockchain. Instead, it comprises a network of interconnected, sovereign blockchains, each powered by Cosmos's technological framework.

General-purpose blockchains like Ethereum often face the challenge of decentralized applications ("dApps") competing for the same limited block space. This can lead to compromised user experiences for dApps that demand greater computational resources. In response, some projects create their own application-specific chains ("appchains"), Layer-1 ("L1") blockchains built for specific use cases, which unfortunately results in a fragmented ecosystem lacking the composability found in general-purpose blockchains.

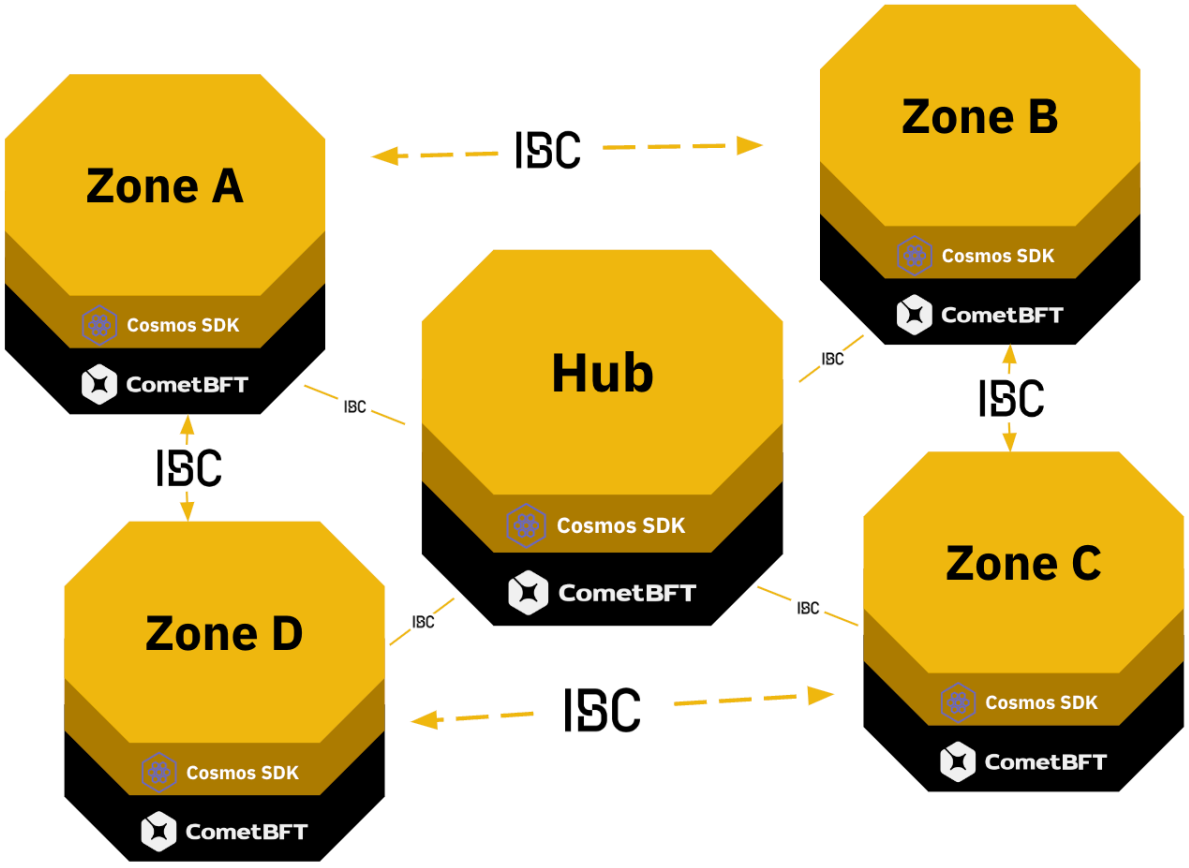
Cosmos presents an alternative to these challenges. By leveraging the Cosmos development framework, developers can build appchains that provide high degrees of customization and the ability to interconnect with other chains within the Cosmos ecosystem. This architecture not only boosts dApps' performance and customization options but also promotes a more cohesive and interoperable blockchain ecosystem.

In this report, we explore the intriguing ecosystem of Cosmos. We begin by examining its technology stack, walking through its features and functions. Subsequently, we delve into the data-driven aspects of the ecosystem's market state and analyze key projects along with their distinct features. Finally, we assess key developments that could shape the future of the ecosystem and conclude with our insights.

3 Technology Stack

In the Cosmos ecosystem, blockchains are developed utilizing the Cosmos technology stack, known as the Interchain Stack, which encompasses **CometBFT**, **Cosmos SDK**, and the **Inter-Blockchain Communication ("IBC") Protocol**. Each of these components addresses a different layer of a blockchain, including consensus, networking, application, and interoperability. Each blockchain within the Cosmos ecosystem has the option to interconnect with its peers by enabling IBC, a messaging protocol that facilitates blockchain communication. When a blockchain opts to activate IBC, it is identified as a "Zone." Zones that gain prominence and establish significant IBC connections with others are recognized as "Hubs," with notable examples including the Cosmos Hub and Osmosis.

Figure 1: Cosmos chains are built using the Interchain Stack, comprising CometBFT, Cosmos SDK, and IBC, each component addressing different layers of a blockchain



Source: Binance Research

CometBFT

CometBFT is a **consensus engine based on Tendermint that powers Cosmos chains**, primarily tasked with the secure and consistent replication of the state machine across the chain's nodes. It addresses both the consensus and networking layers of a blockchain, responsible for inter-node communication and block validation. CometBFT functions through two core components: a **consensus algorithm based on Tendermint** and the **Application Blockchain Interface ("ABCI")**.

Tendermint is a Byzantine fault-tolerant consensus algorithm using the Proof-of-Stake ("PoS") system, where validators' voting power is proportional to their staked tokens. This setup provides a high-performance, fault-tolerant mechanism for network consensus, supporting thousands of transactions per second ("TPS") and ensuring instant finality[(1)]. CometBFT represents an improved version over the standard Tendermint, designed with optimizations such as reducing consensus message count, enhancing block validation efficiency, and lowering the memory footprint for running a node[(2)].

ABCI is the socket protocol for CometBFT, serving as the interface between the consensus engine and the application layer. Applications need to implement ABCI to communicate with CometBFT. ABCI does not mandate the use of any specific language for application development, thereby providing developers flexibility.

Cosmos SDK

While CometBFT operates the consensus layer of a Cosmos chain, **Cosmos SDK is used to construct the application layer atop it**. It is an open-source development framework comprised of composable modules, each designed according to the principles of composability, specialization, and capabilities[(3)]. This design ethos ensures that modules can be seamlessly integrated with one another, each performing distinct functions while maintaining inter-module security. Given that the consensus and interoperability facets are managed by other components of the Interchain Stack, developers leveraging the Cosmos SDK are able to concentrate solely on building the application layer. This focus, coupled with the availability of pre-built modules within the SDK, allows developers to build customized applications with both ease and efficiency.

CosmWasm

CosmWasm is a smart contract platform built for the Cosmos ecosystem. It utilizes a version of WebAssembly tailored for Cosmos, hence the name CosmWasm. Written as a module that can easily plug into the Cosmos SDK, it has been widely used by blockchains built using the Cosmos SDK.

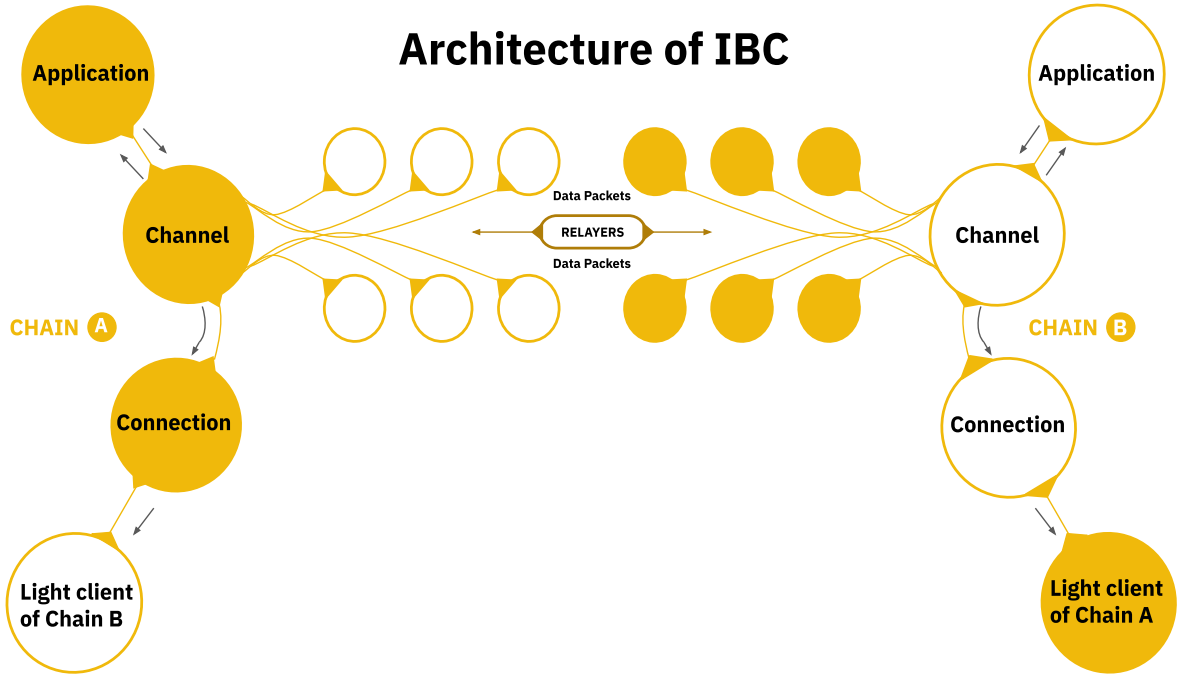
Inter-Blockchain Communication Protocol

IBC is a general message-passing protocol that facilitates communication among blockchains, allowing for the exchange of any form of data between two chains. It is primarily used by blockchains built using the Cosmos SDK. IBC is structured into two layers: **the transport layer** and the **application layer**. The transport layer comprises four components: light clients, relayers, connections, and channels. Collectively, these four elements handle the transport, authentication, and ordering of data packets, which encapsulate the messages being transmitted. On the other hand, the application layer is the interface that users interact with. Built atop the transport layer, it specifies how data packets should be packaged and interpreted by the sending and receiving chains.

