This post will discuss the role liquid staking can play in securing Celestia and the Celestia Ecosystem. By discussing the benefits of liquid staking and the approach that optimizes security and compatibility with Celestia's architecture, the post introduces Stride, the leading liquid staking provider in the IBC ecosystem.

Why liquid stake at all?

Fundamentally, liquid staking allows token holders to stake in order to secure the chain and accrue staking rewards whilst preserving liquidity. Eliminating the tradeoff between staking and staying liquid encourages even more staking (therefore more economic security), as well as more utility for TIA. This is because liquid staking eliminates the DeFi hurdle rate: the additional returns DeFi needs to offer so that users are compensated for the opportunity cost of staking TIA. This leads to a number of benefits.

Known and Proven Benefits

- Capital Efficient Integrations

: stTIA is easier for applications on rollups to integrate than TIA because there's no opportunity cost of staking. For example, if someone launches a lending protocol chain/rollup on Celestia, it's far easier for them to attract liquidity for stTIA deposits rather than TIA deposits. This is because for TIA deposits, the protocol would need to compensate users more than the native staking yield. The same (or even slightly lower) compensation for stTIA would drive much more liquidity, as there would be no DeFi hurdle rate. The same applies for existing DeFi applications in Cosmos such as Mars Protocol.

- Raises Chain's Economic Security

: Similar to above, the option of using stTIA in DeFi incentivizes users to stake. Liquid staking also means that stakers can exit their staked positions without being subject to the unbonding period. Instead of having to unbond, stakers can sell their stTIA for TIA on AMMs like Osmosis. Thus, two barriers to staking are removed, encouraging more users to stake and thereby increasing chain security.

Ideas Specific to Celestia

- Chains can pay for gas and DA with stTIA

: Users may forgo staking TIA in order to keep it handy for gas, or choose to stake all their TIA, limiting the amount available for gas (chain use). Using stTIA as gas ensures that chain use doesn't disincentivize chain security and vice versa. Additionally, validators get paid in a yield-bearing token. Similar to the Gas argument, chains might choose to stake their TIA, and instead pay for DA with stTIA. This is another case of aligning chain use with chain security.

- stTIA can support decentralized sequencers

: stTIA could provide the path to a novel mechanism to decentralize sequencers. By staking stTIA with sequencers in the set, rollups could charge validators with sequencing the share of transactions that is commensurate with the amount of stTIA staked to them. This is significantly more capital efficient than using unstaked TIA for these purposes.

- Rollups could leverage stTIA in treasury management

: When rollups launch their token – for example on Osmosis using StreamSwap – users will buy that token using TIA which goes into the rollup's treasury. If DA fees can be paid in stTIA, rollups could simply liquid stake all the TIA in the treasury so that it continues to earn staking rewards, and pay DA fees in stTIA. If DA fees can't be paid in stTIA, rollups can keep a portion of the TIA for DA costs and liquid stake the rest for stTIA. Then rollups can automate the amount of stTIA they unbond per day in order to maintain DA runway, and in the case of a surge in DA costs additional stTIA could be sold for TIA. This is a win for rollups, since the staking yield extends the runway of their DA expense budget. At the same time, it's a win for Celestia because it increases the number of TIA staked and hence chain security. It also improves stake distribution on Celestia by leveraging Stride (see below) instead of relying solely on the user preferences of dPoS.

Why an appchain approach over same-chain liquid staking?

- Keeping Celestia minimalist

: The appchain approach reduces on-chain complexity for Celestia. The core Celestia code can remain more minimal, and be optimized for on-chain functionality (i.e. providing data availability). This results in less resource intensive activity on-chain, a smaller attack surface on Celestia, and provides more time for Celestia developers to focus on Celestia's unique edge.

- Comprehensive Security Guarantees:

Another benefit of the appchain approach is that an appchain that is solely used for liquid staking has the ability to highly optimize for security. For example, chains can build in health checks that are executed with each new block or even with each new transaction These checks can ensure all liquid staking functionality is working as expected, halting functionality otherwise. Adding similar checks to Celestia would be intrusive and add complexity. Stride's codebase has already been audited and has been running on mainnet for over 12 months, whereas same-chain liquid staking would require deploying

new untested code and undergoing fresh audits.

