

Shardeum Due Diligence Report V2

April 2022



A Message From The Founders

We founded Shardeum because we believe the world will be more equitable, open and healthy if it is decentralized. Shardeum is taking an open, collaborative and community-driven approach to build an ecosystem that will change the world. In our minds we envision a world where you and I have more power and control over our lives, rather than being restricted and influenced by powerful centralized entities. We envision autonomous services operating on decentralized rails. To decentralize the world a smart contract platform must exist that can scale linearly to always deliver stable low gas fees and immediate finality while remaining decentralized. We're confident the technology to achieve this lies in the hands of the Shardeum community. Our team has been on this journey since 2017, and we're excited by the opportunity to partner with you at such an important inflection point. Together, we can achieve decentralization for everyone.

Thank you very much,



Nischal Shetty



Omar Syed

Document Request

- **Org Chart**
 - Nischal Shetty, Co-Founder, Business
 - Marketing: 7 Team Members
 - Omar Syed, Co-Founder, Tech
 - Developers: 7 Team Members
- **Product roadmap & prioritization document with timelines**
 - **Q1 2022**
 - Shardeum Foundation set up in Switzerland
 - Shardeum MVP Demonstrated
 - GitHub Setup
 - Litpaper Published
 - Internal Security Audit
 - **Q2 2022**
 - Private Sale
 - External Security Audit
 - Alphanet Phase 1
 - Send Transactions
 - Deploy Smart Contracts
 - 30 node unsharded network operated by Shardeum. 20 validator nodes, 10 standby nodes and 5 archive nodes.
 - Rotation of Standby and Validator Nodes
 - Faucet to Distribute SHM
 - Alphanet Phase 2
 - 120 node sharded network operated by Shardeum. 100 validator nodes and 20 standby nodes. 5 archive nodes.
 - Shard size of 20 nodes. Only support EIP2930 transactions.
 - **Q3 2022**
 - Bug Bounty
 - Betanet Phase 1
 - Community Can Operate Nodes
 - 250 minimum node sharded network. Shard size of 50 nodes. Supports non-EIP2930 transactions. 10 archive nodes.
 - Betanet Phase 2
 - 1280 minimum node sharded network. Shard size of 128 nodes.
 - Aiming for 200 TPS.
 - **Q4 2022**
 - Shardeum Mainnet Launch
 - SHM Issued

- **List of all your Github repositories that are active and in-use for your product today**

The Shardeum repos are not publicly available yet. They will be available in Q3 2022 when Shardeum goes to betanet. Some Shardus repos are available on GitLab, but the repos for the core Shardus software are not publicly available yet. They will be available in Q3 2022 with the launch of the betanet. The Shardeum Website repo which is being built by the Shardeum community can be found here.

<https://github.com/Shardeum/shardeum-website>

Team

- **Detailed team bios, number of full time team members and full time engineers**

Nischal Shetty, Co-Founder

Nischal Shetty is a Co-Founder of Shardeum, a decentralized, Layer 1 smart contract platform. He is also the Founder, CEO of WazirX, India's largest crypto exchange with over 10 Million users. Nischal is a well-known entrepreneur with over a decade of experience building and scaling global products out of India. A software engineer by education, he has also founded Crowdfire, a social media management product with over 20 Million users in the past. Nischal has also been featured in Forbes '30 under 30' list previously. A passionate blockchain evangelist, he has been active in the Indian crypto space since its inception. Nischal's mission has been to make crypto accessible to every Indian; he's also been advocating positive crypto regulation in India with his Twitter campaign #IndiaWantsCrypto for over 1000 days.

Omar Syed, Co-Founder

Omar Syed is a Co-Founder of Shardeum and Inventor of Shardus. Omar has 30 years of work experience building scalable distributed systems at organizations such as NASA, Yahoo, Raytheon and Zynga. Omar obtained his B.S. in Computer Engineering and M.S. in Electronic Engineering from Case Western Reserve University. At Yahoo, Omar rearchited a scalable cryptographic video streaming system which Yahoo was granted two patents for. Omar founded Arimaa in 2005 which hosted the Arimaa Competition where AI developers built bots to compete with humans in the board game for a \$10,000 prize. The Arimaa competition was sponsored by SpaceX in 2005 and it took 10 years for a bot to win. Research papers have been written about Arimaa by students at universities such as Stanford and Harvard. Omar founded Shardus in 2017 to build software developers can use to create linearly scalable blockchains. Omar's goal is to solve universal poverty and hunger with global basic income.

