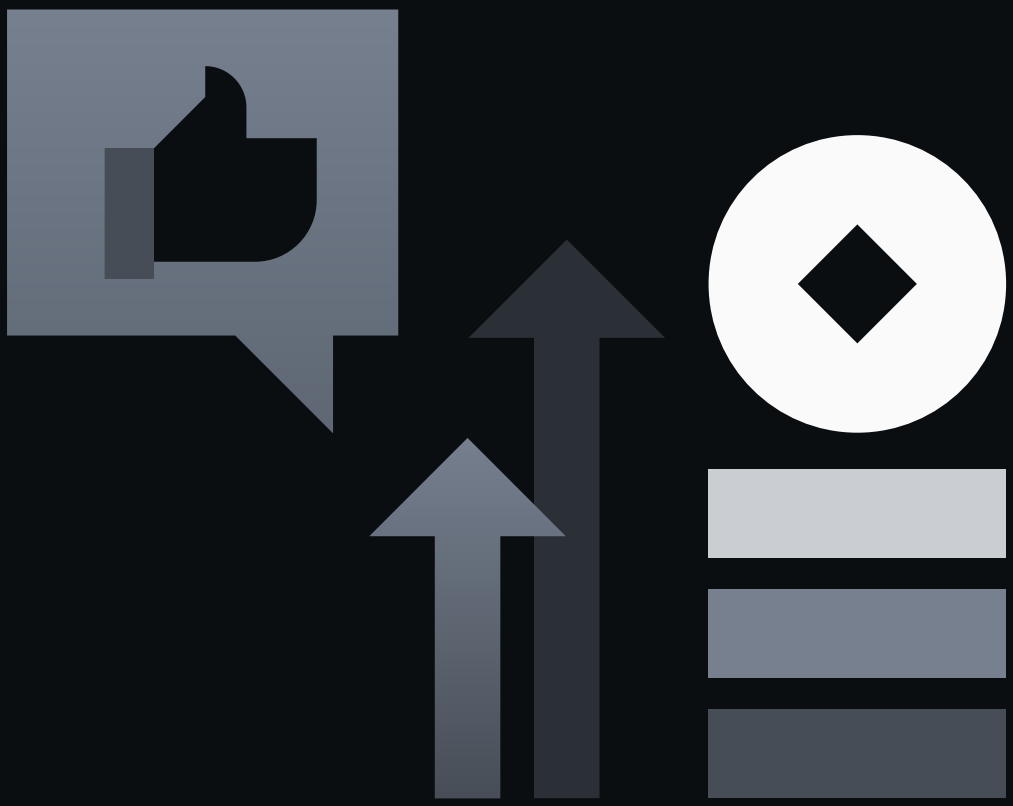
BINANCE RESEARCH

The Hitchhiker's Guide to Restaking

February 2024



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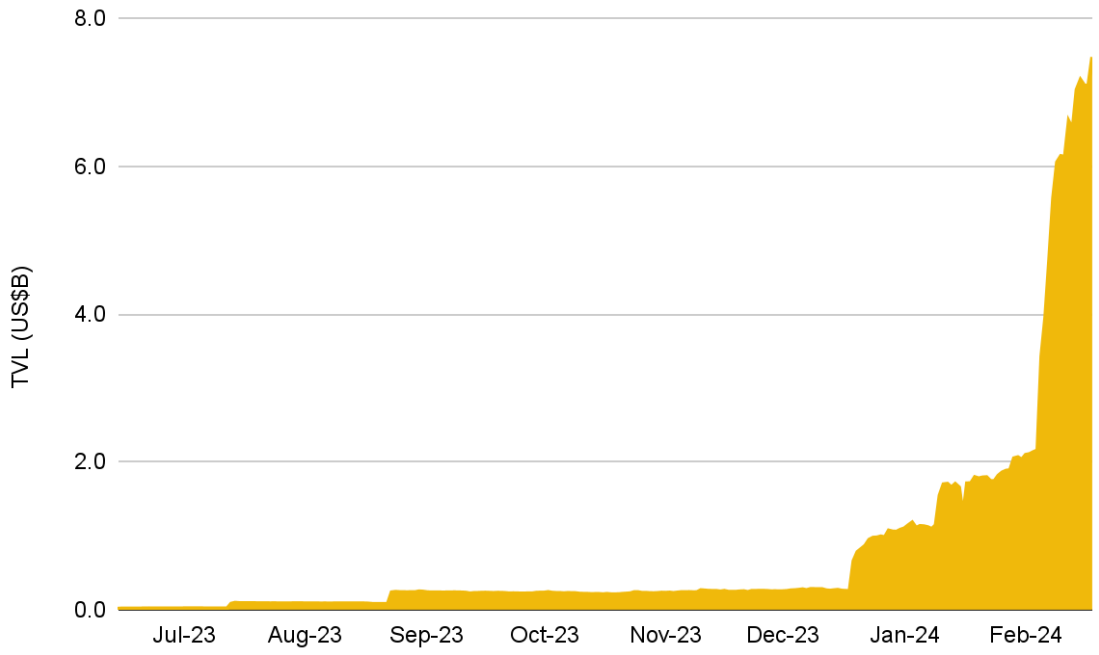
1 Key Takeaways

- Restaking protocols provide a set of smart contracts that allow staked tokens to be repurposed and staked again (i.e., restaked) to provide security to applications beyond the primary blockchain.
- Restaking seeks to solve the problem of fragmented blockchain security. Generating sufficient crypto-economic security can be a time-consuming and expensive process, but pooling existing security from a large chain such as Ethereum can help solve this issue.
- EigenLayer is the originator of this sub-sector and can be thought of as providing "security-as-a-service" through Ethereum. With over US$7B in total value locked ("TVL"), this is the largest restaking project in the market. EigenLayer operates a three-pronged marketplace consisting of restakers, node operators, and actively validated services ("AVSs").
- EigenLayer has taken a phased approach to its launch, utilizing restaking deposit caps to manage the growth of the protocol. They are currently in the middle of Stage 2, with a full mainnet launch expected after Stage 3 in the second half of this year.
- EigenDA, a data availability layer, will be the first AVS to launch using EigenLayer's pooled security model. A number of other teams, including Espresso, AltLayer, Lagrange, Hyperlane, and more, are working on their own AVSs.
- Babylon, a Bitcoin staking protocol, and Picasso, an interoperability-focused infrastructure layer, are working on similar shared security protocols for Bitcoin and Solana, respectively.
- Liquid restaking protocols allow users to participate in restaking while maintaining liquidity through a token ("LRT"). These LRTs can then be used across the DeFi space to generate incremental yield.
- The liquid restaking market is growing fast, boasting over US$3.5B in TVL. Ether.fi, Puffer Finance, Kelp DAO, and Renzo Protocol have emerged at the top of the rankings for now, while many other teams are also innovating rapidly and seeking to enter the market in the foreseeable future.

2 Introduction

The restaking market is heating up in 2024, quickly transitioning from being an emerging narrative to an innovative reality. **Ethereum restaking** has dominated the narrative thus far, largely due to the originator of the sub-sector, **EigenLayer**, which has mostly focused on Ethereum. EigenLayer is the project furthest along in its restaking roadmap and is responsible for the majority of the total value locked ("TVL") in the restaking market.

Figure 1: Restaking TVL has exploded since December, currently at over US$7.5B



Source: defillama.com, Binance Research, as of February 19, 2024

Nonetheless, **other projects are also working on restaking or restaking-adjacent projects across multiple chains**, with some already live and others going live soon. These include the likes of Picasso (Solana restaking) and Babylon (Bitcoin staking), among others. There is discussion of Cosmos appchain integrations with EigenLayer, while AltLayer has expanded its rollups-as-a-service ("RaaS") protocol to include **restaked rollups**[(1)]. In addition, while we saw the growth of liquid staking tokens ("LSTs") in 2023, we are seeing the emergence of liquid restaking tokens ("LRTs") this year.

In this report, after a quick refresher on the basics of restaking, we take a closer look at EigenLayer and recent developments in its ecosystem, restaking on other chains, liquid restaking protocols, and LRTs. We end the report with an outlook, looking forward to what the future might hold for restaking.

3 Restaking Refresher

Before Diving Into Restaking... What Is Staking Again?

At its most basic level, we can define a blockchain as an immutable ledger of transactions with the requirement of tracking valid transactions in a chronological manner. In order to do so, a blockchain ("chain") must perform four key functions:

1. **Consensus**: reaching an agreement between validators or miners on transaction ordering, e.g., proof-of-stake ("PoS"), proof-of-work ("PoW"), etc.
2. **Data availability**: ensuring transaction data is available for the entire network to view
3. **Execution**: processing transactions to update the state of the blockchain
4. **Settlement**: resolving disputes, verifying the validity of transactions, and ensuring the "finality" of transactions

Consensus is sometimes argued to be the most fundamental of these functions and is critical to the immutability of a chain. Essentially, under a **PoS consensus mechanism, the chain will have a set of validators who propose and validate new blocks to add to the blockchain**. In order to become a validator, they **must stake the native token of the chain**. In return, validators earn staking rewards in the form of new tokens and fees. However, if a validator misbehaves or partakes in any type of malicious behavior, they are liable to be "slashed," whereby a portion of their staked tokens gets confiscated.