- Reduced Maintenance Costs:

In addition to reducing complexity and increasing security, maintenance isn't free, and using an appchain liquid staking provider (through ICA) guarantees regular and timely updates if core SDK staking logic changes (e.g. SDK upgrades, delegation logic changes, etc).

- Additional Features and Processes Required for Successful Liquid Staking:

liquid staking tokens do not succeed or fail based on their technology alone; appchain liquid staking providers offer the features and processes required for a liquid staking token to flourish. . These include (1) in-protocol safety checks, (2) processes to ensure deep liquidity for the stToken, (3) relationships that ensure integrations of stTokens in all major DeFi protocols, (4) systems that give stToken holders governance rights, (5) simple UX, and more. Particularly on the DeFi protocol integrations, these take substantial BD and technical work to integrate into various protocols throughout the Cosmos. Existing LST providers have already done this work, and will continue to integrate into upcoming major Cosmos DeFi protocols as well. An additional area of surprising complexity is designing a safe and reliable delegation strategy for liquid staked TIA tokens… Much research has been done here by LSTs, but this is an actively evolving field. This can end up requiring quite a bit of time from Celestia contributors.

- Ease of Onboarding:

Onboarding an external liquid staking provider is extremely simple, and only requires minor code changes from Celestia. In particular, (1) upgrading to IBCv3 and (2) enabling a few "AllowMsgs" to allow external chains to stake, unbond, etc. Stride contributors are more than happy to submit the relevant PR to the Celestia repo.

Why Stride?

Stride is the largest liquid staking provider by TVL in the Cosmos ecosystem. Having launched in early September 2022, Stride now supports 10 appchains (and counting) and has $36m+ in TVL. Stride is a sovereign appchain secured by Interchain Security, which means that the chain is secured by over $1.7bn in ATOM. Aside from compatibility with any blockchains that have IBC v3 enabled, there are a number of reasons Stride would be a great liquid staking provider for Celestia.

- Safety and Security:

Stride is committed to safety and security, and Stride takes a number of steps to remain the most secure liquid staking provider. For instance, Stride is secured by Interchain Security from the Cosmos Hub. This provides Stride with billions of dollars of economic security. Furthermore, Stride has completed 3 audits of its whole codebase, and engages Informal Systems (one of the best auditing firms in crypto) to do ongoing audits of the codebase. In terms of on-chain measures, Stride has rate limiting enabled on-chain, which limits the damage in a "worst-case scenario" to 10-20% of what it could ultimately be. Additionally, Stride runs health checks each block to verify that all liquid staking functionality is working. These will soon be run with each transaction. Stride has a rigorous 5-step deployment process for any mainnet changes to ensure that upgrades work as expected, and no core functionality is ever altered unexpectedly.

- Minimalism:

Stride is a minimal chain, only focusing on liquid staking. Stride has no plans for other functionality on-chain, like DEXes or other DeFi protocols. This gives Stride contributors more time and energy to focus on core liquid staking functionality, as well as reduces the odds of an unintentional bug being introduced. As a minimalist chain, Stride has no conflicts of interest when working with other protocols. Furthermore, by remaining minimalist, Stride is able to have as small of an attack surface as possible.

- Integrations

: Stride is deeply integrated into protocols in Cosmos. These includeOsmosis, Mars, Umee, Astroport, Shade, Crescent, Kujira, Forge, and many others. Stride has gone through the integration processes for all of these chains, including navigating the governance process on each integration partner's governance forums, setting up oracles, running through security verification from risk management experts including Gauntlet, etc. This is costly and time intensive work to reproduce. If Stride launches stTIA, it can automatically integrate into any of these partnerships at launch! Much of the groundwork has also already been laid for future integrations. As a result of these network effects and trust, Stride has over 85% of liquid staking TVL in Cosmos.