There are currently 14 individuals distributed globally in the USA, India and Myanmar working on Shardeum. However, the Shardeum Foundation is not yet incorporated; therefore no employee agreements have been signed.

- **The Lightpaper mentions Shardeum providing additional staff to Shardus to accelerate the development timeline. How many developers do you plan to dedicate to that effort and for how long? What is the cost?**

Shardeum plans to have multiple smaller teams within the tech development team. Such as a team for the validator, archiver, explorer, bridges, tools, etc. The number of developers on each subteam would be about 5 to 10. The total team will be about 30 to 40 with 5 to 10 focusing on Shardus. The pay rate would be comparable to industry standard.

Market

- **TAM analysis for the targeted market segments**

Ethereum's total market capitalization is currently \$406,921,672,280 with 191,876,059 unique addresses equating to \$2,120 per address. There are 622,000,000 people with internet access in India and 307,000,000 people with internet access in the US. This equates to a \$1,969,480,000,000 total addressable market in the US and India alone.

The crypto ecosystem is poised to grow from 300M to 1B people in the next 3 years. A large portion of this growth will come from emerging markets such as India, Brazil, Vietnam, Nigeria, Venezuela, Thailand and Turkey. For users in these countries, low gas fees are a must.

Considering Shardeum's strong presence in the Indian market, Shardeum intends to onboard 25M+ users from India by providing a truly decentralized, linearly scalable and low fee blockchain. Similarly, Shardeum will work on ensuring it captures the bulk of new users onboarding to crypto in other emerging markets. At the same time, Shardeum will invest in efforts to attract Ethereum developers to build on its EVM-compatible smart contract platform that will keep fees low even as usage grows; ensuring that developers do not have to move again in the future.

Product and Technology Roadmap

- **Provide technology stack documentation**

This can be found at <https://docs.shardus.com/>

- **Product architecture overview**

This is not publicly available yet, as Shardus is in the process of filing patents on some key innovations introduced in Shardus.

- **Flowcharts (how data flows from on-chain to off-chain and vice versa)**

Transactions are submitted through an RPC server which forwards them to the network of validators for processing. Explorer servers collect the transaction data from the network and make it available through APIs and web interfaces.

- **Links to APIs**

There are APIs for the RPC servers and explorers. These APIs are exactly the same as the APIs provided by Ethereum ecosystem RPC services and explorers. These are not created or documented by Shardeum, but rather by the Ethereum community.

- **Access for us to conduct product demo**

The ability to run a local Shardeum network will be possible after the betanet launch in Q3 2022. Until then, one can follow the instructions for running a local Shardus network provided at <https://docs.shardus.com/>.

- **Access to block explorer**

Not launched yet.

- **Node Hardware Requirements**

- **What are the minimum hardware requirements to run a node?**

Shardeum plans for validator nodes to not exceed a cost of \$50/month. In this budget one can obtain a decent dedicated server with at least 4 cores and 8 GB of memory. The archiver servers are expected to cost about \$1000 per month and have much more resources than validator nodes. The exact specs will be determined after some testing with the Shardeum Alphanet.

- **What AWS machine types did you use for each node instance in your test network**

T3.mediums which had 2 CPUs and 4 GB of RAM.

- **What is the current bottleneck in your node – CPU, Disk, or Network?**

Bottlenecks change as Shardeum identifies current bottlenecks and improves its software to overcome them. Also since the system is designed to scale up by just adding more nodes it is hard to determine a hardware bottleneck. Shardeum believes it can reach 10k or 100k nodes before an algorithmic bottleneck is reached.

- **Please provide a high-level overview of how your consensus mechanism works.**

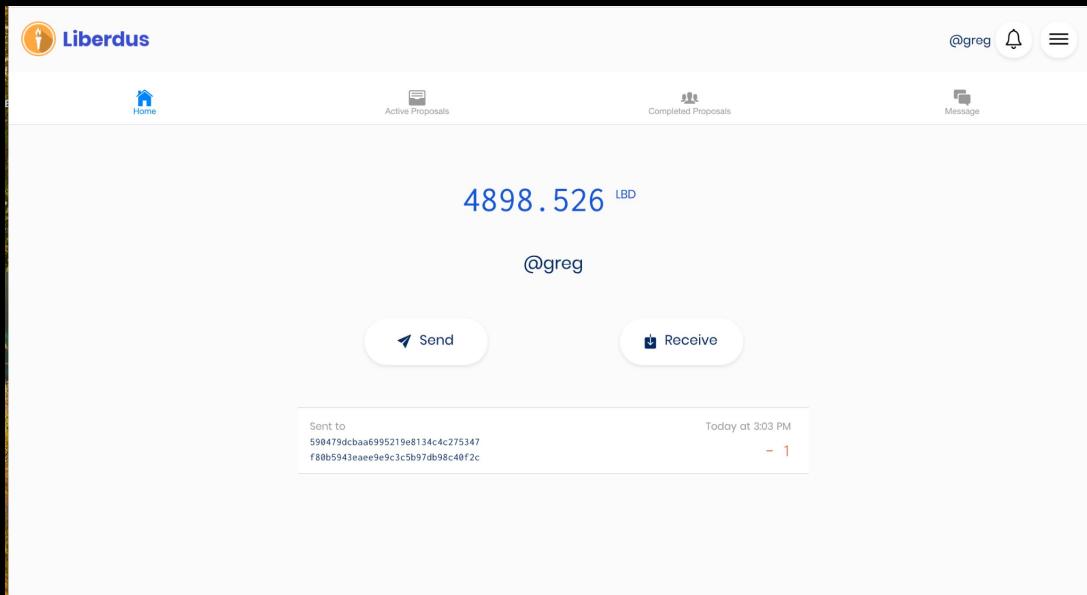
Proof of Quorum simply means to generate a receipt showing that a majority of the consensus group have voted for the transaction. Each node in the consensus group signs the transaction hash and gossips it to other nodes in the consensus group. Nodes collect these votes and when the number of votes is more than 50%, these votes form a receipt that can prove consensus on the transaction. There will be a fixed amount of SHM that will need to be staked (and could be slashed for misbehaving) to become a validator.

- **Can you confirm that you are building a framework that allows anyone else to create blockchains (like Substrate) and Shardeum is the first instance of such a network (like Polkadot is for Substrate)?**

We, the Shardeum Foundation, are building Shardeum. Shardeum is the first smart contract platform built using the Shardus framework. It is important to note that Shardus is a separate entity organized as an association of contributors, and Shardeum does not own the Shardus IP. Shardeum has a perpetual license of the Shardus software to ensure continuity of the project.

- **What is the status of the Liberdus Payment Network built on Shardus and what is the relationship of that to Shardeum, if any?**

A Liberdus test net was live for several months in 2020 to demonstrate an application of Shardus to the public. Progress has come to a halt on Liberdus as the project achieved its mission of showing the public that Shardus can be used to build decentralized applications. There is no relationship between Liberdus and Shardeum.



Detailed Technical Questions

- **Opine on the differentiation between Shardeum's approach to scalability vs Dfinity's and vs Avalanche's approach with subnets**

Avalanche is similar to Ethereum but with PoS and using the snowball consensus algorithm. The TPS for the network is the same as the TPS for a single node. It scales by using more powerful nodes and does not use sharding for scaling.

Dfinity which is now called The Internet Computer uses a PBFT like consensus algorithm. Again the TPS of the network is the same as the TPS for a single node. It also scales by using more powerful nodes and does not use sharding to scale.

- **Does Shardeum shard all three of the following: compute, data, and network?**

Yes, Shardeum mitigates blockchain's compute IO, disk IO and network IO bottlenecks by sharding transactions, sharding state data and sharding the network. The Shardeum network is partitioned into dynamic chunks of addresses and each validator node is only responsible for validating transactions for the addresses it's assigned to, gossiping transactions to validator nodes within its shard and storing the state of the addresses it's assigned to.