A simplified version of IBC's messaging process works as follows:

1. Two chains engage via 'Connections' components within the Transportation Layer, each having light clients of their counterpart chain.
2. When Chain A desires to communicate with Chain B, it sends the block header where the message resides, accompanied by a commitment proof of the message.
3. 'Relayers' then transmit the message to Chain B, with the 'Channels' components serving as conduits between the chains.

Figure 2: High-level overview of IBC's workflow



Source: IBC-Go Documentation, Binance Research

4 Market Metrics

Over time, Cosmos has grown into a vast ecosystem comprising a myriad of L1 blockchains tailored to different use cases and objectives. Presently, these L1s, totaling over 94, have a combined market cap of US$108B, of which US$32B[4] is interconnected by the IBC protocol. This underscores Cosmos's position as one of the most robust ecosystems in terms of economic value. **IBC, as a cross-chain communication protocol, has exhibited significant usage, with a 30-day volume of US$5.3B[5].** This performance, coupled with IBC's flawless security record, highlights IBC's prominence as one of the most utilized and reliable cross-chain communication protocols.

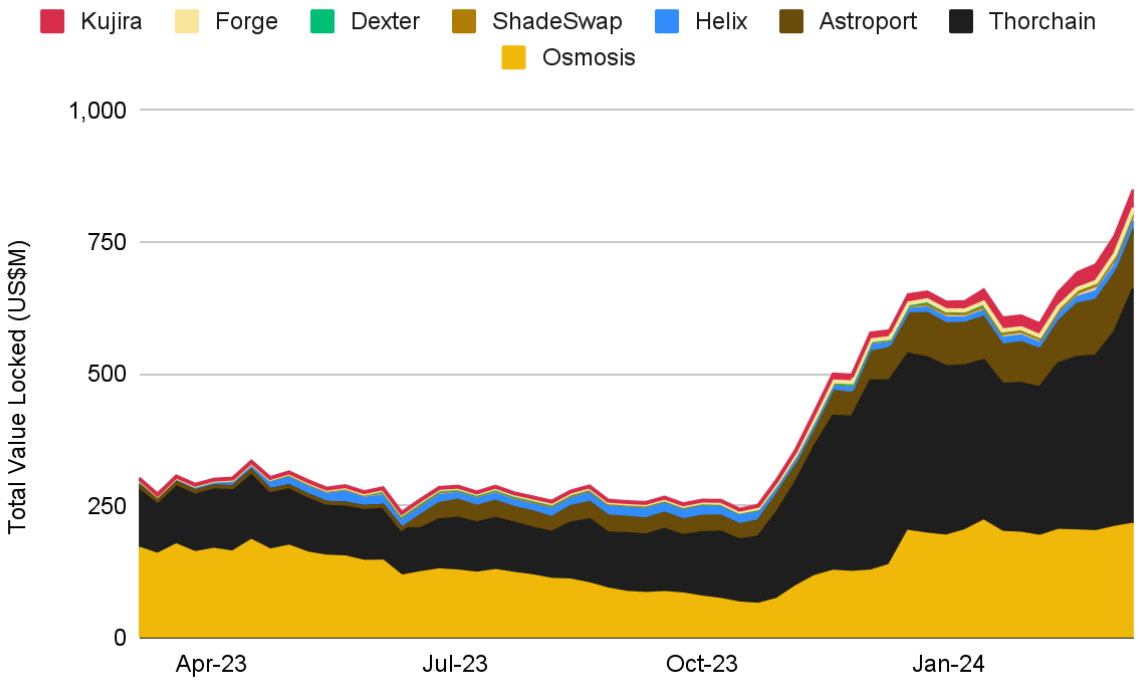
Figure 3: Osmosis, Noble, dYdX, Celestia, and Cosmos Hub are the top five projects in terms of 30-day IBC volume

Logo	Name	30D IBC Volumes (US$M)	Peers	Monthly Active Users (K)
	Osmosis	1,506	84	291
	Noble	898	36	10
	dYdX	585	14	17
	Cosmos Hub	422	66	537
	Celestia	392	14	352

Source: Map of zones, Binance Research, as of March 11, 2024

The decentralized exchange ("DEX") landscape of Cosmos is primarily shaped by a few key players, including Osmosis, Astroport, Kujira, and Helix. Leading the sector, Osmosis boasts the highest total value locked ("TVL"), surpassing the TVL of the second-largest DEX, Astroport, by a factor of two. Kujira operates FIN, an orderbook exchange supporting diverse trading pairs quoted in Kujira's own stablecoin, $USK. With a range of products including the money market Ghost, liquidity engine BOW for FIN, the DeFi liquidation marketplace ORCA, and more, Kujira is positioned among the largest L1s within Cosmos by TVL. THORchain deserves mention as an exceptional case; while it is a cross-chain liquidity protocol built using the Cosmos SDK, it does not enable IBC due to various reasons[6] and is thus not identified as a zone within the Interchain ecosystem.

Figure 4: Market resurgence has driven notable TVL growth across DEXes within Cosmos over the past year

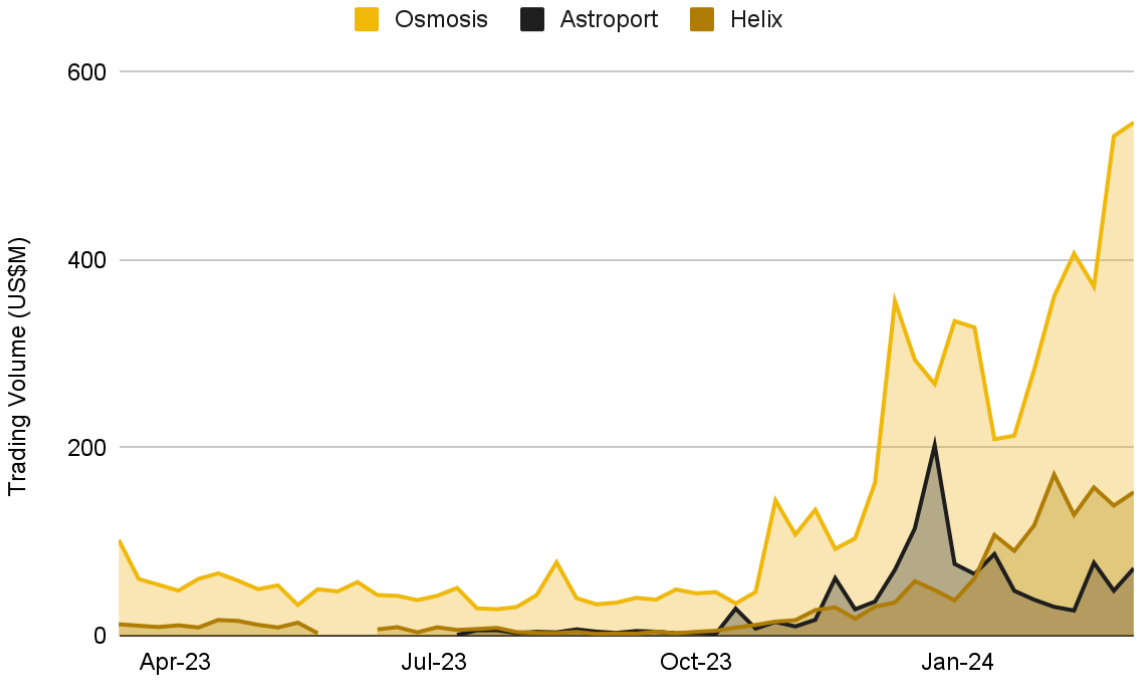


Source: DeFiLlama, Binance Research, as of March 11, 2024

Analysis of trading volume corroborates Osmosis's status as a leading DEX within Cosmos. In the past year, Osmosis DEX has achieved a total trading volume of over US$6B, significantly surpassing Astroport and Helix, which recorded volumes of US$1.3B and US$1.7B, respectively, according to DeFiLlama. Osmosis's DEX's preeminent position is hardly surprising given **Osmosis's role as a flagship hub within the Cosmos ecosystem, marked by its large number of peers and leading IBC volume**. As a native DEX on Osmosis, **Osmosis DEX not only contributes to the chain's success but also reaps benefits from it**. The Osmosis team has also pioneered some of the most well-known features within the Cosmos ecosystem, including Superfluid Staking and Mesh Security. Its established position has also contributed to more capital inflow and further adoption, as exemplified by Milkyway's decision to leverage Osmosis DEX's deep liquidity, injecting approximately US$40M.

Astroport, on the other hand, operates as a multichain DEX across several blockchains. The Astroport and Osmosis communities recently green-lighted a partnership for deploying Astroport's PCL pools to Osmosis, which is deemed mutually beneficial. As two largest Cosmos DEXes, the potential synergy of this partnership will be interesting to follow. Helix distinguishes itself by utilizing an orderbook model rather than an automated market maker ("AMM") model employed by its peers. Despite this distinction, Helix has yet to gain a significant advantage. The widespread adoption of AMM for spot crypto trading, combined with the liquidity strengths of leading DEXes like Osmosis, diminishes the appeal of Helix's orderbook model in attracting users compared to others.