- Features and UX

: Stride supports all of the key features you would expect from a liquid staking provider, including staking, unstaking, and frequent on-chain safety checks. Additionally, Stride supports a 1-click liquid staking UX, where users can liquid stake their TIA from Celestia in 1-click, signing a single transaction on Celestia. In Stride's next software upgrade (1-2 weeks) this will also allow users to receive their stTIA on any chain of their choice, including back on Celestia itself. This will allow users to liquid stake their TIA with a single Celestia signature and deploy it in DeFi without ever feeling like they've left the chain (the user signs 1 transaction, and ends up with stTIA on the chain of their choice). Stride is actively working on liquid governance

for its stTokens (expected to deploy very soon, within 2 months) This would allow stTIA holders who lock up their LSTs to vote on Celestia governance proposals. Stride has a proven, highly technical contributor team, and has shipped many best-in-class features. For example, the Stride team helped onboard the live Stride chain to Interchain Security, with no loss of chain functionality or liveness.

- Alignment with Supported Chains:

Stride and its contributors are heavily aligned with the success of its host chains. Outside of providing hands-on support at the time of integration, as well as other technical support during key upgrades etc, Stride contributors have undertaken a number of initiatives for supported chains. For example, Stride contributors played a key role in developing the Liquid Staking Module (see below). Additionally Stride has set up and currently helps run a validator selection process for the Cosmos Hub and Osmosis. The process involves appointing a council to select the validators to which tokens liquid staked with Stride will be delegated on a given chain. This process ensures both that the validators are aligned with the host chain, and that they are selected in a decentralized manner. Stride could undertake a similar initiative for Celestia, as well as a number of other initiatives, such as adding the Liquid Staking Module to Celestia (see below).

How will Stride be held accountable to Celestia?

In order to ensure Stride will be held accountable to Celestia, Celestia could integrate the Liquid Staking Module (LSM). The LSM is a safety framework that regulate the adoption of liquid staking. It introduces certain checks and balances, controlled by Celestia governance, that can be used to regulate liquid staking providers and mitigate the risks of liquid staking. These include:

- X% Liquid Staking Cap:

This measure ensures that no more than X% of total stake can be liquid staked (in total across all providers). This is a key safety feature, as it can be used to prevent liquid staking providers from collectively controlling more than ⅓ of the total staked TIA supply. Celestia governance controls the Liquid Staking Cap parameter and can set it to any value they prefer. For reference, the Cosmos Hub Liquid Staking Cap is 25%.

- Required Validator Self-Bonding:

This requirement is a first step towards solving the principal-agent problem. Validators who wish to receive delegations from a liquid staking provider to self-bond some TIA so that their own capital is subject to slashing if they were to act maliciously. Celestia governance controls the multiplier between a validator's amount of self bond and the number of liquid staking tokens that validator can accept. For reference, the Cosmos Hub Validator Bond Factor is 250.

Additionally, LSM would also allow regularly staked tokens to be converted to their liquid staked form without having to undergo the unbonding period. This means that if a liquid staking provider were to launch on Celestia after the launch of Celestia's chain, already-staked TIA would not have to be unbonded in order to be liquid staked, therefore allowing TIA tokens to be liquid staked without having to forfeit any staking rewards.

Should Celestia choose to integrate the Liquid Staking Module, Stride contributors are happy to shoulder much of the technical burden.

Next Steps (Engineering)

Outlined are some of the next steps to bring stTIA live (total ~1 day of engineering work):

- ICA:

Stride contributors would submit a pull request to the Celestia Github repository to add Interchain Accounts (ICA). This is a small ticket item (only around 12 lines of code).

- Testing:

Stride contributors would then run through all the routine testing flows.

- IBC Connection:

Stride contributors would set up an IBC connection between the two chains. Again, this is a short process requiring only a few minutes' coordination and work.

- Launch stTIA:

After the above steps are completed, stTIA will be ready and users will be able to liquid stake their TIA!

As mentioned, Stride contributors are happy to do all the work above, and requires no engineering work from the Celestia team. The entire process would be fairly straightforward and short.

In summary, we believe that Liquid Staking and Stride in particular are uniquely positioned to increase the utility, security, and capital efficiency of the Celestia ecosystem and TIA. We've been researching and contributing to Liquid Staking for over

a year and are excited for the unlock it can provide Celestia and the ecosystem at large. That said, this is just the start of a conversation around liquid staking: we are very excited to work with the extremely impressive team in the Celestia ecosystem and encourage anyone who has thoughts, comments or questions to leave them below (: