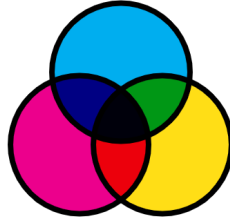


Stargate Upgrade Proposal

Iqlusion



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Context:

Stargate is our name for the process of ensuring that the widely integrated public network known as the Cosmos Hub is able to execute the cosmoshub-3 -> cosmoshub-4 upgrade with the minimum disruption to its existing ecosystem. This upgrade will also realize the Internet of Blockchains vision from the Cosmos whitepaper.

Integrations from ecosystem partners are at risk of breaking changes due to the Stargate changes. These changes drive the need for substantial resource and time requirements to ensure successful migration. Stargate represents a unique set of circumstances and is not intended to set precedent for future upgrades which are expected to be less dramatic.

There is a widespread consensus from many Cosmos stakeholders that these changes to core software components will enhance the performance and composability of the software and the value of the Cosmos Hub in a world of many blockchains.

A Yes result on this proposal provides a clear signal that the Cosmos Hub accepts and understands the Stargate process and is prepared to approve an upgrade with proposed changes if the plan below is executed successfully.

A No result would force a reconsideration of the tradeoffs in the Alternatives section and the forming a new plan to deliver IBC.



The number of changes implemented in the upgrade of the Cosmos SDK, Tendermint, and IBC to prepare for cross-chain communications are branded as the Stargate upgrade. At minimum, the Stargate upgrade will impact the following Cosmos ecosystem partners:

1. Exchanges
2. Wallets
3. Custodians
4. Validators
5. Delegators
6. Block Explorers

The Stargate upgrade will consist of the following changes:

- [Inter-Blockchain Communication \(IBC\)](#) - Enable the cross-chain transactions and messaging functionality. This will deliver on the promise of an interconnection of Cosmos chains that will be connected via the Cosmos Hub
- [Protobuf Migration](#) – Blockchain performance & developer acceleration
- [State Sync](#) – State sync of new nodes enabling them to join the network faster
- [Full-Featured Light Clients](#)
- [Chain Upgrade Module](#) – upgrade automation for chains that will reduce risks of loss of funds during upgrades

We intend for the approval of this proposal to signal both the Cosmos Hub's approval of these changes to the Gaia client software and approval for a process that resolves the novel challenges that these changes bring.

Development Milestones

The development milestones consist of the following releases that make up the Stargate:

Tendermint v0.34

Upgrades to Tendermint consensus with protocol breaking changes will require release candidate testing via group testnets and Cosmos Hub testnets.

The Cosmos Hub is currently on Tendermint 0.32 and the upgrade will also bring in 0.33 features.

v0.33 introduced some breaking changes, including:

- Remove TotalTxns and NumTxns fields from the header



- Remove redundant data from Commit. Commits no longer contain Vote structs directly, but rather a new, smaller CommitSig struct that leaves out redundant data like the height, round, and BlockID. This makes blocks much smaller.

v0.34 introduces more breaking changes, including:

- Validator sets are now sorted by voting power instead of by address
- Events can be hashed into the header to enable use cases where verifiability of events is helpful.
- Transaction types can be defined at runtime to enable better integration with the EVM and WASM VMs in the CosmosSDK
- Amino has been removed in favor of Protobuf. See [blog post](#):

IBC v1.0

IBC v1.0 includes delivery of the Inter-Blockchain Communication features. Clients, connections, and channels will be fully functional once Stargate is activated, but IBC transfer packets (ICS 20) will require an additional parameter change proposal to activate, conceptually similar to how transfers were activated after the launch of the Cosmos Hub.

Cosmos SDK v0.40 Stargate

The Cosmos Stargate SDK v0.40: <https://github.com/cosmos/cosmos-sdk/milestone/25>. This release includes the protobuf migration for encoding, querying, as well as other development work that is important to the Stargate release.

Cosmos SDK v0.38 features

The Stargate release builds on top of the Cosmos SDK 0.38 and includes features like sending funds directly to the community pool.

See the changelog for more details:

<https://github.com/cosmos/cosmos-sdk/releases/tag/v0.38.0>

Most of the work on v0.38 was intended to improve the modularity of the Cosmos SDK so that developers could use the software as a dependency rather than forking the code.

There are some features in 0.38 that will be of particular interest to the Hub.

- [#4233](#) Add upgrade module that coordinates software upgrades of live chains.
- [#5249](#) Funds are now allowed to be directly sent to the community pool (via the distribution module account).
- [#4814](#) Add security contact to Validator description.



Note: The Cosmos SDK 0.39 release will [revert the pruning features](#) introduced in 0.38 that proved to pose a risk of data corruption. This decision will persist in the Cosmos SDK 0.40 and Stargate.

Upgrade Risks

The Stargate upgrade comes with considerable risks and management of these risks has been the overwhelming priority of the teams working on all of these components.

- The Cosmos engineering teams have experienced dramatic changes to [organizational structure](#). These changes represent the first attempt to deliver a major software change with this structure. Empirical research has seen correlations between organizational complexity and security vulnerabilities . See [The Influence of Organizational Structure On Software Quality: An Empirical Case Study](#).
- Protobuf Risks
 - The serializations tend to have a pervasive impact on codebases. While enabling a gradual transition is a goal, the primary goals are conceptual integrity.
 - The protobuf transition will create an uncertain amount of API breakage that won't be fully clear until integration testing has begun.
 - The protobuf transition also touches security sensitive areas like signature verification and malleability.
- IBC Risks
 - IBC is a complex and novel feature on a blockchain and introduced permissionless extensibility of the Cosmos Hub.
 - Outcomes from [Game of Zones](#) demonstrate widespread familiarity with IBC and IBC's security model in the community but risks remain once real value exists in the IBC network.
 - IBC increases the risks associated with consensus attacks, emergency upgrades and validator centralization.
- We don't believe there are any exceptional risks associated with the state sync feature and the upgrade module. They provide some additional features for validators to master but are not unprecedented.

The Stargate Plan

The purpose of the Stargate effort is to ensure that Cosmos can fulfill the vision of an Internet of Blockchains in 2020 while mitigating the risks outlined above. It is also an attempt to create a



process for complex future on-chain upgrades on the Cosmos Hub. The plan for Stargate will include the following steps:

1. Run the Stargate Testnet and use this as an integration testing target with widest possible ecosystem participation to help confirm the readiness of the release software.
2. Engage and support critical partners during the integration process so that partners are able to actively participate in the testing process and provide insights into their success with the upgrade.
3. Dedicate significant resources in terms of full time human resources and documentation efforts to ensure that everyone integrated into the Cosmos Hub can self-certify as Stargate-ready.
4. Report back to the Hub on the success of the integration process.
 - a. We expect that the primary responsibility of the Cosmos Hub is to assess whether we have mitigated the above risks sufficiently.
 - b. We will provide a written report of the entire Stargate effort to enable Hub governance to make an informed decision.
5. At conclusion, we will indicate why we have confidence that an upgrade won't be disruptive to the Hub's ecosystem.

The Stargate Testnet

The Stargate testnet will be a decentralized simulated upgrade of the Cosmos Hub.

The Iqlusion team is asking for all Hub validators to participate in the new testnet, and we will organize replacing validators who choose not to participate.

The Stargate testnet will test all the features in the forthcoming Stargate release. It may need to be relaunched to accommodate bug fixes, but we anticipate that it will be substantially feature-complete at launch.

The testnet will allow zones to also test IBC integrations. We will conduct a planned IBC channel-preserving upgrade of the testnet to build experience with how upgrades interact with IBC.



The Stargate Testnet Upgrade

There are several components of the upgrade process that the Cosmos Hub community should gain experience with.

1. This upgrade will allow validators and full node operators the opportunity to use the cosmosd upgrade manager for zero downtime upgrades. This system has been tested on the Regen Network and other zones' testnets, but not all Cosmos Hub stakeholders have had the benefit of that experience.
2. This upgrade will also be the first channel-preserving IBC upgrade. This will provide an opportunity to experience swapping the light client of a channel with the upgrade while preserving the state, like ICS20 tokens.
3. Integrators with the Cosmos Hub can attempt to provide higher levels of quality of service across integration points. For instance, account numbers will be preserved across upgrades, allowing for less reconfiguration of systems.

Our plan is to conduct an upgrade of the Cosmos Hub to provide all parties the necessary experience with these new systems.

After Stargate Testnet

This proposal is only to signal acceptance/rejection of the Stargate plan. Upon successful approval and execution, this proposal will be succeeded by a second governance proposal whereupon the Cosmos Hub will vote to accept/reject the precise software version that will be released and the mainnet upgrade process. The Iqlusion team will provide a written report, integration case studies, and opportunities to answer questions to ensure that the Cosmos Hub has complete visibility into the outcomes of the Stargate process. It should always be each validator's responsibility to decide what software they will run, and nothing in this proposal should be construed to undermine that responsibility.

Alternatives to Stargate



Given the risks and complexity of Stargate, it is reasonable for the Cosmos Hub to ask “Is there a plausible alternative to Stargate?”

Our assessment is that all plausible alternatives to Stargate have unacceptable costs and would delay IBC to an unacceptable degree.

The root cause of the requirement for the Stargate process is the cumulative effects of a well-structured and robust engineering process, the technical judgment of the active contributors to the Cosmos Hub, and feedback from current community members towards the best possible software for the Cosmos network.

The cumulative effects of this approach is that the Stargate changes are interwoven and interdependent to a large degree. One of the biggest components of this interdependency is that we want to enable systems other than the Cosmos SDK to interact with IBC 1.0, and we don't want to force these systems to implement the legacy amino serialization system. We also don't want to impose the burden of mixing the legacy amino serialization system and the next protobuf system in any released version.

We have considered breaking of cryptographic key custody systems to be of highest consequence and so are supporting what is expected to be as close as possible to compatible systems for signatures. For other interfaces, our analysis is that maintaining two interfaces posed an unacceptable increase in complexity.

We have also considered and rejected that idea of launching a beta mainnet with Stargate while the Cosmos Hub continues on the launchpad release as too complex and confusing.

Given these considerations, we believe that the decision to do Stargate in the proposed manner represents that best way to translate the work of the engineering teams into a fully realized mainnet.

The core technical discussion behind Stargate can be found in a range of Github issues, Discord discussion, and tweets, but are summarized best in the following Architecture Decision Records:

[Cosmos SDK ADR 19 Protocol Buffer State Encoding](#)

[Cosmos SDK ADR 20 Protocol Buffer Transaction Encoding](#)

[Cosmos SDK ADR 21 Protocol Buffer Query Encoding](#)

[Tendermint ADR 55 Protobuf Design](#)

[Tendermint ADR 42 State Sync](#)