The slashing mechanism incentivizes validators to operate the network properly. Additionally, as **more validators join (and more tokens are thus staked), the more difficult it is to attack the network**. For example, a typical way to attack a blockchain network would be to attempt to gain control of the majority (51%) of staked tokens in a PoS system and thus have the power to propose malicious blocks or reorganize blocks. The **more tokens are staked or the higher the value of the staked tokens, the more costly and difficult it is to attempt this type of attack**. This is essentially how **staking helps secure a blockchain.**

How Does Restaking Work?

Restaking takes this one step further and allows users to stake their assets multiple times, on a primary blockchain and also on additional protocols. For example, EigenLayer allows Ethereum stakers to repurpose their staked $ETH to secure other applications built on the network. Stakers can choose which additional services they want to secure with their currently staked $ETH and earn an extra yield from doing so. In return,

they agree to grant EigenLayer additional slashing rights on their staked $ETH (on top of the slashing rights on the underlying Ethereum staking contract).

Essentially, restaking protocols provide a set of smart contracts that allow staked tokens to be repurposed and staked again (i.e., restaked) to provide security to applications beyond the primary blockchain.

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What Problems Does Restaking Seek to Solve?

The problem that restaking seeks to solve is that of **fragmented blockchain security**. At a basic level, if a builder wants to create a decentralized network, they need to establish some form of crypto-economic security. In the Ethereum network, for example, this is created through the staking of $ETH tokens. However, it can be incredibly inefficient for other services to follow suit. **To establish a new proof-of-stake ("PoS") network like Ethereum or BNB Chain, for example, there are significant capital costs.**

Let's say the project issues a token to fulfill this security function; they would then have to convince ecosystem participants to take on the price risk of staking this new token as well as the opportunity cost when compared to simply staking $ETH instead.

Additionally, **generating sufficient security can be a time-consuming process. Even then, the security one can generate is likely to be inferior to that of Ethereum itself**. What this often results in is that many projects, which do not necessarily need to issue their own token, are forced to do so, while painstakingly and slowly attempting to create their own crypto-economic security. **Restaking seeks to solve this problem by pooling the security of a large chain like Ethereum and making it available for other applications to utilize.**

Figure 2: EigenLayer has over 2.6M $ETH restaked on its platform

Protocol	TVL (US$B)	TVL ($ETH,M)
EigenLayer	7.71	2.64

Source: EigenLayer Application, Binance Research, as of February 19, 2024

4 Key Projects

EigenLayer

How Does It Work?

EigenLayer refers to itself as a "**restaking collective for Ethereum**"[2] and aims to create a marketplace for decentralized trust. It is the originator of restaking and, subsequently, the largest and most important project in this space. We can think of EigenLayer as providing "security-as-a-service" through Ethereum, or **Ethereum security-"as-a-service".**

EigenLayer operates a three-pronged marketplace comprising:

1. **Restakers**: those who **stake their liquid staking tokens ("LSTs") to secure other applications on the network**. They earn extra yield for this but are also subject to extra slashing conditions. Users can also choose to **directly stake their $ETH** with EigenLayer (this process is referred to as **native restaking**).

2. **Node operators (validators)**: those that run the EigenLayer software. Many **restakers might choose to delegate to trusted node operators rather than running a node themselves** (analogous to stakers delegating their tokens to trusted validators). The node operators can gather the delegated stake, spin up an Ethereum node, and then earn fees from Ethereum PoS. They can augment this with additional yield from the protocols they choose to help secure through their stake. They keep some of these fees and send the rest to delegators. If the **operator misbehaves** with regards to the EigenLayer modules that it is participating in, then their deposited stake (and those delegated to it) will be **subject to slashing**.

3. **Actively validated services ("AVSs")**: services that build on top of EigenLayer and aim to attract restakers to help them with security. Sometimes **called modules**, these AVSs can be anything from new blockchains, data availability ("DA") layers, virtual machines, oracle networks, bridges, etc.

Through this system, EigenLayer introduces **two novel ideas: (1) pooled security via restaking and (2) free-market governance.**

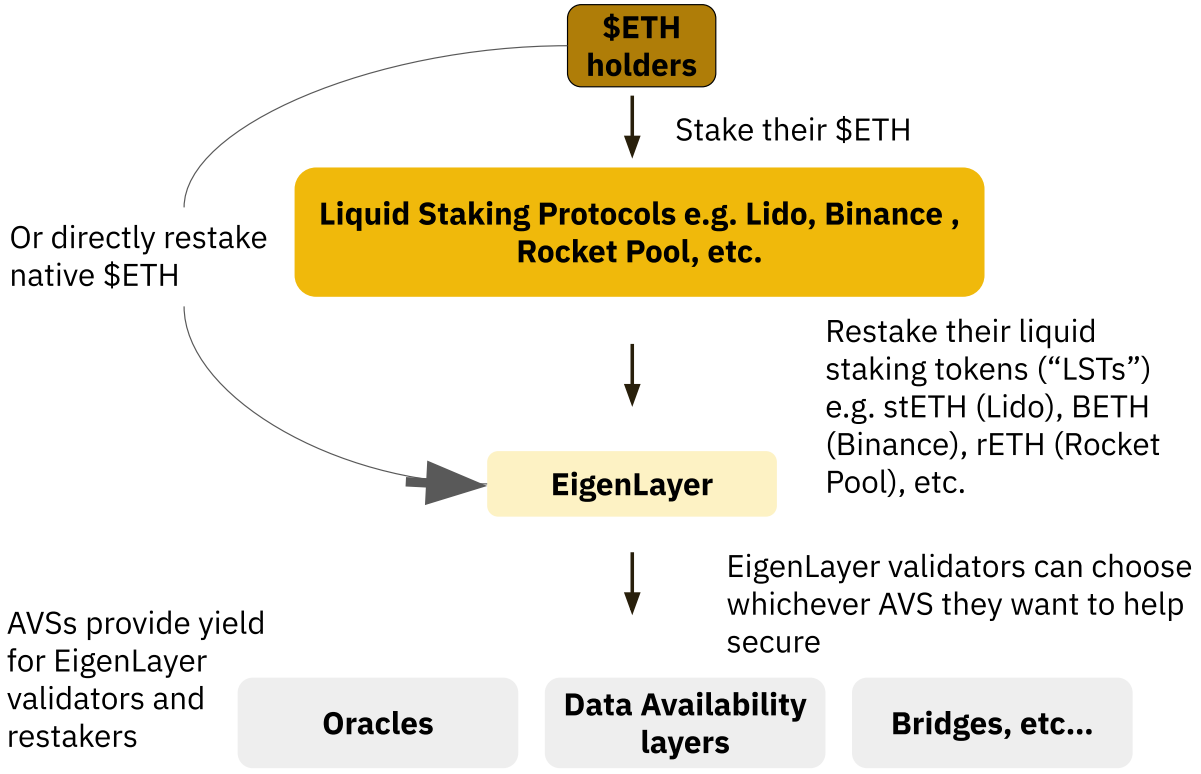
1. **Pooled Security via restaking:** EigenLayer enables pooled security by enabling new modules to be secured by restaked $ETH rather than their own tokens.
   - ➢ Specifically, after restakers lock up their LSTs or native $ETH with validators, the validators can then opt-in to secure whichever modules they choose.

- ➢ The validators set their withdrawal credentials to an EigenLayer smart contract so that, in case they misbehave, they are liable to get automatically slashed.
- ➢ In return, the modules pay fees for the security and validator services that go to the validators and restakers.
- ➢ The result is a pooling of Ethereum's very strong crypto-economic security among other protocols built on top of it.

2. **Free-market governance:** EigenLayer provides an open market mechanism that allows validators to determine their own risk/reward trade-off and choose which modules to provide security to.
    - ➢ EigenLayer sees this as akin to the service that venture capital firms provide, whereby their backing is essential to innovation, but the profit comes at a risk (the risk of slashing, in this case).

Together, these create an **open and competitive marketplace** where validators can sell pooled security and protocols can buy it for a price. This removes the significant capital cost of bootstrapping a new security model, as protocols can just purchase it. It also helps create a **flywheel** whereby the more valuable the modules secured via EigenLayer, the higher the returns for $ETH stakers. This leads to a higher value of $ETH and thus better Ethereum security, which in turn creates better security for each EigenLayer module, further incentivizing users to create new modules on it.