Figure 5: Osmosis has significantly outperformed its peers with a total trading volume of over US$6B in the past year



Source: DeFiLlama, Binance Research, as of March 11, 2024

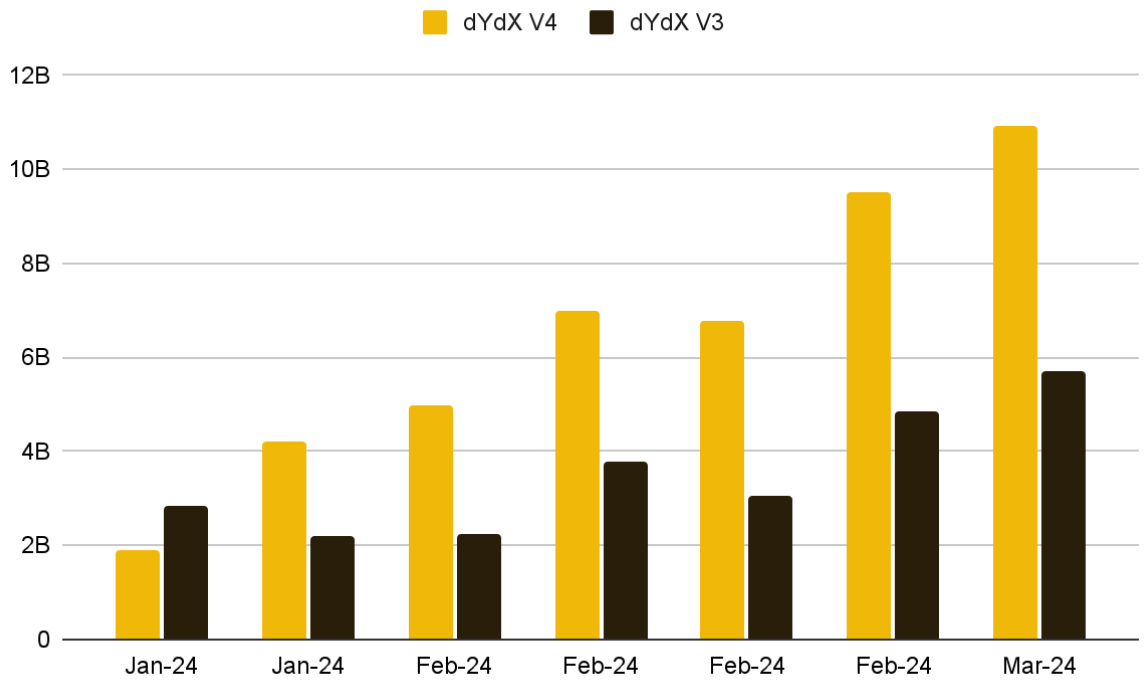
Taking a look at the perpetual DEX landscape, dYdX stands out as the undisputed leader, significantly outperforming its competitors in trading volume. In June 2022, the dYdX team announced plans[7] to migrate toward a standalone blockchain, dYdX Chain, leveraging the Cosmos SDK and Tendermint PoS consensus mechanism for its V4 upgrade. This strategic pivot was motivated by concerns regarding the centralization of dYdX V3. After thorough evaluation, **the team concluded that the Cosmos technology closely aligns with their objective of fully decentralizing the protocol while meeting the high-performance requirements of a perpetual DEX**.

Prior to its V4 iteration, dYdX V3 had established itself as the leading perpetual DEX in the DeFi sector, attributed largely to its adoption of the orderbook model. **dYdX deems the orderbook a cornerstone feature, valuing its alignment with the operational mechanics of centralized exchanges ("CEXes") and its capability to deliver an institutional-grade level trading experience to both individuals and traditional market makers**. The protocol provides market makers with flexibility, while traders benefit from enhanced precision in setting the prices of their transactions. This model enables dYdX to broaden its array of order types, such as trailing stop and bracket orders, thereby augmenting the variety of trading pairs available and deepening market liquidity.

The inauguration of V4 represents a significant advancement for dYdX, underscoring the team's dedication to continuous improvement. **To date, dYdX V4 has processed over US$50B[8] in trading volume**, with its daily volume frequently averaging around US$1B,

often surpassing that of smaller-scale CEXes. In 2024, the dYdX team is prioritizing initiatives such as Permissionless Markets, Core Trading Improvements, and UX/Onboarding Enhancements[9], aimed at bolstering its already formidable market position. Over the years, dYdX has constructed a substantial competitive moat, securing its status as a leading entity in the perpetual DEX space. Consequently, in the short to mid-term, dYdX is poised to maintain its dominance within the market.

Figure 6: Trading volume of dYdX V4 has shown notable increase compared to V3

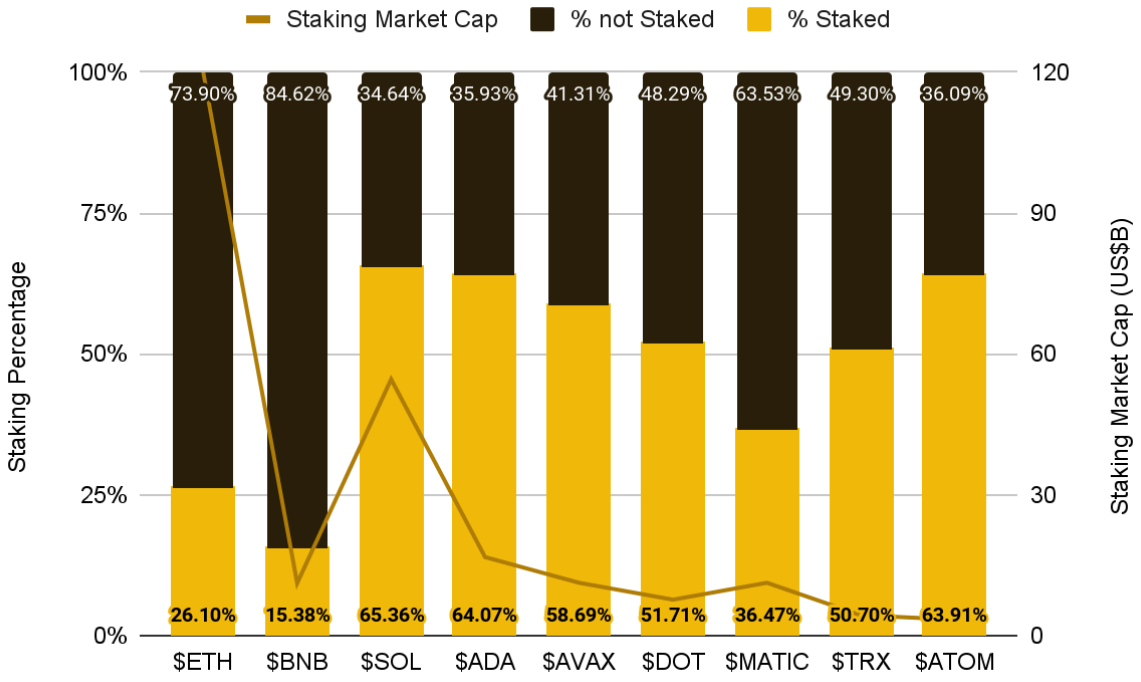


Source: DeFiLlama, Binance Research, as of March 11, 2024

In examining the staking landscape of Cosmos, it is evident that, in comparison to other major L1s by market cap, the staking ratio of $ATOM is one of the highest, currently standing at approximately 64%. **Despite this substantial staking ratio, a mere 2% of the staked $ATOM is liquid staked**, according to protocols' staking metrics. In contrast, Ethereum exhibits a staking ratio of 25% for $ETH, yet boasts a considerably higher portion of liquid staking at 38%[10]. Liquid staking has emerged as a prominent narrative in DeFi, especially after the Shanghai Upgrade. This is due to its ability to amplify returns from yield strategies, thereby drawing significant capital and participant interest. However, it's noteworthy that the liquid staking narrative predominantly flourishes within the Ethereum DeFi ecosystem, with other major L1s exhibiting a less vibrant liquid staking DeFi landscape.

As such, **this context should not be viewed as a deficiency within Cosmos but rather as an untapped area of growth**. Capitalizing on this potential could substantially enrich the DeFi landscape in Cosmos, presenting a considerable opportunity for development and expansion in this sector.

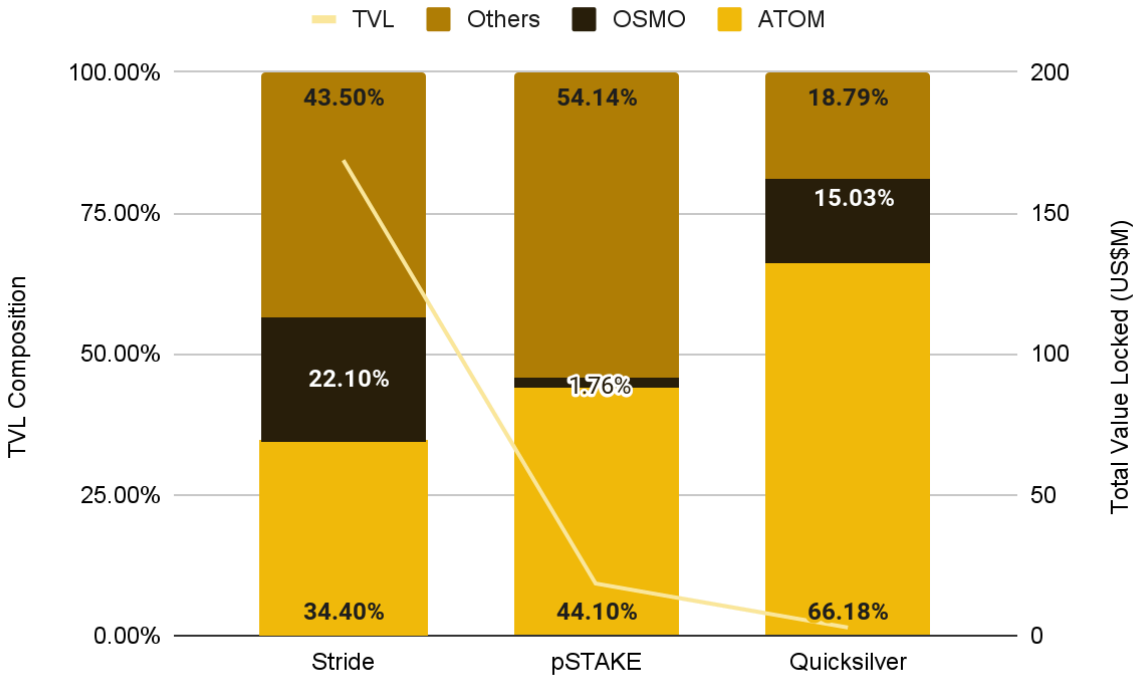
Figure 7: $ATOM has one of the highest staking ratios compared to other major L1s



Source: Staking Rewards, Binance Research, as of March 11, 2024

Diving deeper, the liquid staking market of Cosmos is led by Stride, pSTAKE, and Quicksilver.

Figure 8: Among the three, Stride leads the pack in terms of TVL and token supported



Source: DeFiLlama, Binance Research, as of March 11, 2024

Stride stands as the predominant force in the liquid staking domain of the Cosmos ecosystem, boasting a TVL of US$168M[11]. It also supports the highest number of tokens – twelve in total[12] – compared to its competitors, who each support only five[13]. Extensive token support is a strong competitive advantage within the Cosmos liquid staking landscape, especially considering that all Cosmos L1s operate on a PoS basis. Therefore, the broader the token support, the larger the total addressable market for a liquid staking protocol.

Another crucial factor in the competition among liquid staking protocols is the extent to which their liquid staking tokens ("LSTs") are integrated and utilized within the wider DeFi ecosystem. This is exemplified by Lido Finance's success, where $stETH has maintained its position as a leading Ethereum LST through substantial on-chain liquidity and protocol adoption. In this vein, Stride enjoys a competitive advantage due to its relatively larger scale of usage, positioning it favorably in the steadily growing liquid staking landscape of Cosmos.

Figure 9: Cosmos has cultivated a thriving ecosystem, comprising a myriad of unique L1 blockchains catering to different purposes and use cases

Source: Map of Zones

As depicted in Figure 9 above, Cosmos has cultivated a thriving ecosystem, attributed to its robust technological framework and the customizability and flexibility it provides. In the subsequent section, we will discuss some of the key projects in the ecosystem. Given the vast number of projects within Cosmos, it is impractical to cover each one in detail.

Therefore, the absence of any projects should not be interpreted as a negative assessment of their value or potential.

5 Ecosystem Projects

Note that the mention of specific projects does not constitute endorsement by Binance. Instead, projects cited are merely used for the purposes of introducing related projects.

Cosmos Hub

Launched in 2019, Cosmos Hub is the first and largest blockchain in the Cosmos ecosystem. Built using the Interchain Stack, Cosmos Hub operates as a PoS blockchain secured by $ATOM. The Hub itself doesn't possess smart contract functionality; instead, it serves primarily as an interoperability hub for the ecosystem. Over the years, a thriving ecosystem has been cultivated around the Cosmos Hub. However, **due to the unclear value accrual of $ATOM, there has been ongoing debate regarding the Hub's position within the Cosmos ecosystem**.

In this context, the concept of **Replicated Security** (previously Interchain Security V1) was introduced. This feature, which received overwhelming support (over 99%[14]) from the community, allows **the Cosmos Hub – referred to as a 'provider chain' – to lend its security to 'consumer chains' in exchange for fees**. This means that new Cosmos chains can be launched using the security of the Cosmos Hub while bypassing the time-consuming tasks of bootstrapping and maintaining their own validator sets. To compromise a consumer chain, an attacker would have to gain control over the Cosmos Hub itself, implying that the consumer chain fully inherits the provider chain's security. Replicated Security enables the Cosmos Hub and $ATOM to gain increased significance and value accrual as the hub can serve as the ecosystem's security hub. Hub can also earn additional fees and help simplify the onboarding process for new Cosmos chains.

To launch with Replicated Security in the Cosmos Network, **a project needs approval first from $ATOM holders via a governance proposal, and then from at least two-thirds of Cosmos Hub's fixed set of 180 active validators**. Once approved, all Cosmos Hub validators are required to validate blocks for the new 'consumer chain', with no option to opt out. Penalties apply for failing to validate the new chain's blocks, similar to those for the Cosmos Hub. Consumer chains often incentivize validators through revenue sharing arrangements, which can include **transaction fees**, **application fees** (like MEV and swap fees), and **token inflation** if there's a native token for the consumer chain.

Replicated Security officially went live in 2023, with two projects utilizing it. Neutron is the first project to implement Replicated Security and to be launched as a consumer chain on the Cosmos Hub. Stride followed as the second consumer chain of the Cosmos Hub, setting a precedent by becoming the first standalone appchain to transition to Replicated Security.

Both projects are part of the Atom Economic Zone (“AEZ”), an ATOM-aligned group of chains and dApps that directly contribute to the value of the Cosmos Hub.

In addition to Replicated Security, development efforts are ongoing for other forms of "Shared Security" models, specifically **Opt-in Security** and **Mesh Security**. Unlike in Replicated Security, where all validators are required to secure consumer chains, **Opt-in Security provides validators with the option to assess the profitability of securing consumer chains. If they deem it unprofitable, validators can opt out**. Opt-in Security also has the advantage of allowing consumer chains to launch without requiring a governance proposal, thus enabling permissionless chain launches. However, as validators come and go, the overall security of the chains may fluctuate, leading to potential instability. Mesh Security, a concept introduced by Osmosis, will be explored further in the Osmosis section.

Overall, the Cosmos Hub team has been striving to enhance its value accrual and support the sustainable growth of the Interchain ecosystem. Replicated Security is just one of the progressive initiatives they're working on. According to the Cosmos Hub 2024 Roadmap, the platform could soon be rolling out new features, **including Atomic IBC, which promises to bring atomic composability to Cosmos Hub consumer chains, and IBC Routing, set to reduce relayer costs by routing light client updates through the Hub for any chain using IBC**. It will be intriguing to observe how these developments take form and the way Interchain Security models progress throughout the year.

To learn more about Replicated Security, Neutron, and Mesh Security, please check out our previous report, Modular Blockchains: The Race to Become the Top Security Provider.

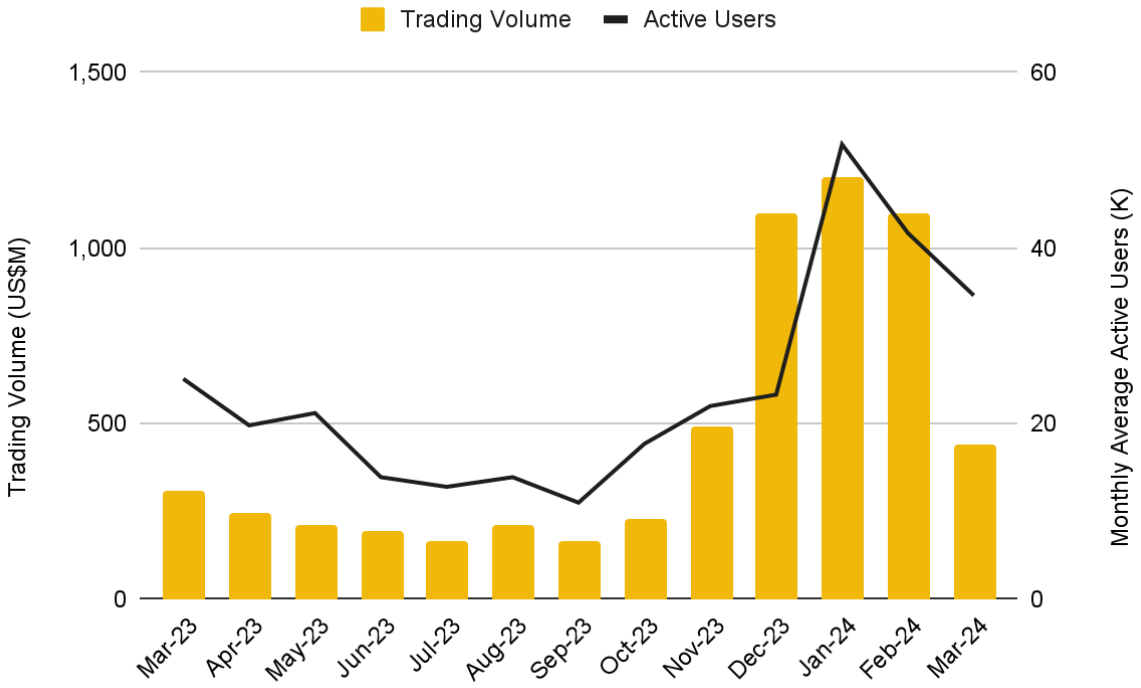
Osmosis

Osmosis is a prominent liquidity hub in the Cosmos ecosystem, **regularly leading IBC volumes and interconnecting with more zones than any other Cosmos chain**. Its decentralized exchange, the Osmosis DEX, stands as the largest DEX in the Cosmos ecosystem in terms of TVL and trade volume, offering deep liquidity and a broad range of trading pairs to its users. Over the past year, the Osmosis DEX has facilitated over US$6B[15] in trading volume while seeing an increase in active users. Osmosis has also been actively pursuing additional features aimed at enhancing the functionality of its DEX and furthering the sustainability of its tokenomics. It launched **Supercharged Liquidity** – Osmosis's take on concentrated liquidity – and is working on **OSMO 2.0**, an overhaul of the existing tokenomics designed to emphasize long-term sustainability.

Additionally, Osmosis hosts numerous notable dApps in the wider Cosmos ecosystem. Notably, Mars, a money market protocol that migrated to Osmosis following Terra's collapse, and Levana Protocol, a perpetual DEX that also found a new base in Osmosis post Terra's downfall, have both shown exceptional growth. Another important deployment on

Osmosis is Milkyway, a liquid staking protocol for Celestia's $TIA token. It primarily chose to launch on Osmosis because the Osmosis DEX hosts the largest on-chain TIA liquidity and supports CosmWasm contracts. Since its launch, it has brought around US$40M[16] of $TIA to Osmosis.

Figure 10: Osmosis's trading volume and active users have seen notable upticks over the past year



Source: Token Terminal, Binance Research, as of March 11, 2024

One of the most distinctive features of Osmosis is Superfluid Staking — an innovative staking solution enabling users to earn both swap fees from liquidity pools and PoS staking rewards simultaneously.

Superfluid Staking operates in three stages:

1. Liquidity providers deposit tokens into liquidity pools.
2. They then lock the received liquidity pool ("LP") tokens through Superfluid Staking.
3. Consequently, the LP tokens accrue both fees and rewards from AMM pools and network staking.

This mechanism marks a groundbreaking innovation as it's the first time that liquidity providers can contribute to the DEX liquidity provision while concurrently securing the network and earning rewards. This greatly enhances capital efficiency and the allure of participation in the Osmosis network.

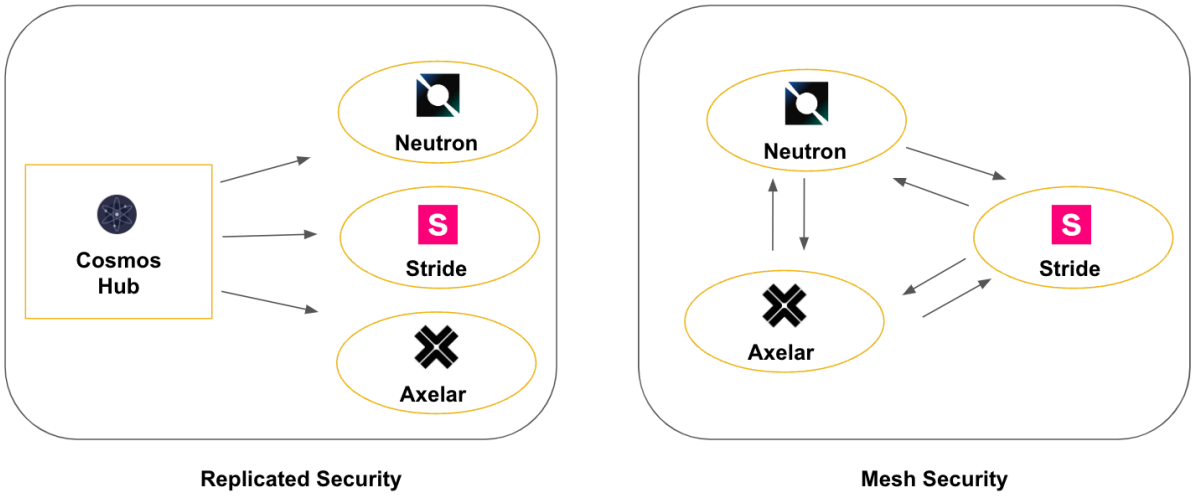
Announced on May 18, 2023, Mesh Security is another notable initiative by Osmosis. It is backed by the Osmosis Grants Program ("OGP"), with key funding partners such as ATOM

Accelerator, Akash, Axelar, and the Osmosis Foundation. The Mesh Security development will adopt a bottom-up approach, constructed as a public good by various teams across the Cosmos ecosystem. Functionally, **Mesh Security allows token delegators—with tokens staked on one Cosmos chain—to restake them on a different partner chain**. Should their chosen validator on the partner chain misbehave, the delegators' staked tokens are slashed on both chains. In return for undertaking this risk, token delegators earn staking rewards.

There are three main differences between Mesh Security and Replicated Security:

1. Unlike the unilateral security flow from provider to consumer chain in Replicated Security, **Mesh Security enables bidirectional or multilateral security with appchains combining their market caps**.
2. Replicated Security mandates validators to run extra nodes for consumer chain validation, whereas Mesh Security, centering on token delegators, doesn't pose such requirements.
3. While Replicated Security suits early-stage projects comfortable with relying on Cosmos Hub's validator set, Mesh Security caters to appchains looking to bolster economic security and intra-ecosystem ties. Therefore, **Mesh Security is considered complementary, not rivalrous, to Replicated Security**, and potentially an upgrade path for maturing appchains.

Figure 11: While Replicated Security uses a hub-and-spoke, unilateral security model, Mesh Security is more focused on bilateral or multilateral security



Source: Binance Research

Mesh Security can benefit the Cosmos ecosystem in three ways:

1. **Mesh Security enhances crypto-economic security for all appchains without compromising their autonomy**, fostering shared economic dependencies within the Cosmos ecosystem.
2. Not only focusing on multilateral security, **Mesh Security also accommodates unidirectional relationships**. Larger chains can secure new ones using restaked

tokens without requiring governance approval from the provider chain - a divergence from the Replicated Security model.

3. There are **cases where a service is best run through multilateral security**, i.e., a name service protocol might be best served in the form of a consumer chain that is secured by all other appchains in the "mesh", rather than controlled by the validators of just one appchain.

The development of Mesh Security is set to be completed in three phases, lasting approximately three months each. Whether Mesh Security is truly complementary or becomes competitive to other Shared Security models remains a key story to follow.

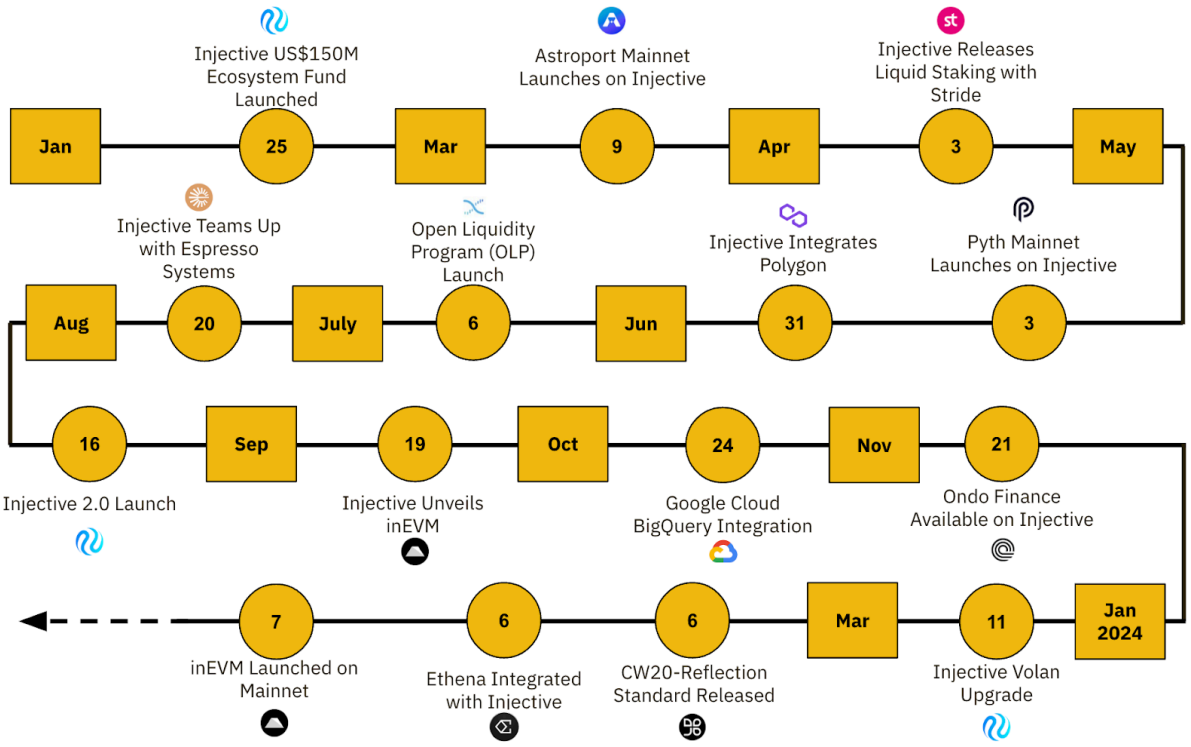
Injective

Injective is a L1 blockchain optimized for DeFi applications. It is built with the Cosmos SDK and utilizes Tendermint-based PoS consensus mechanism, providing instant transaction finality with the ability to sustain lightning-fast performance. **Injective's architecture leverages a fully on-chain orderbook**, empowering applications like spot, futures, and perpetual market to build upon it and harness its liquidity. Distinctively, **Injective adopts the Frequent Batch Auctions ("FBA") mechanism as its order matching solution to address the inefficiencies found in the traditional Continuous Double Auctions ("CDA") utilized by CEXes**[17]. The CDA model's susceptibility to front-running often undermines liquidity efficiency, detrimentally affecting the trading experience for retail investors. FBA mitigates these concerns through mechanisms such as order auction intervals, uniform clearing prices, and sealed bids, thus improving the liquidity environment for market participants. This novel feature, combined with the instant finality of Tendermint PoS algorithm, positions Injective as a highly performant DeFi platform.

In the past year, Injective has seen significant strides in ecosystem growth. The native token, $INJ, has experienced notable appreciation in value, alongside several technological advancements and initiatives aimed at ecosystem development. Particularly notable are the introductions of **inSVM** and **inEVM**, Injective's SVM and EVM rollup solutions. **These solutions foster a multi-VM development environment that enables developers from both Solana and Ethereum ecosystems to deploy smart contracts with minimal modifications**. This broadens Injective's ecosystem capabilities and enhances development compatibility across Cosmos, Solana, and Ethereum.

Additionally, Injective has partnered with Ethena, a synthetic dollar provider based on Ethereum. Ethena's USDe leverages LST and ETH as collateral, balanced by a short ETH perpetual position. Since its public launch on February 19, USDe has seen an explosive increase in capital inflow, with its supply quickly soaring past US$1B[18]. Such growth has propelled Ethena to the forefront of discussions among the DeFi community. Consequently, this integration represents a strategic move and has the potential to boost the vitality and growth of the Injective ecosystem.

Figure 12: Timeline of notable events within the Injective ecosystem



Source: Binance Research

Currently, Helix, Dojoswap, and Hydro Protocol are the top three biggest projects in the Injective ecosystem, commanding 10%, 38%, and 43%[19] of Injective's TVL, respectively, according to DeFiLlama. Helix, the primary DEX of Injective, specializes in spot and perpetual trading and has introduced Pre-launched Futures, a product witnessing increased popularity within the DeFi derivatives space in recent months. Entering 2024, Helix's trading volume has observed some positive shifts. Nonetheless, **when juxtaposed with DEXes like Osmosis and dYdX, notable gaps still remain**. The wide range of trading pairs and deep liquidity depth on Osmosis and dYdX naturally draw a larger user base.

Dojoswap, launched in December 2023 as Injective's native AMM DEX, swiftly climbed to become the second largest protocol in the ecosystem. Its ascension is credited to a variety of offerings that include liquidity mining, airdrop opportunities, and launchpads, offering users a variety of yield opportunities. Furthermore, the recent introduction of the CW404 standard, in collaboration with Injective, has also boosted its traction.

As the sole liquid staking protocol in Injective, Hydro Protocol has rapidly ascended to prominence within the ecosystem, capturing a significant share of TVL. This rise is partly due to users staking their tokens for future Hydro airdrops. Hydro's vision extends beyond simple liquid staking; it aims to establish itself as the yield and liquidity strategy infrastructure within Injective, with plans of introducing LSDFi products that combine real world assets and other DeFi yield sources.

Sei Network

Sei Network is a general-purpose L1 blockchain specifically designed for an optimal trading experience. The network goes beyond DeFi trading to include various forms of asset exchange, such as in-game assets and NFTs. Based on the Cosmos SDK, Sei uses the Tendermint consensus algorithm with design adjustments aimed at optimizing throughput, scalability, and speed — all of which are crucial for its trading-centric structure.

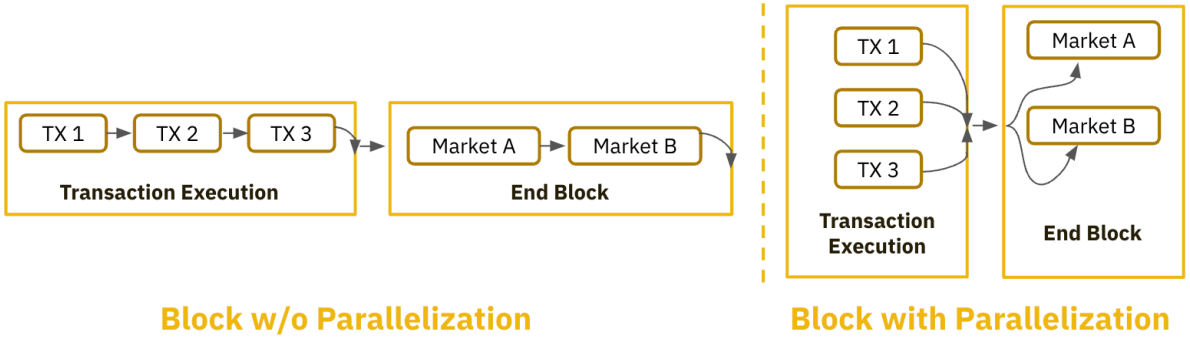
Sei implements two distinct features to achieve its trading optimization:

- **Twin-Turbo Consensus**
- **Parallelization**

Twin-Turbo Consensus is defined by two core elements: **Intelligent Block Propagation** and **Optimistic Block Processing**. In essence, Intelligent Block Propagation streamlines the transaction dissemination process to increase network throughput. Under this system, **block proposers initially disseminate a proposal containing a unique identifier and the hash of each transaction in the block, rather than sending the entire block with full transaction details to validators**. As most validators usually have the transactions in their local mempool, this process prevents validators from wasting time waiting on retrieval of transactions they already possess, thus enhancing overall efficiency.

On the other hand, Optimistic Block Processing accelerates the block committing process to improve latency. Under the Tendermint consensus, validators receive a block proposal, verify its validity, and then initiate the prevote and precommit phases before reaching consensus. As Figure A illustrates, with Optimistic Block Processing, **validators "optimistically" commence the block processing upon receipt of the block proposal**, rather than waiting for the precommit step to complete, thus improving overall latency.

Figure 13: Illustration of block processing with and without parallelization



Source: Sei Whitepaper, Binance Research

For chains using the Cosmos SDK, such as Sei, validators undergo a three-step process upon receipt of a block. Initially, a validator runs BeginBlock logic, followed by DeliverTx logic, and finally, EndBlock logic. Each of these steps is fully configurable, and **Sei modifies the latter two to implement parallel processing**.

Under conventional methods, transactions within the DeliverTx step are processed sequentially. However, Sei reconfigures this to enable simultaneous processing of multiple transactions, using the concept of a Directed Acyclic Graph to determine if certain transactions need sequential processing to avoid conflicts. Subsequently, for order processing at the end of the block, Sei employs parallel processing for independent orders that are related to its native order-matching engine. **Two orders are considered independent if they do not affect the same market within the same block**, with developers having the flexibility to define dependencies between different markets.

Additionally, Sei incorporates features such as a **native order matching engine** for additional optimization. Sei's native order matching engine allows decentralized exchanges built on it to deploy their own orderbooks. **It adopts FAB to prevent front-running, and employs order-bundling to enhance cost efficiency**. Collectively, these unique features and enhancements enable Sei to optimize its performance, positioning it as one of the fastest blockchains on the market.

Despite the recent surge in its token price, Sei is still in the early stages of overall adoption and ecosystem growth. Its TVL is currently around US$25M[20], with Astroport — a leading multi-chain DEX in the Cosmos ecosystem — being the most substantial dApp building on it. Consequently, **its recent momentum could be more reflective of market speculation around its narratives such as parallelized EVM than broad adoption**. However, as a high performance chain, Sei has laid a solid foundation for ecosystem growth. Moving forward, the emergence of 'killer dApps' and the imminent launch of Sei V2 will be critical for attracting capital inflows and garnering users' attention.

Sei V2

Introduced in November 2023, Sei V2 is a protocol upgrade that is slated for release in H1 2024. This upgrade includes three main features: EVM Support, Optimistic Parallelization, and SeiDB.

- **EVM Support**: In its current incarnation, the Sei protocol supports Cosmwasm as its smart contract environment. With V2, Sei is expanding these capabilities and will add components to support EVM smart contracts. This enhancement allows developers to redeploy Ethereum smart contracts onto Sei without requiring any code modifications, thereby attracting a larger developer community to its ecosystem.
- **Optimistic Parallelization**: Using Optimistic Parallelization, Sei will run all transactions in parallel optimistically. In cases of conflicts, Sei identifies the conflict point, determines transactions that can run in parallel and sequentially, and then reruns the process. This recursive execution continues until all conflicts have been resolved.
- **SeiDB**: SeiDB aims to upgrade the storage layer of the chain. This effort is designed to prevent state bloat, boost state read/write performance, and simplify the process for new nodes to synchronize state data and catch up.

Stride

Launched in September 2022, Stride is a blockchain that provides liquid staking solutions to the Cosmos ecosystem, supporting 12 different blockchains. Focused heavily on security, **Stride embraces the philosophy of Chain Minimalism**[21], which means it only **hosts the core Stride liquid staking protocol, without any other applications or smart contracts**. This approach is designed to prevent potential attack vectors that could compromise blockchains integrating Stride's liquid staking solution. In July 2023, Stride became the Cosmos Hub's second consumer chain, incorporating Replicated Security and as a result, is secured by the complete Cosmos Hub validator set.

Stride leverages two features to perform multichain (Interchain) liquid staking:

- **Interchain Account ("ICA")**
- **Interchain Query ("ICQ")**

ICA is a feature that broadens interoperability by enabling interactions with a specific chain (referred to as the host chain) through a remote interface from another chain (termed as the controller chain). This means that **a blockchain (controller chain) can control an account on a different blockchain (host chain) and execute actions like staking, sending assets, and voting**.

For instance, consider Stride and the Cosmos Hub. In this scenario, Stride acts as the controller chain, while Cosmos Hub serves as the host chain. When a user wishes to stake their $ATOM, they interact with the Stride interface. Then, Stride sends an IBC packet containing the instructions to the Cosmos Hub, performing the staking on behalf of the user, and carrying out unstaking actions in a similar manner.

ICQ, or Interchain Query, enables a blockchain to retrieve data from another chain, allowing it to query information about the application state. In the case of Stride, it employs ICQ to access specific information such as deposit balances and accrued rewards. When combined, ICA and ICQ significantly enhance the interoperability of the IBC protocol. This allows accounts in one zone to be controlled by a different zone, with relevant information seamlessly queried across zones, thereby facilitating improved communication.

Figure 14: Stride utilizes ICA to perform multichain staking for its users

Source: Binance Research

Stride currently provides its liquid staking solution to 12 blockchains, including major Cosmos chains such as the Cosmos Hub, Osmosis, Celestia, and dYdX, among others. Of its US$161M TVL, the top three assets being staked are $ATOM, $TIA, and $OSMO, accounting for 34%, 32%, and 22% of Stride's total staked assets, respectively.

Figure 15: $ATOM, $TIA, $OSMO, $DYDX, and $STARS are the top staked assets on Stride

Logo	Ticker	Amount Staked	Percentage of TVL
	$ATOM	US$58M	34%
	$TIA	US$55M	32%
	$OSMO	US$37M	22%
	$DYDX	US$10M	6%
	$EVMOS	US$2M	1%

Source: Stride, Binance Research, as of March 11, 2024

Moving forward, Stride intends to expand its support to include more blockchains and tokens within the Cosmos ecosystem. While Cosmos's liquid staking landscape hasn't yet reached the scale of Ethereum's, it is experiencing steady growth. The utilization of Liquid Staking Tokens ("LSTs") across the Cosmos DeFi landscape embodies another growth factor that could drive demand for LST assets. Therefore, Stride, with its established prominence, is well-positioned to secure sustainable long-term growth.

Axelar

Axelar, developed using the Cosmos SDK, is a PoS network that acts as a **communication layer for dApps to interact across both the EVM and Cosmos ecosystems**. It enables the transfer of tokens, smart contract calls, and general messaging, all overseen by a network of validators. These validators operate nodes to monitor the state of the network, authenticate transactions, and manage cross-chain communication.

Figure 16: Axelar's messaging process relies heavily on the important roles of Axelar Gateways and network validators

Source: Axelar, Binance Research

Axelar Messaging Process

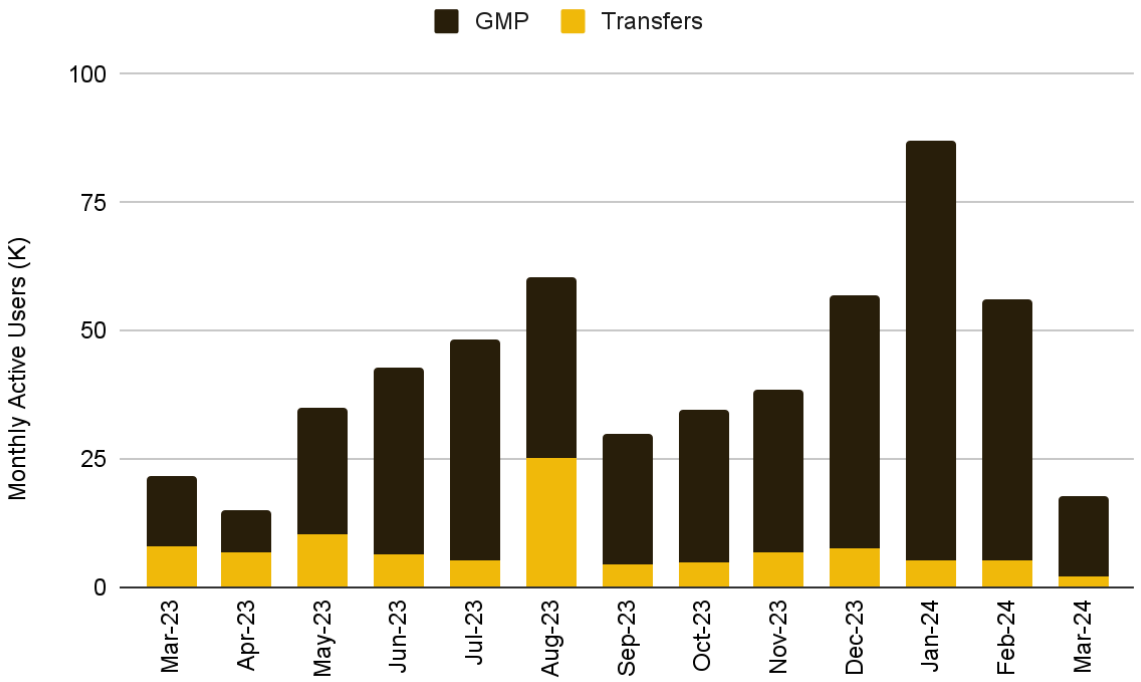
1. A dApp user initiates a cross-chain message via the Axelar Gateway on the source chain. This action triggers an event, which is then propagated by a relayer to Axelar's validators for processing.
2. Validators verify the event's authenticity by confirming that their nodes on the source chain have observed it.
3. Once validated, a requisite number of validators who hold a share of cryptographic keys must authorize the message.
4. Following authorization, the message is relayed to the destination chain, where it is ready for execution.

To enhance security, Axelar incorporates measures such as **quadratic voting** and **key rotation**[22]. Unlike traditional PoS systems, where weight delegation can centralize power due to stake concentration, **quadratic voting naturally disincentivizes the concentration of voting power**, fostering greater decentralization. **Validators also periodically rotate their key shares**, adding another layer of security against potential vulnerabilities. Additionally, Axelar Gateways employs **rate limiting to restrict the volume of assets that can be transferred within certain intervals**. Together, these measures work in concert to ensure the integrity and safety of the network's operation.

Since 2023, Axelar has experienced a surge in adoption, evident in the rise of both transaction numbers and active users. This increase is largely attributed to the implementation of its General Message Passing ("GMP") feature, which enables **sophisticated cross-chain function calls and state synchronization**. Moreover, GMP began supporting interactions between Cosmos and EVM chains in May[23], representing a major enhancement for Axelar.

Prior to GMP, **the interoperability between these ecosystems was largely confined to asset bridging**, offering limited composability. The **introduction of GMP introduced more complex interchain communication**, catalyzing Axelar's increased use. The impact of GMP is clear in the data: approximately 82% of transactions involve GMP messaging, and roughly 82% of active users are engaging with GMP[24]over the past year, **highlighting the integral contribution of GMP and its importance to Axelar's growth**.

Figure 17: GMP contributes significantly to Axelar's usage, with 82% of active users engaging with GMP over the past year



Source: axelarscan.io, Binance Research, as of March 11, 2024

A notable example to demonstrate the utility of GMP is the integration with Ondo Finance, a leading issuer of on-chain U.S. T-Bills. Ondo Finance leverages GMP for Ondo bridge, fostering a unified on-chain USDY liquidity. Axelar is also not short of enterprise partnerships, evident by its recent collaboration with Microsoft, marking Axelar's entry into the Azure Marketplace. This partnership makes tools like AxelarJS SDK and GMP available to developers, offering advanced hybrid blockchain solutions. Given the extensive use of Azure worldwide, this partnership could significantly fuel Axelar's growth and expansion.

Neutron

Neutron is a **general-purpose, permissionless smart contract platform** powered by Tendermint, Cosmos SDK, and CosmWasm, aiming to foster a secure and robust environment for dApps within the Cosmos ecosystem. Neutron has proposed a novel concept known as **Integrated Apps**, which are smart contracts with the capabilities of appchains. Using various modules provided by Neutron, Integrated Apps can tailor their network's blockspace to offer gasless onboarding for new users and eliminate network selectors, thereby facilitating seamless deposits from any connected blockchain with a single click[25]. Other examples include Neutron's use of ICA and ICQ modules, which permit applications on its platform to interact with and retrieve data from other IBC-enabled chains reliably and efficiently, thereby promoting seamless cross-chain DeFi operations.

Moreover, as the first project to utilize Replicated Security, **Neutron offers a highly secured smart contract environment backed by the Cosmos Hub**, allowing projects to launch without needing to build a separate appchain from scratch. This eliminates concerns about incentivizing a validator set and additional cost burdens, which are common for projects launching as appchains. Thus, projects can utilize the platform Neutron provides to enjoy the perks of Replicated Security and cross-chain compatibility without extra costs.

In September 2022, Lido expressed interest in launching on Neutron, although no recent updates have emerged to confirm this progression. Nevertheless, a significant development occurred in September 2023 when **Neutron collaborated with Lido and Axelar to bring wstETH**, Lido's wrapped liquid staked ETH, into the Cosmos ecosystem. This signifies a major step for bringing the extensive ETH liquid staking market into the Cosmos ecosystem and represents a good example of cross-ecosystem interoperability. Although the finalization of Lido's deployment on Neutron is still in progress, it certainly represents a vital event to monitor for the future growth of Neutron.

Celestia

Celestia is a data availability ("DA") network that offers scalability solutions for modular L2s. Built with the Cosmos SDK as a permissionless network, Celestia employs a PoS mechanism for consensus. The DA layer is a critical bottleneck towards fully unlocking the scalability of L2s. **While Ethereum currently serves as a DA layer, its monolithic L1 design isn't fully optimized for this role, particularly as the number of L2s increases and they gain more dominance**. Therefore, the industry has started to focus on Alternative-DA Layers like Celestia, which are specifically designed from the ground up to optimize DA. For more information on the topics of modular blockchains and DA, check out our recent report "Scaling Blockchains: Embracing Modularity."

As the first public network that is designed to be optimized for DA, Celestia offers a dedicated space for L2s to temporarily post batched transaction data. It assumes the responsibilities of **DA** and **consensus**, shifting the load of transaction execution and settlement onto other networks. Celestia does not handle transaction executions via native smart contracts, cross-rollup bridging, or dispute resolutions. Instead, Celestia stores, **encodes, and orders data in a trust-minimized way, allowing users to retrieve data as needed**. This specialization avoids the typical high fees and congestion seen on more comprehensive blockchains like Ethereum, making Celestia an efficient option for L2s.

Celestia's approach to scalability centers on the decoupling of execution from consensus and uses the technologies of **Data Availability Sampling ("DAS")** and **Namespace Merkle Trees ("NMTs")**[26]. DAS is a mechanism for **light nodes to verify DA without having to download all data for a block**. It works by having light nodes conduct multiple rounds of random sampling for small portions of data within a block, rather than the entirety of the block itself. Meanwhile, NMTs enable applications to **process only the data relevant to them**, thereby significantly reducing data processing requirements.

Capitalizing on its first-mover advantage, coupled with lower costs and enhanced speeds, Celestia has already seen notable adoptions from other projects. For instance, L2s such as Manta Pacific[27], and app-specific chains like Aevo and Lyra, have leveraged Celestia's DA layer. As of writing, Celestia has processed over 13M transactions, with a cumulative blob size of 4.82GB, as per the data from Celestia's block explorer, Celenium[28].

Figure 18: Manta Pacific stands as the largest consumer of Celestia's data space to date

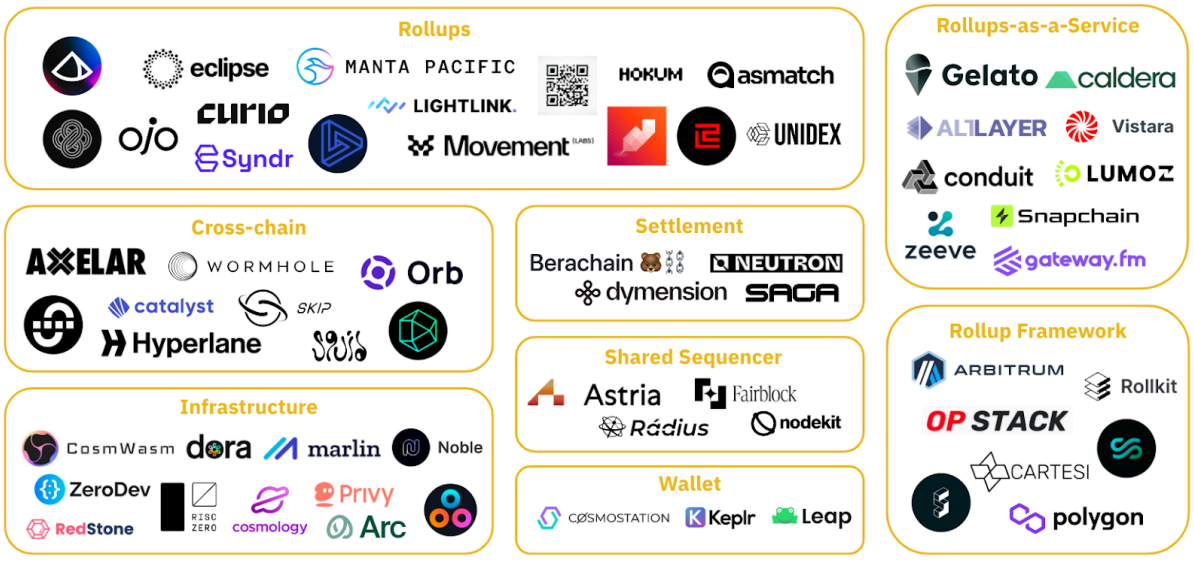
Logo	Name	Size (MB)	Blobs
	Manta Pacific	1,249.28	15,470
	Orderly	477.24	9,083
	Aevo	400.99	3,996
	Lyra	176.35	4,130
	Public Goods Network	110.4	1,798
	Hypr	94.98	1,522

	Ancient8	89.98	5,052

Source: celenium.io, Binance Research, as of March 11, 2024

Despite the nascent status of the alt-DA space, Celestia, with its aforementioned advantages, already supports a thriving ecosystem which can significantly contribute to its future expansion. The growing ecosystem has positively impacted Celestia's staking network as well, with projects such as Manta Pacific, Altlayer, Dymension, and Saga announcing airdrops for $TIA stakers. This has contributed to a notable rise in the number of unique Celestia delegates since the start of the year.

Figure 19: Celestia has capitalized on its early market presence, now boasting a large and diverse ecosystem



Source: Celestia, Binance Research

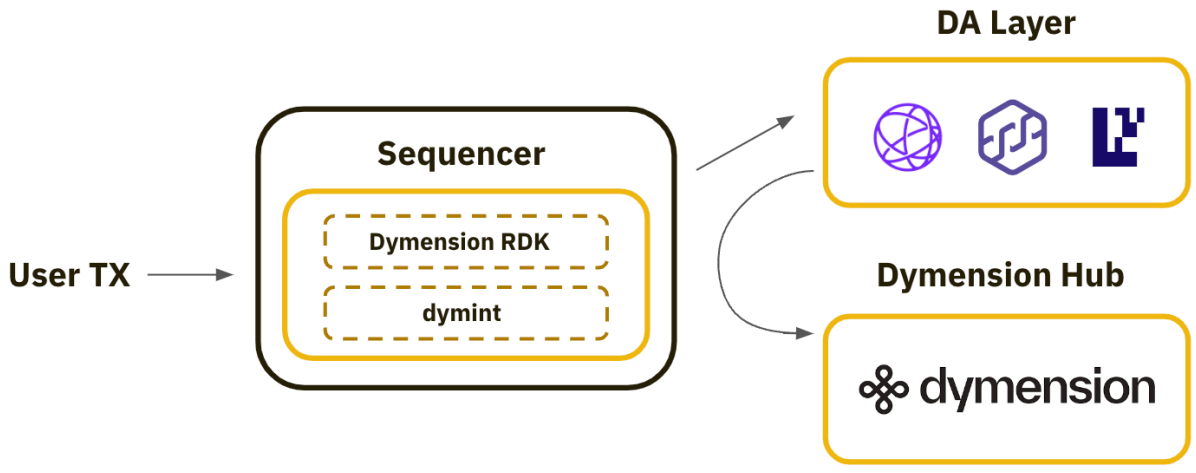
Celestia serves as a compelling choice for projects with scalability at their core, including gaming, social media or artificial intelligence sectors. Especially emerging dApps with less reliance on Ethereum and a focus on cost reduction could prefer alt-DA layers like Celestia. However, the choice between Ethereum's security and Celestia's scalability depends on the market and application needs. With competitors such as EigenDA and Avail expected to make their debut this year, coupled with the incoming EIP-4844 upgrade, 2024 will be an interesting year to follow how the DA landscape would evolve.

Dymension

Dymension is a settlement network designed to provide an optimized service for RollApps, a term coined by Dymension referring to application-specific rollups. Dymension follows a modular architecture where **Dymension Hub, a Cosmos SDK PoS L1, functions as the settlement layer, and RollApps, L2s built using Dymension RDK, act as the execution layer**. For DA, RollApps can choose the providers based on their security and cost considerations. RollApps are interconnected to each other through IBC, and are capable of communicating with other IBC-enabled chains via the Hub. Furthermore, Dymension offers an embedded AMM to RollApps, providing a shared liquidity layer that allows asset routing and price discovery.

RollApps are defined by two components, server and client[29]. The server component is **where RollApps developers can deploy their custom business logic using the Dymension RDK**. The client component, referred to as dymint, **replaces Tendermint and is responsible for block production, peer message propagation, and inter-layer networking**. A transaction lifecycle in RollApps begins with users submitting transactions to the RollApp Sequencer, which is responsible for validating, ordering, and processing transactions[30]. The sequencer batches transactions and publishes them to a DA network. Once the data is accepted by the DA network, the sequencer then publishes the state root to the Dymension Hub.

Figure 20: Illustration of RollApp's transaction lifecycle



Source: Dymension, Binance Research

Dymension offers a vertical scaling solution consisting of modular L2s that are scalable, customizable, and interconnected. These RollApps share the security provided by the Dymension Hub and can focus on specific applications, forming an internet of rollups. The Dymension team defines the roadmap of Dymension into four stages: Singularity, 2D, 3D, and 4D[31].

The team depicts of each stage as follows:

- **Singularity - Dymension Hub**: This phase ensures adequate delegated stake for the Dymension blockchain and appropriate validator operations. It also involves establishing IBC and bridging connections across the crypto environment, developing opening Dymension protocol governance proposals, and initiating incentives for single-asset staking and foundational trading pairs in the liquidity layer.

- **2D - Permissioned RollApps**: This phase involves the first mainnet IBC-rollup to be deployed to the Interchain. Once it functions as planned the team will be ready to introduce 'The Draft', the process where Dymension governance approves various prominent RollApps to transition from testnet to mainnet.

- **3D - Permissionless RollApps**: After a few batches of rollups on 'The Draft' have successfully transitioned from testnet to mainnet and proven to be stable, the need for Dymension governance to approve new RollApps will be removed, allowing permissionless deployment. This phase also includes the introduction of on-chain incentive streams to RollApps according to TVL.

- **4D - Internet of RollApps**: In this stage, the team foresees Dymension operating a circular and self-sustaining on-chain economy, seamlessly interconnecting an array of autonomous crypto services, games, and global applications.

The Dymension team has just released The Draft on March 5 and kick started the permissioned deployment phase, aka 2D. For RollApp builders looking to participate in this stage, they need to present their projects to the community, specifying their application, long-term vision, token allocation, among others, and approved projects will receive funding, community support, and liquidity incentives. Dymension's RollApps present an interesting solution to the modular blockchains landscape. Having just started with its RollApps ecosystem, it will take time to see how the team's vision evolves.

6 Key Developments to Watch

In this section, we discuss some of the critical developments that could shape the ongoing trajectory of the Cosmos ecosystem.

- **Progression of the Interchain Stack:** Rooted in the principles of sovereignty and interoperability, the Interchain Stack forms the foundational pillar of the Cosmos ecosystem, underpinning its L1 blockchains. These development tools have been battle-tested, demonstrating their versatility through the widespread adoption of developers and projects alike. This underscores the importance of the stack's continuous evolution, especially within the rapidly advancing blockchain industry. The **Interchain Stack Roadmap for 2024 outlines four pivotal focuses for its ongoing development: Modularity, Developer Experience, Technical Debt, and User Adoption**[32]. These focal points aim to broaden the stack's applicability, reduce entry barriers and initial costs for developers, refine the existing codebase, and enhance overall engagement with the ecosystem. The initiatives outlined are designed to adopt a developer-first strategy, bolster community involvement, and forge key partnerships. Additionally, Cosmology, a Cosmos development platform that recently raised US$5M, is also a critical project in this context. As the Cosmos ecosystem broadens its influence, monitoring the progression of Interchain Stack is vital to ensuring it remains attractive to developers and retains its competitive edge in the constantly shifting blockchain space.

- **Growth of the modular blockchain thesis:** The rise of Celestia has significantly intensified the discourse around modular blockchains, capturing considerable attention, particularly as token prices surge and holders benefit from substantial airdrops. Within the Cosmos ecosystem, other noteworthy projects aligning with this narrative include Dymension and Saga. At its core, Cosmos is an ecosystem designed for parallel scalability. Projects such as Dymension and Saga introduce vertical scaling solutions that offer strong customizability and flexibility, thereby augmenting the broader Cosmos landscape. Given that this narrative is in its early stages, more growth is expected. Keeping a close watch on the evolution of this sector is critical, as these developments are expected to play an important role in the continued expansion of the Cosmos ecosystem.

- **Competition among Shard Security solutions and $ATOM's utility:** Shared Security remains a critical element within the Cosmos ecosystem. **Babylon's solution of harnessing Bitcoin's security to secure Cosmos appchains could challenge Cosmos's native solutions such as Replicated Security and Mesh Security**, which may have indirect ramifications for the positioning of $ATOM. The value accrual of $ATOM has consistently been a pivotal topic for the Cosmos community, thus highlighting the importance of the development and evolution of both the AEZ and the utility of $ATOM moving forward.

7 Closing Thoughts

The evolution of Cosmos over the years reflects its ambitious vision of creating an internet of blockchains, which has increasingly materialized. Today, its ecosystem has industry leaders across various sectors, including Celestia as a DA layer and dYdX as a leading perpetual DEX, among others. Moreover, there are projects within Cosmos demonstrating potential and establishing a solid groundwork for future growth, including Injective and Sei in the DeFi space and Dymension as a modular settlement network.

The development and success of the Cosmos ecosystem thus far can largely be attributed to its versatile technology stack and the dedicated team behind it. They have collectively been instrumental in nurturing the ecosystem to its current striving state. With continued strong developments in the ecosystem, Cosmos has strengthened its position as a foundational ecosystem in the industry, laying a solid foundation for its future expansion.

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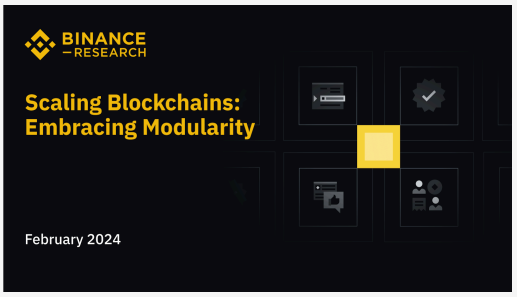

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