Figure 3: A simple illustration of how EigenLayer works



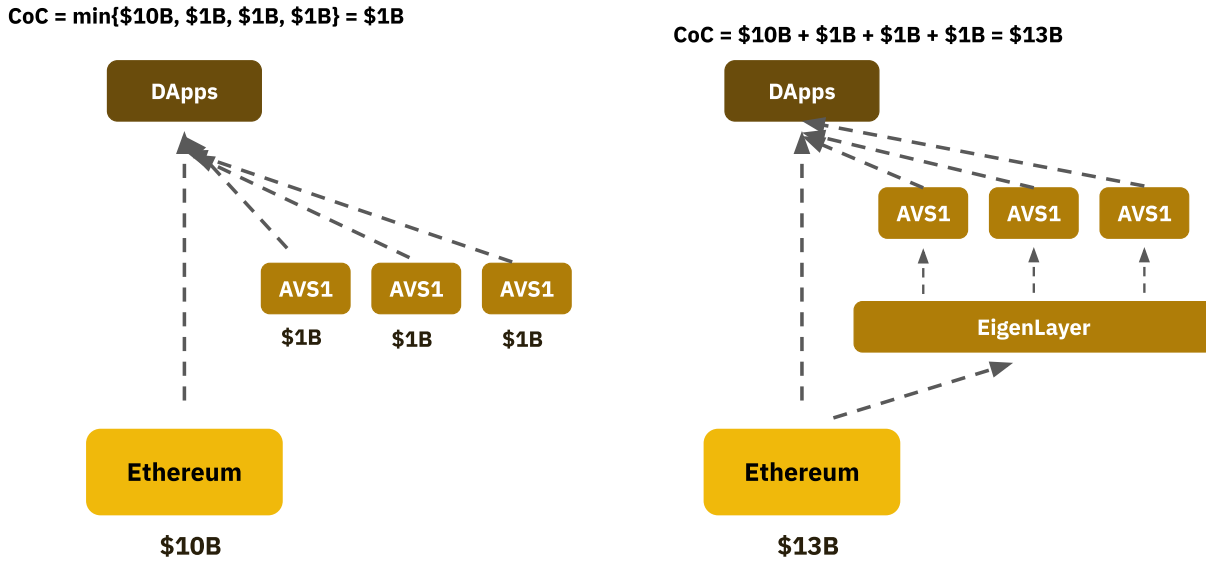
Source: Binance Research

The Impact of Trust Aggregation

The trust aggregation that EigenLayer helps provide is fairly significant, as we can see below. As **new AVSs can be secured with a much larger pool of capital than they would ordinarily be able to attract, the cost of corruption ("CoC") is much higher than it would otherwise be.**

Instead of a new Ethereum module being secured by a US$1B stake, for example, it can now be secured by a much larger pool of capital. The mechanism essentially increases the CoC from the minimum of the stake to the sum of the stake.

Figure 4: An illustration of the pooled security model of EigenLayer



(a) AVS economics today. To corrupt the AVS, the attacker need only attack one of the modules which are secured by a stake of $1B; that is significantly less than the $10B of stake securing the L1.

(b) AVS economics of pooled security. Corrupting the DApp here would require the attacker to attack the pooled stake of $13B.

Source: EigenLayer whitepaper, Binance Research

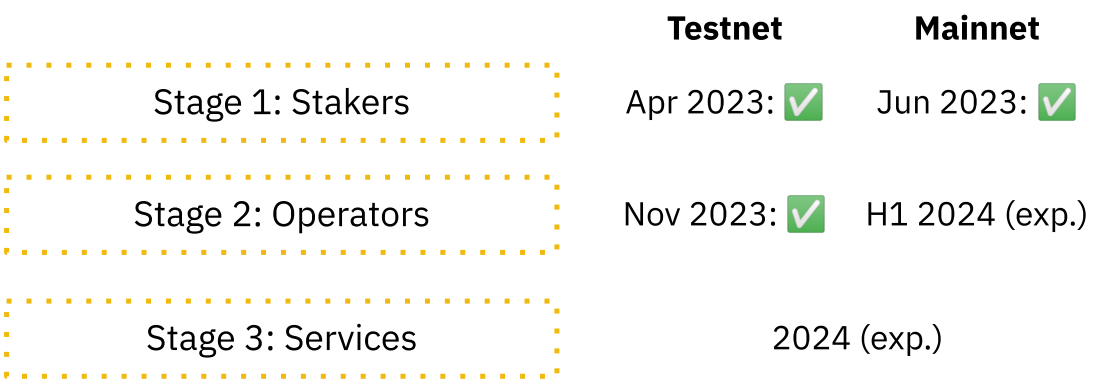
Timeline

EigenLayer has taken a phased approach to launching, spanning three stages. The goal for this was to ensure a smooth onboarding experience for all of the different players who are expected to become part of the EigenLayer ecosystem.

Stage 1 is focused on stakers and was initially launched last June. The idea behind Stage 1 is to get stakers used to the process of restaking and familiar with the EigenLayer module and interface. EigenLayer initially supported three LSTs for restaking, in addition to

native $ETH. Through a series of additions over the last few months, **EigenLayer now accepts 12 LSTs**[3]**.**

Figure 5: EigenLayer's phased roadmap



Source: EigenLayer Blog, Binance Research

Stage 2 is focused on operators, and the testnet was initially introduced in November 2023[4]. Since the launch, **operators have been able to register on the network and begin validating for the first AVS, EigenDA.** Naturally, restakers have also been able to delegate to operators of their choice in order to start putting shared security to work. Rollup developers have also been able to integrate EigenDA as the DA layer for their rollups and try it out in a testnet scenario. The **mainnet for Stage 2 is expected later in H1 2024**.

Stage 3 will be focused on onboarding AVSs (in addition to EigenDA) and the addition of payments and slashing features. Stage 3 is expected in the second half of this year. Only after all three stages have been completed will we have the official and complete launch of the EigenLayer protocol.

Deposit Caps

In order to ensure a smooth mainnet transition, EigenLayer has been using deposit caps to manage the amount of stake on the protocol. In the Stage 1 mainnet launch, there was a limit of 9,600 tokens across three LSTs and 9,600 native $ETH[5]. Over the last few months, both the deposit caps and the number of accepted LSTs have slowly increased.

EigenLayer's **most recent deposit cap increase saw a temporary removal of all TVL caps** – the first time that all TVL caps were removed. The goal was to invite all organic demand for restaking and observe the level of interest in the product from an uncapped point of view. In this temporary pause, from **February 5 to 9, EigenLayer saw its TVL rise by over 180%, surging from ~US$2B to over US$6B and becoming the fourth-largest DeFi dApp**[6]. At the time of writing, EigenLayer's TVL is over US$7.5B, with more than 2.6M

$ETH restaked.

Ecosystem Projects

One of the interesting areas to watch are the projects that EigenLayer is set to bring to the ecosystem. EigenLayer seeks to change the capabilities of Ethereum, especially from an infrastructure perspective, and it will be interesting to watch the different modules that participate.

The set of possibilities enabled by EigenLayer is rather broad and can encompass all sorts of protocols, from Ethereum sidechains to oracles and bridging layers. Nonetheless, **the most relevant protocols are likely those where bootstrapping security is most difficult and those with some level of synergy between them and Ethereum**, at least during this relatively early stage.

- **EigenDA:** EigenDA is the first AVS that uses EigenLayer to secure itself and, as the name suggests, is a DA layer.

  - **What's a DA layer again?** As a brief overview[7], the idea behind DA is to ensure that a blockchain's transaction data is available for the entire network to view. This is especially **relevant to Ethereum L2 rollups (as they post back transaction data to the Ethereum L1), which have historically used the native Ethereum DA layer for their DA needs**. However, this has been changing with the recent launch of Celestia[8] and other solutions such as Avail[9] that are making progress with their vision. EigenDA is another entrant in this market and seeks to partner with rollups in order to provide them with lower transaction costs and higher transaction throughput.

  - **Mechanism:** DA costs are typically a relatively high portion of rollups' costs[10]. Thus, a **specialized DA layer might be a relevant strategic move for many rollups, especially as the user base continues to grow**. Here is an example of how an L2 might choose to use EigenDA and become part of the EigenLayer ecosystem:
    i. An Ethereum L2 might choose to use EigenDA as their DA layer rather than the Ethereum L1.
    ii. Taking Arbitrum as an example, every time it uses EigenDA, some $ARB tokens will flow back towards the validators who are running the EigenDA software and helping secure it.
    iii. The validators will keep some of these tokens, while some will flow back to the underlying restakers, providing both parties with additional yield.

iv. To incentivize validators to behave honestly, the staked $ETH they have locked into EigenLayer is subject to additional slashing conditions, as previously highlighted.

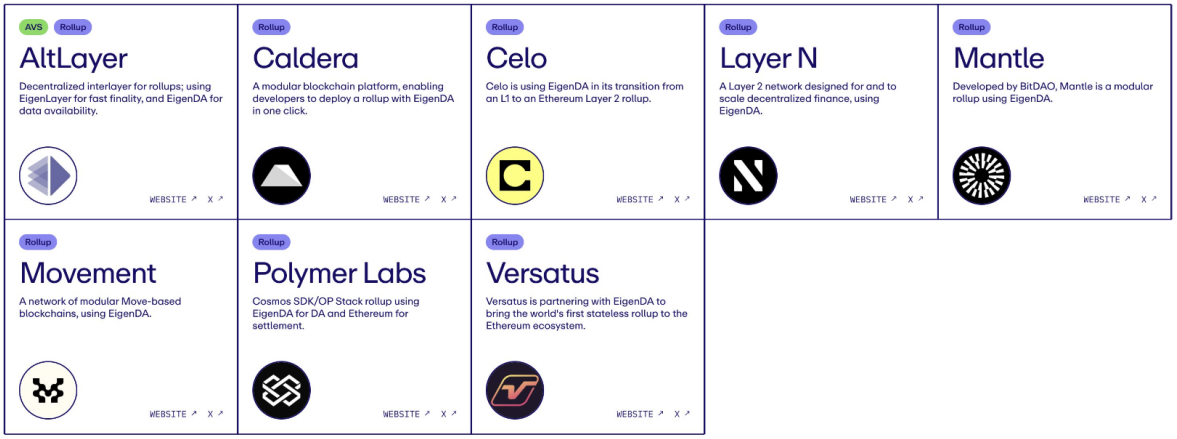
➢ **Partners:** EigenDA has already partnered with a number of major crypto projects, with many more set to be announced as they get closer to a mainnet launch. Notably

i. **Arbitrum Orbit:** EigenDA has announced support[11] for Arbitrum Orbit chains, which will allow developers the ability to build EigenDA-based Orbit rollups. The integration was made possible through a partnership with rollup-infrastructure provider AltLayer. To learn more about Arbitrum Orbit, please check out our report, "The Layer-2 Evolution: Superchains, L3s, and More."

ii. **OP Stack:** In late December, EigenDA open-sourced their fork of the OP Stack, with integrated EigenDA support. The OP Stack is the software that powers OP Mainnet and numerous new rollups, including Base, Zora, Mode, and many more. Check out the latest in our report, "The OP Stack: What's New?".

iii. **Launch Partner Program:** EigenDA also recently announced its Launch Partner Program, with eight rollup infrastructure providers that are actively working toward integrating EigenDA as a DA option for their users.

Figure 6: The participants of the EigenDA Launch Partner Program



Source: EigenLayer Blog

➢ **Outlook:** EigenDA testnet was initially launched in testnet (alongside Stage 2 of the EigenLayer roadmap) in November 2023. Its **mainnet is expected**

later in H1 2024.

- **Other AVSs:** While **EigenDA is set to be the first AVS to launch**, many other teams have also been working on their modules, and are gearing up to launch as we approach the EigenLayer mainnet. Notable teams include **Espresso** (decentralized sequencing), **AltLayer** (rollup infrastructure), **Lagrange** (building a light client for optimistic rollups), **Hyperlane** (interchain messaging), **Near** (building a fast finality layer to improve composability across the Ethereum rollup ecosystem), **Omni** (cross-rollup messaging), and many others. Full details are available on the EigenLayer website here.

Restaked Rollups With AltLayer

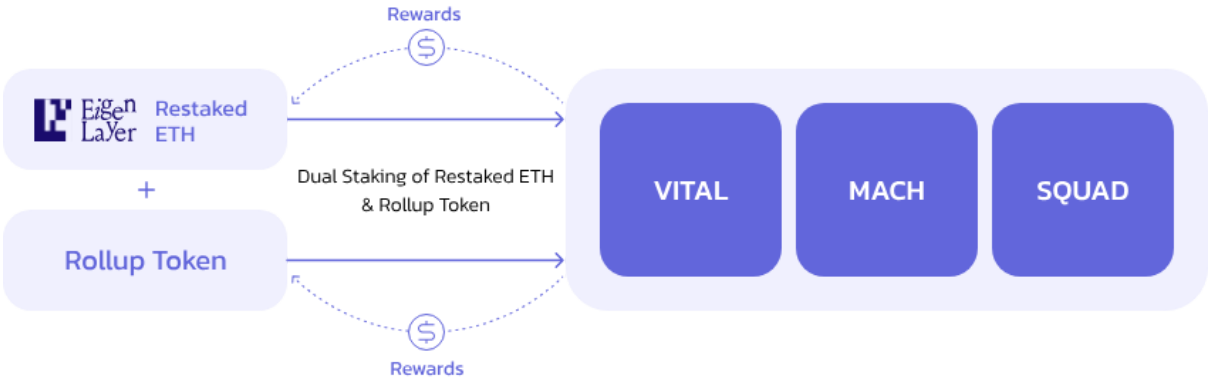
AltLayer is a **rollup infrastructure provider** that helps developers launch and maintain their rollups. Initially starting their journey with rollups-as-a-service ("RaaS") provision, they have recently been expanding their product suite and formed key partnerships with EigenLayer to further their vision. AltLayer maintains partnerships with a number of the leading rollup teams in the industry, and can help developers launch on OP Stack, Arbitrum Orbit, zk Stack, Polygon CDK, and others.

We **covered AltLayer and their RaaS platform in detail in our recent report, "The Rollups-as-a-Service Primer." ** We recommend readers check this out to get further background on AltLayer and their various products. We will primarily be discussing their new restaked rollups[12] in this sub-section rather than their entire product suite.

- **Restaked rollups:** AltLayer's restaked rollups consist of three vertically-integrated AVSs that can be created on-demand for any given rollup.
  - **VITAL:** helps provide decentralized verification of a rollup's state through validity proof challenges or the generation of zk-proofs.
  - **MACH:** helps provide rollups with fast finality and cross-rollup interoperability. It also has features to mitigate MEV in rollups.
  - **SQUAD:** enables decentralized sequencing for rollups.

Together, these features help create decentralized, interoperable, and efficient rollups that utilize EigenLayer's restaking mechanism for security.

Figure 7: An illustration of how AltLayer's restaked rollups work



Source: AltLayer Documentation

- **Outlook:** The restaked rollup product is **currently in testnet**, whereas their existing RaaS product is live. AltLayer also offers **ephemeral rollups**, which are disposable, app-tailored rollups. Use cases include hot NFT mints, games, event ticketing, etc.

- **$ALT:** AltLayer's also recently launched their $ALT token, which is to be used for economic bond, governance, protocol incentivization, and protocol fees across the AltLayer ecosystem.

Considerations

As with any new primitive in the swiftly growing crypto market, particularly an infrastructure protocol like EigenLayer, there are a **number of risks to be aware of**. The reader should note that **this is not an exhaustive list, especially as it would be near impossible to predict future vulnerabilities in a new technology.** However, these are some of the factors that you might want to consider when analyzing EigenLayer.

Technical Risks

- We can consider **the risk of validators colluding to attack a set of EigenLayer protocols simultaneously**. This risk can arise because validators may choose to restake multiple times for multiple different services, which could theoretically make an attack economically feasible. The EigenLayer whitepaper discusses this in more detail and proposes the solution of an open-source dashboard that monitors validator restaking and could allow protocols to incentivize those validators that are only participating in a limited number of protocols.

- The risk of **unintended slashing** is also worth considering. This could be a result of a programming bug or any number of smart contract security issues in protocols that are built on top of EigenLayer. Two solutions are proposed to combat this: (1)

security audits; and (2) a governance layer that can veto slashing decisions via multisig (although this may raise centralization concerns).

Structural Risks

- One conversation that has recently been circulating in the community has been **whether or not restaking is a form of leverage**. The answer depends on a variety of factors, and there is debate on either side of the argument.
    - At this stage of development, where no AVSs are even live and users are simply depositing into EigenLayer or into liquid restaking protocols, there are arguments that there is no leverage. **Inherently, the concept of pooling security to cryptographically secure other applications (i.e., restaking) is not the same as borrowing capital and investing it in order to make a return (i.e., using leverage).**
    - However, it **can become a slippery slope, as any degen knows**. After EigenLayer is live, undoubtedly there will be some subset of users borrowing capital, restaking it (perhaps with a liquid restaking protocol), and then using it as collateral in DeFi to run the cycle again, which could potentially be considered leverage in the system.

"Inherently, the concept of pooling security to cryptographically secure other applications (i.e., restaking) is not the same as borrowing capital and investing it in order to make a return (i.e., using leverage)...However, it can become a slippery slope, as any degen knows."

- It should also be noted that **AVSs are free to set their own unique and heterogeneous slashing conditions**. What if an AVS is able to slash validators for relatively arbitrary reasons and distribute that $ETH instead of burning it? If there is suddenly an incentive to slash, how does that change the cost of the system for validators and restakers?
    - **AVS selection and slashing analysis will become critical factors** for users and validators as and when the system goes live.

Other Considerations

- **Protocol sustainability** is also a risk for the adoption of EigenLayer. Tokens can provide useful monetary incentives and revenue for protocols, and **if all value is now accruing towards $ETH instead of protocol-native tokens, it may be difficult**

for certain projects to thrive and develop in the long term. However, we should note that **EigenLayer does introduce the possibility of dual staking,** i.e., security composed of both restaked $ETH and an AVS's own token. Again, this is covered in more detail in the whitepaper.

- We draw the reader's attention to **Vitalik Buterin's blog posts** "Don't overload Ethereum's consensus" and "Should Ethereum be okay with enshrining more things in the protocol?". The former discusses **potential risks in building complicated financial systems on top of restaking**. If these systems spiral out of control and significant monetary value is lost, some in the community might expect an Ethereum hard fork to fix these errors. Vitalik argues that any such expectations should be resisted, and it should be understood that Ethereum cannot be held accountable for any application-level mishaps. This might limit the types of protocols that are able to launch on EigenLayer and might drive some towards other platforms. That said, EigenLayer founder Sreeram Kannan has previously responded[13] in a constructive manner, stating that EigenLayer's underlying thought process is consistent with Vitalik's.

  The **second post discusses the idea of "enshrining," i.e., internalizing new technological developments into the core Ethereum protocol.** With the excitement behind restaking in recent months, some in the community have discussed the idea of enshrining it into the core Ethereum protocol. While Vitalik discusses a number of different features outside of restaking, it is a helpful post to understand the philosophical reasoning behind the simplicity of Ethereum and how we should think about enshrinement.

Outlook

As highlighted in the Timeline section, EigenLayer is **expected to complete all three stages of their phased mainnet launch by the second half of 2024**. Here are a few additional factors to consider:

- EigenLayer's TVL has seen a continuous rise over the past few months, and each increase in the deposit cap has been met with a strong level of demand. A notable driver of this capital inflow has been the **EigenLayer restaked points program**[14]. The points measure the contribution of users to the shared security of the EigenLayer ecosystem and are proportional to the amount of stake that users deposit.
  - The question we should ask is: **how much of this capital will flood back out after the mainnet launch?** While not confirmed, many users have anticipated a potential EigenLayer token, and it is a legitimate question to ask how much of EigenLayer's US$7B+ TVL is simply due to **potential**

airdrop farming. This is especially relevant as, **although EigenDA is in testnet, the other AVSs are largely still being built.** Thus, after the mainnet launch and conclusion of the points program, many users might ponder the more efficient use of their capital, at least until a number of AVSs go live.

- As a reminder, Ethereum started off as a proof-of-work ("PoW") chain and only started the transition to proof-of-stake ("PoS") at the end of December 2020 with the launch of the Beacon Chain and completed it in 2023 with The Merge. It should therefore not come as a surprise that **Ethereum has a relatively low staking ratio compared to its peers**.
  - As things stand, **around 25% of all $ETH is staked**[15]. This is compared to 50%+ figures for the likes of Solana, Cardano, Avalanche, and others. Prior to the advent of restaking and the popularization of LSTs, many in the Ethereum community thought that Ethereum staking would reach equilibrium at around 20–30%. Given that it is already here and restaking is relatively new, we could see Ethereum's staking ratio blow past the 30% mark.
  - Remember, **restaking adds another layer of yield to staking**. It would thus be fairly logical to think that this might have the effect of increasing the percentage of staked $ETH. **At the same time, the more $ETH that is staked, the lower the yield**[16] (as staking rewards get split between a larger total of staked $ETH). The relative power of each effect is worth looking closely into to get a better idea of how restaking might affect the Ethereum staking ratio over the next few months.

Figure 8: Among the top eight L1s by market capitalization, Ethereum has the second-lowest staking ratio. Could this change with restaking?

Logo	L1	Market Cap (US$B)	Staking Ratio
	Ethereum	352.6	25.4%
	BNB Chain	52.8	14.3%
	Solana	49.4	67.2%
	Cardano	22.1	64.3%
	Avalanche	14.5	52.8%
	Tron	12.0	50.6%
	Polkadot	9.9	56.6%
	Polygon	9.5	37.9%

Source: www.stakingrewards.com, as of February 19, 2024

- Finally, we should consider that projects might choose to launch on top of EigenLayer for reasons other than shared security. **Joining EigenLayer might make sense as a distribution and marketing strategy** for projects, especially considering how much activity restaking has generated in the last few months. This is an important consideration when analyzing how large EigenLayer could grow and what level of network effects it could generate.

Restaking on Other Chains

While restaking has largely been associated with the Ethereum ecosystem, the idea of shared security is also present on other chains. In our report, **Modular Blockchains: The Race to Become the Top Security Provider**, we took a close look at the **Cosmos ecosystem and their Replicated Security and Mesh Security models.** We also looked at **Bitcoin-related solutions, such as Babylon and Stacks**. Here, we refresh our understanding of Babylon and also talk about Solana restaking with Picasso.

Bitcoin "Restaking": Babylon

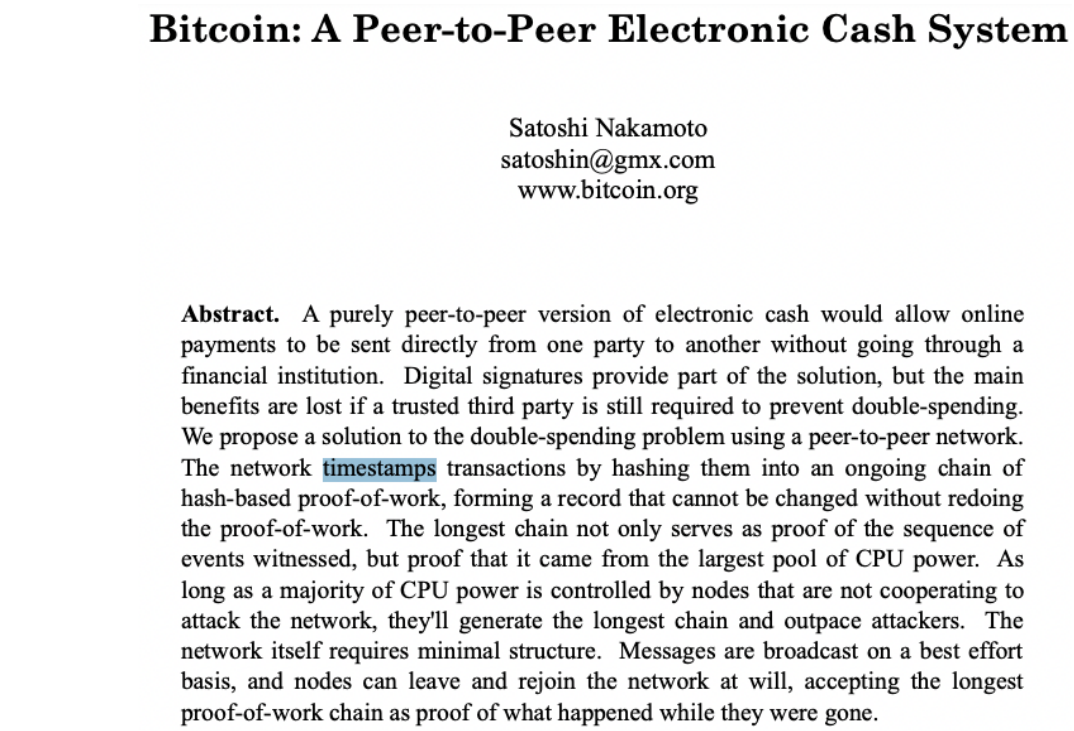
Babylon is a Bitcoin staking protocol that aims to **leverage the US$1T+ of crypto-economic security of Bitcoin to enhance the security of other PoS chains**. Babylon aims to create a two-sided marketplace where **Bitcoin holders can securely stake their $BTC and choose whichever PoS chain(s) and dApps they want to support and earn yield from**. The PoS chains and dApps can opt-in to using $BTC-backed security in order to bootstrap their crypto-economic security, as discussed earlier in this report.

- **How does it work?**
  - Similar to EigenLayer, the key to Babylon's protocol is the enforcement of a **slashing mechanism.** If the staker misbehaves, their staked $BTC must get slashed.
  - However, the issue that they faced was the **limited expressiveness of Bitcoin**. Bitcoin is very different to smart-contract L1s like Ethereum, BNB Chain, and Solana, and does not have native smart contract functionality. One solution is to bridge $BTC to another PoS chain and enforce a slashing mechanism there, but this requires trust in a third-party.
  - Thus, **Babylon overcame this lack of smart contracts through a combination of advanced cryptography, and optimization of the Bitcoin scripting language**. Babylon expresses the staking contracts in terms of UTXO transactions written in the Bitcoin script. Further technical details in their litepaper.
  - The important feature to note is that **Babylon's solution does not involve bridging $BTC, but simply requires locking it up on the Bitcoin chain itself**.

- **Bitcoin's timestamping**
  - A key feature of Bitcoin that Babylon uses is its **timestamping**. Bitcoin solves the double-spend problem by timestamping transactions and then distributing them to form the basis of PoW consensus. These timestamps provide an irreversible chronological record of transactions and can thus help settle any security issues on the chain.

- Bitcoin can also be used to timestamp events from other chains in a process called **checkpointing**. The transactions that timestamp these events are then referred to as **checkpoints**.
- Babylon uses this feature and periodically records the checkpoints of other PoS networks on the Bitcoin blockchain, which helps provide a layer of security for transactions. If an attacker attempted to corrupt a PoS network that utilizes Babylon Chain, they would have to attack the Bitcoin blockchain itself, essentially creating Bitcoin-equivalent security for these chains.

Figure 9: Babylon Chain utilizes the timestamp feature of Bitcoin to help secure other chains



Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
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Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.

Source: Bitcoin whitepaper

❖ Babylon Chain

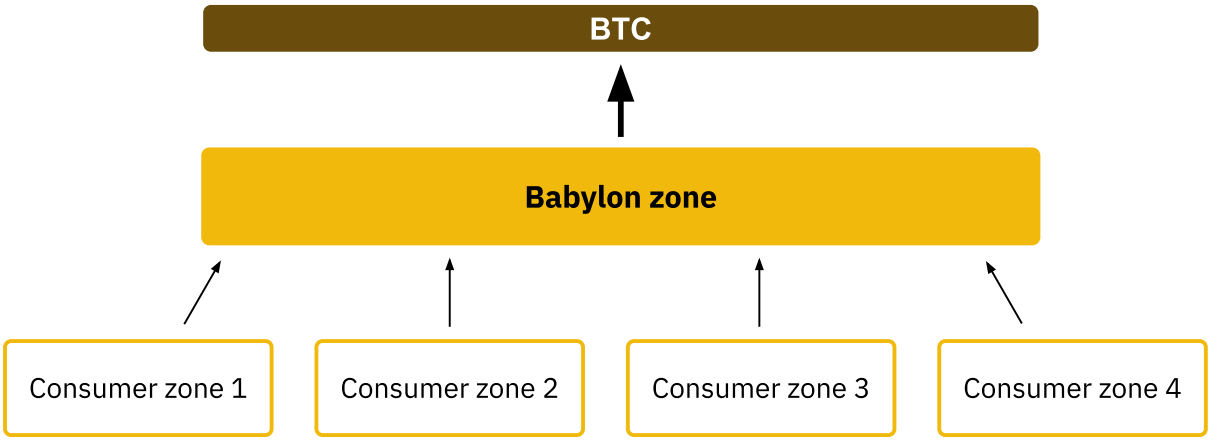
- Babylon's Bitcoin staking protocol essentially acts as a middle man, or what they call a "**control plane", between PoS chains who want to use Bitcoin's security to back themselves, and Bitcoin holders.** The protocol is **implemented as a chain (i.e., Babylon Chain)** in order to ensure its security, scalability, and censorship-resistance.
- Because the Bitcoin chain has limited and expensive block space, it is unsustainable for every PoS which uses Babylon to directly timestamp on to it. To solve this issue, the Babylon team designed a Bitcoin timestamping protocol and implemented it as a **Cosmos-SDK chain**, namely, Babylon Chain.

- Babylon Chain enables the **aggregation of timestamps for any number of Cosmos SDK chains** via the inter-blockchain communication protocol ("**IBC**").
- Babylon is starting its journey focusing on Cosmos appchains but hopes to expand onto all types of PoS chains in the future.

❖ **Babylon's Architecture:**

- Babylon uses a **three-part architecture**: (1) Bitcoin, as the timestamping service; (2) the Babylon Chain, a Cosmos Zone, as the middle layer and aggregator; and (3) other Cosmos Zones, as the consumers of security.
- **Checkpoints from participating Zones are sent to the Babylon Chain via IBC.** Babylon Chain aggregates these so that only one checkpoint stream must be put onto Bitcoin to timestamp transactions from all the different Zones simultaneously.
- This **aggregated checkpoint is then sent to Bitcoin**. The finality of the Bitcoin network is usually considered to be around six blocks (taking about an hour), after which the transactions included in the aggregated checkpoint can be considered protected via the full security of Bitcoin. In return, the participating Cosmos Zones obtain Bitcoin timestamps with validity proofs from Babylon Chain.
- Participating validators can also **download Babylon Chain blocks to verify all the checkpoints** and ensure that Babylon validators behaved honestly.
- **Faster unbonding periods**: Due to the characteristics of PoS chains, specifically the potential for so-called long-range attacks[17], the withdrawals of a user's staked tokens, i.e., the unbonding period, can often take days or even weeks. Liquid staking is one solution that has emerged to alleviate this issue, although it comes with its own risks. **PoS networks that utilize Babylon to post checkpoints to Bitcoin can reduce this period from weeks to just a few hours**. Technical details can be found here.

Figure 10: Babylon's architecture



Source: Babylon Chain Blog, Binance Research

- **Differences versus EigenLayer and Cosmos Mesh Security:**
  - With **both EigenLayer restaking and Cosmos Mesh Security, the asset is already staked to secure the primary chain**. This is **not the case with Babylon's Bitcoin staking**, as the Bitcoin chain is secured by PoW, and not PoS. Thus, although this protocol satisfies some definitions of restaking, it is somewhat closer to staking.
  - **Bitcoin does not have smart contracts to implement the slashing mechanism in the same way as EigenLayer does on Ethereum** and Mesh Security does on Cosmos. Instead, Babylon uses Bitcoin's scripting language and cryptography to implement their slashing.

- **Risks:**
  - A key point to remember is that the Babylon Chain helps record checkpoints for **past blocks** in the Bitcoin chain, protecting them with the robust security of Bitcoin. New blocks are still dependent on the validators of each individual PoS network, and neither Babylon nor Bitcoin can take responsibility for protecting these blocks.

- **Integrations and timeline:**
  - Babylon has already **integrated with 45+ Cosmos chains on testnet, with a total market cap of over US$7.4B**[18]. These include the majority of top Cosmos appchains, such as Osmosis, Injective, Akash, Juno, Secret Network, Evmos, Stride, Sei, and many more.
  - Babylon's testnet has been live since March 2023, and is a demonstration of **Babylon's Bitcoin timestamping technology,** as discussed above. A **mainnet launch, with the Bitcoin staking protocol, can be expected in 2024**.
  - Babylon announced a US$18M fundraising round in December 2023[19].
  - In mid-February, a **proposal** went live on the Cosmos Hub forum calling for an **official integration between Babylon and the Cosmos Hub**. If approved, the proposal will install a Babylon extension on to Cosmos Hub and all of its consumer chains. **Bitcoin holders will then be able to delegate to Cosmos Hub validators to directly secure Cosmos appchains**. The appchains can then select how their fees will be split between $ATOM stakers, native token stakers, and $BTC restakers.

Given the hybrid model of Babylon, which combines PoS and PoW and then adds IBC for communication, we can view it as seeking to **leverage the best parts of Ethereum, Bitcoin, and Cosmos**. It is a promising new approach to blockchain design and relies on key features from existing platforms. It will be interesting to monitor how this approach performs with their current Cosmos cohort and whether the team can successfully branch out to include other PoS networks.

Solana Restaking: Picasso

❖ What is Picasso?

- ➢ Picasso is an **infrastructure layer** which aims to **improve DeFi interoperability**[20]. Originally built on the Kusama network, Picasso aims to do a full migration to a Cosmos appchain in the near future.

- ➢ Picasso is part of the broader Composable ecosystem[21], and is a L1 blockchain that uses Cosmos SDK (Tendermint + IBC). Through expanding the inter-blockchain communication protocol ("IBC") outside of the Cosmos, Picasso has successfully connected **the Cosmos, Polkadot, and Kusama ecosystems**. These connections have been live since Q1 2023[22].

- ➢ Picasso also launched the **Ethereum <> IBC testnet in October 2023, and is aiming to launch both the Ethereum, and Solana IBC connections in Q2 2024**. Picasso uses its native $PICA token to secure its network. For further detail on how exactly Picasso works and their aims, we recommend checking out their recent blog post here.

❖ Solana restaking:

- ➢ Picasso has built a **Restaking Layer on Solana**, which serves as the **validation layer for what they refer to as the "Guest Blockchain"**[23]. This chain will essentially be deployed inside of Solana as a smart contract, and will provide the features to make Solana IBC-compatible.

- ➢ The Guest Blockchain will have to be validated like any other PoS chain, and will use previously staked assets to secure itself via the Restaking Layer. **Native $SOL, as well as $SOL LSTs like $jitoSOL, $mSOL, $bSOL, are accepted as collateral**.

- ➢ In order to initially **bootstrap the liquidity on the Restaking Layer, Picasso is running a three-stage campaign called Mantis Games**[24]. The first phase involved an NFT auction, whereas the second phase (which is currently active) is a team staking competition. Phase three will involve a swap competition with a score system to further help bootstrap liquidity and get users used to the protocol.

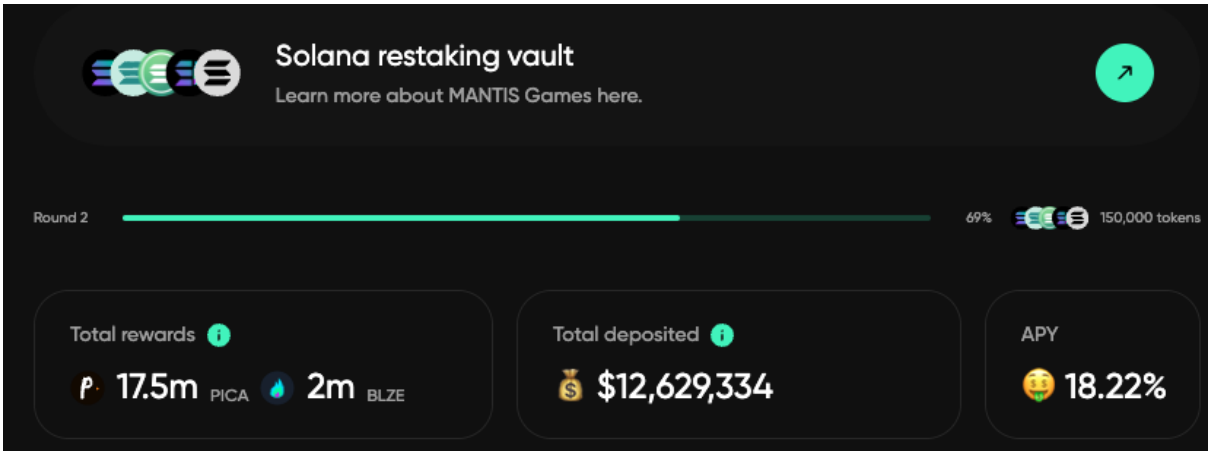
❖ AVSs:

- ➢ The first AVS that Picasso has designed is a **Solana <> IBC bridge,** which will enable the **liquidity of the Solana ecosystem to be able to interoperate with other IBC-enabled chains**. This connection will also serve to further the development of new cross-chain use cases between Solana and other ecosystems, including Cosmos, Polkadot, Kusama, and more.

i. 20% of the fees that the bridge generates will go towards $PICA stakers, while 40% will go towards restakers[25]. This is in line with their general guidance where **20% is set for $PICA stakers, and 30-50% is allocated towards restakers (depending on the AVS).**

➢ **Rome Protocol**, a Solana **shared sequencer, is set to become[26] the second AVS** to use Picasso Solana Restaking Layer. More details are expected in the coming weeks.

Figure 11: Picasso's Solana restaking vault currently has over US$12M in deposits



Source: Mantis Games website, as of February 19, 2024

❖ **Partnerships:**

➢ Picasso has also been announcing partnerships with a number of leading Solana dApps in recent weeks.

➢ Notable examples include **Meteora (DeFi platform), Raydium (orderbook AMM), Kamino Finance (DeFi), MarginFi (DeFi),** and more.

❖ **Outlook:**

➢ Last week, Picasso announced[27] that **existing Solana validators can now join as AVS node operators** to help validate Solana IBC.

➢ After the third phase of the Mantis Games bootstrapping campaign concludes, **we expect to see the Solana IBC bridge to enter mainnet at some point in Q2 of 2024.**

➢ Picasso also recently published an introductory post[28] on the forum for notable Solana DEX aggregator, Jupiter. Picasso is hoping to get entry into Jupiter's LFG launchpad program to help bring $PICA to Solana.

4 Liquid Restaking

What Is It?

First, we had staking, and then we got liquid staking. As a refresher, staking on Ethereum involves locking up your $ETH. Liquid staking protocols like Lido then came along and helped users stake their $ETH, but also gave them a liquid staking token ("LST") in return ($stETH in the case of Lido). Users can maintain liquidity with the LST and use it to earn additional yields across DeFi.

Liquid restaking essentially provides this service for restakers. For example, a user might ordinarily deposit their $ETH or LST into EigenLayer, which would then be locked and thus illiquid. On the other hand, **with a liquid restaking protocol, a user could deposit their $ETH or LST, and the protocol would handle the restaking for them**. In return, **they would get a liquid restaking token ("LRT")**, with which they could **maintain their liquidity and earn additional yield in DeFi**.

Figure 12: The three layers of the swiftly expanding Ethereum staking market

Source: Binance Research

Different Ways to Restake

Before looking more closely at the different LRT platforms, it is important to note the differences in restaking methods. There are essentially three ways to restake: native restaking on EigenLayer, LST restaking on EigenLayer, and liquid restaking protocols.

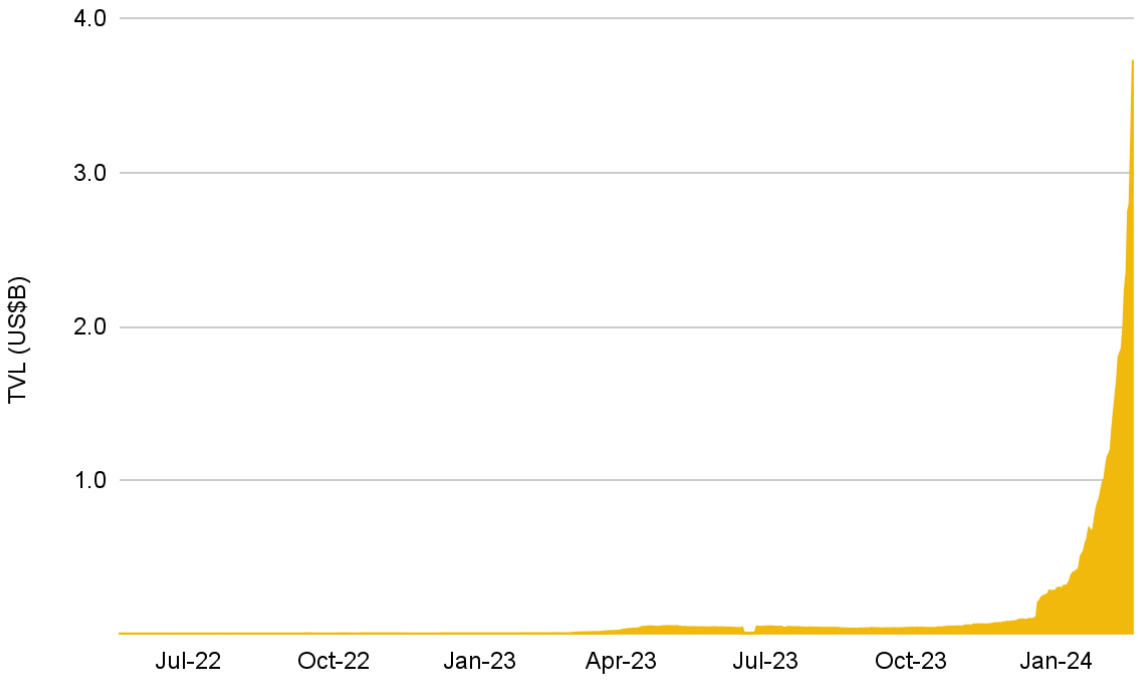
Figure 13: A short comparison between different ways to restake

	Native Restaking on EigenLayer	LST Restaking on EigenLayer	Liquid Restaking Protocols
Summary	A user must operate an Ethereum node, stake at least 32 $ETH on the Beacon Chain, and set the withdrawal credentials to an EigenPod (an EigenLayer smart contract).	LST holders can restake their LSTs to EigenLayer directly through their website. This does not require operating a node.	A user can deposit their $ETH or LST into the protocol. They will operate Ethereum nodes on users' behalf and restake with EigenLayer, while giving the user a liquid LRT in return. Some of these protocols do native restaking on users' behalf, while others simply deposit their LSTs for them.
Deposit Caps?	None	Yes, EigenLayer has been slowly increasing them	None
Infrastructure?	Yes, operate an Ethereum node	None	None
Minimum amount required?	32 $ETH	No minimum	No minimum
Liquidity?	No, $ETH is locked	No LSTs are locked	Yes, LRT token
Risk Angles?	1) Ethereum Client 2) EigenLayer smart contracts	1) Ethereum Client 2) EigenLayer smart contracts 3) LST protocol	1) Ethereum Client 2) EigenLayer smart contracts 3) LRT Protocol 4) LST Protocol (if you deposit LSTs)
Ease of staking			

Liquid Restaking Protocols

Now that we understand how liquid restaking protocols work, we can examine the major players and compare their key features.

Figure 14: Liquid restaking protocols have seen a strong rise in TVL this year



Source: defillama.com, Binance Research, as of February 19, 2024

Ether.fi

Ether.fi is the largest liquid restaking protocol (as of the time of writing) with over US$1.2B in TVL. Ether.fi's LRT is called **$eETH.** Having initially launched in November 2023, $eETH is also the first major LRT that entered the market.

- **Details:**
  - We should note that Ether.fi **only accepts $ETH, not LSTs**.
  - After a user deposits their $ETH and collects the $eETH token, they are free to use it in DeFi to maximize their returns.
  - Their staked $ETH will **accrue both Ethereum PoS staking and EigenLayer restaking rewards** (once EigenLayer restaking rewards are live).
  - Users can also earn **Ether.fi Loyalty Points**, which are set to "play a role in decentralized governance"[29].

i. Ether.fi Loyalty Points = $ETH staked * 1000 * days staked

- **Operation Solo Staker:**
  - This is ether.fi's method of trying to contribute to a more decentralized Ethereum network.
  - Ether.fi has partnered with **distributed validator technology ("DVT") developer, Obol Labs**, to promote solo stakers.
  - After ether.fi collects the deposited $ETH, they create validator keys using blocks of 32 $ETH. These validator keys are given to node operators to perform validation duties. However, instead of giving them to a small number of the largest operators, **ether.fi instead uses DVT to split these keys between multiple solo stakers**. This helps to decentralize the Ethereum network, as it **contributes to a more diverse group of validators**. More details here.

- **Ether.fan:**
  - Ether.fi also has a related **NFT project called ether.fan where users can stake their $ETH and mint an NFT to earn more points.** The NFT represents the staked $ETH, accrues staking rewards automatically, and boosts rewards depending on how long a user stakes.
  - All $ETH staked through ether.fan is allocated towards solo node operators using DVT.

- **Fundraising:**
  - Ether.fi raised a US$5.3M seed funding round[30] in February 2023.

- **Outlook:**
  - Ether.fi is aiming to further their involvement in the staking ecosystem by **building their own AVSs**. CEO, Mike Silagadze discussed this in a recent appearance on The Edge Podcast[31].
  - Ether.fi also has a detailed roadmap on their website, with **further DVT integration, DAO governance, and open-sourcing** of their software on the cards over the next few months.

Puffer Finance

Puffer Finance is the second largest liquid restaking protocol and provides stakers with its native LRT, **$pufETH.** While Puffer only launched at the start of February, its performance has been strong with TVL already over ~US$1B[32].

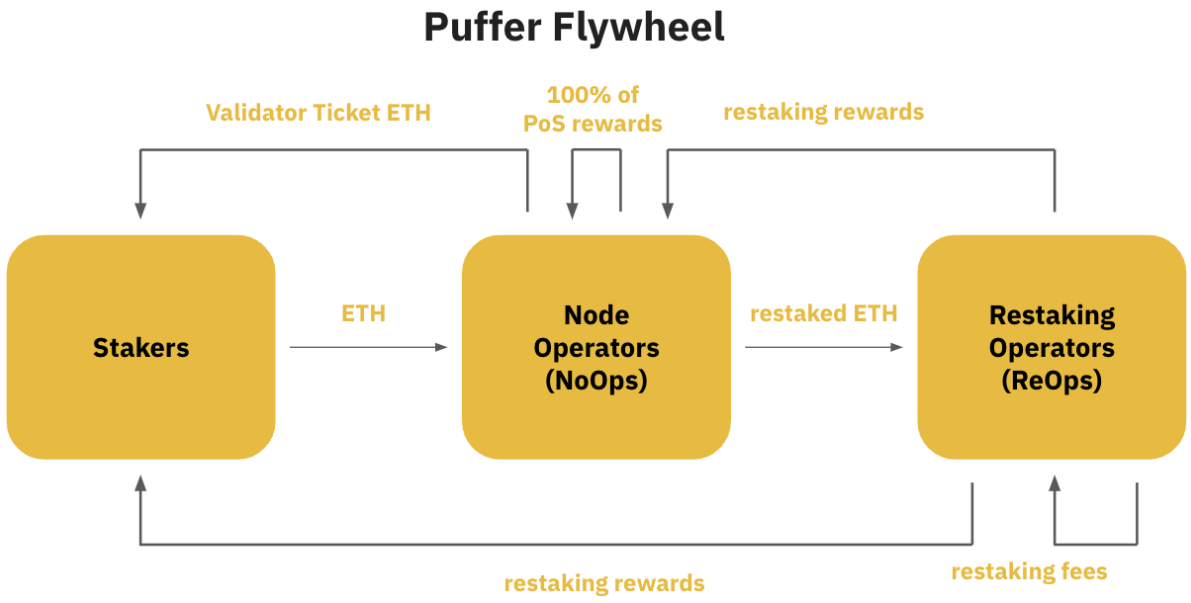
- **Details:**

- An important factor to note about Puffer Finance is that it **only accepts $stETH** (Lido's $ETH LST) deposits at this stage. After Puffer's mainnet goes live, it is their **intention to swap the Lido $stETH into $ETH and natively restake that onto EigenLayer.** This so-called vampire attack strategy is arguably part of the reason that TVL has risen so fast for Puffer.
    i. The success of Puffer also has **implications for Lido's dominance** in the DeFi sector, which has long been a topic of discussion among the community. In fact, Puffer has explicitly stated that the main goal of this strategy is "to reduce the stETH dominance in the LST space"[33].

- Users who deposited $stETH with Puffer when EigenLayer's LST deposits were open (prior to Feb 9), will accrue both EigenLayer points and Puffer points. Users who deposited after this are set to accrue Puffer points until mainnet launch, after which they will also accrue EigenLayer points.

- Puffer Finance has also committed to **self-limiting the growth of the protocol to 22% of all Ethereum validators**[34], as a way to protect Ethereum's decentralization.

Figure 15: The Puffer Flywheel



Source: Puffer Finance documentation

- **Anti-slashing technology:**
    - One of Puffer's key innovations is their anti-slashing mechanism. Specifically, it is called **Secure-Signer** and is backed by an **Ethereum Foundation grant**.
    - This is particularly relevant to node operators. Although the technicalities are beyond the scope of this report, we recommend checking out further details

here.

- **Fundraising:**
  - Puffer Finance raised a US$5.5M seed round in August 2023[35].

- **Outlook:**
  - Puffer Finance is expected to launch mainnet in the coming weeks. They also discuss a **Puffer L2**, with $pufETH holders set to earn revenue from L2 fees, and **oracle and bridge AVSs** in a recent blog post[36].

Kelp DAO

Kelp DAO's LRT solution has over US$490M in TVL and enables liquid restaking with their **$rsETH** token. Kelp DAO is built by the same team as Stader Labs.

- **Details:**
  - Kelp currently supports **native $ETH, Lido's $stETH, Stader's $ETHx, and Frax's $sfrxETH** for liquid restaking purposes.
  - Users can collect Kelp Miles and EigenLayer points as liquid restaking incentives when depositing into Kelp.
    i. Kelp Miles = (Amount of $rsETH) * number of days * 10,000
  - Kelp also has a referral program in place.
  - Earlier in February, **$rsETH also became the first LRT live on Polygon zkEVM**[37] and also partnered with LayerZero to bring it to **Arbitrum**[38].

- **DeFi integrations:**
  - Kelp currently has integrations with **Pendle, Uniswap, Curve, and Balancer**.
  - Kelp depositors can use their $rsETH to interact with these protocols and **earn incremental yield and additional Kelp Miles / EigenLayer points**.

- **Outlook:**
  - Kelp expects further DeFi opportunities to open up over the coming months[39].

Renzo

Renzo currently has over US$350M in TVL with their **$ezETH** LRT.

- **Details:**
  - Renzo currently **accepts native $ETH, $stETH, and $wBETH**. Similar to the others, users can earn both Renzo's ezPoints and EigenLayer points when using the protocol.
  - Renzo work with **Figment in order to stake the native $ETH.**

- Renzo also has a referral program in place.
- Renzo has DeFi integrations with Balancer, Pendle, Curve, and Uniswap, where users can use their $ezETH to earn more yield / points.

❖ **BNB Chain restaking:**

- In early February, Renzo became the first restaking protocol to support BNB Chain restaking, when they added support for $wBETH[40].

❖ **Arbitrum restaking:**

- Renzo also recently announced a collaboration with Connext Network to bring cross-chain restaking to Arbitrum[41].

❖ **Fundraising and outlook:**

- Renzo announced[42] a US$3.4M seed round earlier this year, at a US$25M valuation.
- Renzo plans to use the capital for additional **audits**, increased rewards for its **bug bounty program**, more **DeFi integrations**, and hiring. Renzo's general **mainnet will also launch after EigenLayer's Stage 3 launch**. Renzo also plans to work on **cross-chain staking solutions**, something it is already dabbling in with its BNB Chain and Arbitrum integrations.

Others

This is a swiftly growing and nascent market, with a number of teams, including the likes of Eigenpie and Swell, innovating and working on solutions. While these are the four largest liquid restaking protocols at the time of writing, we are sure things will keep moving around quite a bit over the coming weeks and months.

One factor we should draw our attention to is the earlier discussion of **AVS selection**. As AVSs start going live through the rest of this year, with (presumably) more and more **heterogeneous slashing conditions**, it will become critical to be careful in choosing who to restake with. **Liquid restaking protocols can serve as important guiding platforms here**, and help users figure out which yields might be too good to be true and which protocols are worth supporting. Additionally, we should note that liquid restaking protocols handle significant amounts of $ETH (or LSTs) and can direct them to different validators. This means that these protocols can be **critical stewards of Ethereum's decentralization** if they choose. For example, initiatives like **ether.fi's Operation Solo Staker**, are very important here, and can have material impacts on Ethereum's decentralization. The fact that they are **promoting DVT technology** with this initiative is also noteworthy, as this becomes a more important conversation in the coming months.

5 Outlook and Closing Thoughts

Restaking is a sub-sector that is growing rapidly. Many in the community believe that this new set of developments is poised to bring about a sea change in the ecosystem, particularly from the infrastructure side. If the demand we have witnessed so far, for both EigenLayer and liquid restaking protocols, is anything to go by, we might be in for an interesting ride.

At the same time, the beginning of new technological developments and the proliferation of a whole new set of companies is often fraught with risks, even if the underlying technology is not. While not inevitable, the likelihood of some mishaps in this rapidly innovating yet nascent market is something to consider very carefully.

It will be interesting to see which protocols emerge on the other side of this wave. New and innovative AVSs and how they feed into the broader Ethereum value flywheel will also be important to keep an eye on. As always, the Binance Research team will keep its ears to the ground and keep all of you informed.

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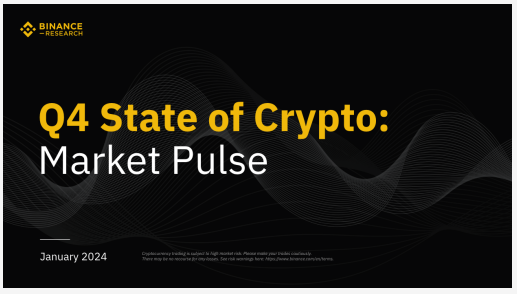

Q4 State of Crypto: Market Pulse

A compilation of key charts and insights on the market

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