- **Shardeum's Litpaper says "...Shardeum does consensus on each transaction separately. This allows a transaction that affects multiple shards to be processed simultaneously by these shards rather than**

consecutively as with block level consensus." -- can you elaborate on the overhead required to perform consensus on a per-transaction level, and how that is coordinated simultaneously in a cross-shard manner?

There is s^2 (where s is the shard size) more network overhead when consensus is performed on each transaction since the nodes in the consensus group validate the transaction and gossip their vote to other nodes in the consensus group. As the overall network size gets larger and there are more shards, the overhead becomes worthwhile since the shard size does not grow. Also if there are N transactions to be processed and a block can hold B transactions the cost of block level consensus is N/B whereas the cost for transaction level consensus is N . In terms of order of complexity both are $O(N)$, but the scale factor B can be significant and provide a lower slope to the line. We cannot go into too much detail of how consensus is done when the transaction spans multiple shards as this is an innovation that is being patented. We can say that nodes in multiple shards join together to form a consensus group to process the transaction. The important result is that atomic processing of the transaction is achieved without introducing any complexities.

- **What are some of the toughest technical challenges that Shardeum is solving to achieve their solution? Please feel free to be as technical as needed.**

One of the biggest problems with sharding a blockchain is the difficulty of maintaining atomicity of the transaction across shards since each shard had its own chain and a transaction could be approved in one chain and not in another. Transaction level consensus ensures atomic processing of transactions.

Achieving linear scaling such that each node added to the network increases TPS right away is a difficult problem to solve. Shardeum has been able to achieve this by implementing dynamic state sharding.

Keeping nodes synchronized in a dynamically sharded network is also very difficult. Shardeum has come up with many clever algorithms at the protocol level to achieve this. The protocol layer used within Shardeum has been in development for over 4 years by the Shardus project. These innovations are being patented by Shardus.

Another big problem is maintaining a high level of decentralization while increasing the TPS. Solutions that use vertical scaling lose decentralization while increasing TPS, but sharding actually increases decentralization while increasing TPS.

- **How do you handle situations where a transaction succeeds on one shard but fails on another shard and then you need to perform a rollback? What**

are the performance implications of too many rollbacks?

Since a receipt is generated showing more than 50% of the nodes in the consensus group approved the transaction, there is no possibility of rollback. There is immediate finality, unlike a blockchain where a confirmation is probabilistic.

- **Is your network susceptible to the following DoS attack: Keep submitting transactions that touch every single shard in the network in the same transaction -- this will ensure that each transaction is "expensive" for the network to process and will slow down every single shard and require most transactions in the network to be processed serially. This will eliminate most of the benefits of parallel processing in the network made possible by sharding. What are your thoughts on this technical challenge and can it be overcome?**

This is a possibility, but it can be eliminated by limiting the number of shards a transaction can touch to say 10. Also there can be exponentially higher fees for involving more than 3 shards. Most real transactions only touch 1 or 2 shards.

- **Is your gas fee proportional to the number of shards touched in a given transaction?**

Shardeum has not finalized what the gas fees will be; such topics are being discussed with the community. Yes, it would be possible to have the fees increase with more shards that a transaction involves.

- **Is dynamic sharding a specific case of static sharding where shard size is set to 1 (with redundancy of course)? If you can please elaborate a bit more about the differences between this special case and dynamic sharding then that would be great!**

One is not a subset of the other. The Shardus team can't go into too much detail here as they're in the process of filing a patent on this. Here's a hint: in static sharding groups of nodes cover the same range of addresses; in dynamic sharding different nodes cover different address ranges but ensure there is enough overlap so that any one address has a shard size number of nodes covering it.

- **How much does your network slow down when running cross-shard smart contracts instead of the simpler payment transactions?**

Most of the slow down comes from running the transaction through the EVM and not due to the transaction touching multiple shards. There is about a 5x to 10x slow down with

running transactions through the EVM.

- **Litpaper mentions archive nodes**

- **How do you plan to balance the token incentives for running an archive / validator / sandby node such that you have the right proportion of archive nodes and enough validator / standby nodes?**

Shardeum is still in the process of discussing what the node rewards should be with its community and what portion should go to archive nodes vs validator nodes. If a simple cost is used to cover the hardware, archive servers are expected to cost about 10x more than a validator node. Based on this the archive node would receive 10x what a validator receives.

- **What is your target % of archive nodes that you want to aim for?**

The current guess is about 1 archiver for every 100 validators with a minimum of 5 and maximum of 100. This is still under discussion with the community. Shardeum may also need some experience with testnets to make a better decision on this.

- **Litpaper mentions the catch-up process is quick because of the archive nodes:**

- **How does the catch-up process work?**

Archive servers hold the transaction history and the validator nodes only have to hold the current state. Thus syncing is much faster because the validators do not need to download all the historical data.

- **Do you have a diagram that explains this?**

Shardeum doesn't have a diagram for this at present. There are internal docs that describe the process. However, these docs are not publicly available yet.

- **Do nodes need to sync up with archive nodes and validate the full state of the chain history or is there a way where they can do a fast catchup without having to re-validate the full chain history?**

The nodes do not have to validate the full history. More and more networks are moving away from this approach. In a sharded network it would be impossible to do that since one of the assumptions is that the TPS rate of the network is higher than what a single node can process. Thus, a node is only catching up on the current state and even that is limited to the subset of the address range covered

by the node.

- **If there is a fast catchup approach that doesn't require validating the full history, how can you prove that the initial state that the new node is syncing to is valid?**

The syncing validator nodes are able to download partition state hashes with a provable receipt from the archive nodes and based on this they can quickly download the state data for the partitions they cover from other already synced nodes. They cannot be lied to by the other nodes since they have a hash of what the data should be.

Tokenomics

- **How did you arrive at the 11% allocation for the Foundation vs. 5% for the Ecosystem?**

This distribution is large enough to help the foundation grow the Shardeum ecosystem. Shardeum analyzed all the existing L1 distributions, and took into consideration its objective to ensure there's no concentration of SHM into the hands of a few in order to arrive at these figures.

- **What will the 11% of the allocation for the Foundation be used for?**

The Foundation Fund is used for two purposes. First, reserves are kept for unforeseen future needs of the project and second for ecosystem development investments as needed. Based on market analysis Shardeum has determined 5% will suffice for ecosystem development. However, to ensure that opportunities aren't missed due to a lack of funds, Shardeum has a foundation reserve that can be used at any time. In addition, 10% of funds raised will be allocated to business development to help with the ecosystem effort.

- **Token allocation of 5% for ecosystem development looks small, could you elaborate on how you plan to develop the ecosystem?**

SHM is deflationary and will accrue in value over time. Based on Shardeum's valuation, Nischal's ability to generate organic growth and market analysis, Shardeum believes 5% is adequate for ecosystem development. If more funds are needed to invest in the ecosystem, Shardeum will pull from the foundation reserves. See "GTM" section to learn more about how we will develop the ecosystem.

- **How did you arrive at the 2 year vest? How will the team be incentivized for a longer period to continue Shardeum development?**

The 2 year vesting period with a 3 month cliff was determined based on market analysis and investor advice. Shardeum's analysis found that a two year period is the best viable option for a vesting schedule.

The team will be incentivized to continue to increase the value of assets they've earned and to continue to earn a paycheck. In the web 2 world many people are only compensated with a paycheck and some get stock options. Now, they can earn SHM for 2 years in addition to a paycheck and then remain in a great culture where they can generate greater value for the SHM they've earned.

GTM

- **Overview of the GTM strategy, with prioritization for market segments, strategies and tactics**

Shardeum's GTM strategy will revolve around its mission, "Decentralization for everyone.". The strategy will focus on building a global ecosystem of developers and users who don't want to be limited by a TPS bottleneck. Shardeum's technical capabilities to scale linearly while maintaining true decentralization will allow the ecosystem to snowball into the decentralized world we all dream of. To achieve this, Shardeum's GTM strategy will emphasize product, positioning and place.

- **Product**

- **EVM-Compatible**

Shardeum will target the existing Ethereum ecosystem and benefit from network effects. Marketing efforts will focus on enticing Ethereum users to continue using the EVM applications they like with forever stable low gas fees and fast transaction times on Shardeum. Shardeum will target Ethereum developers who seek scalability to port their applications to Shardeum where they will never have to worry about losing users again due to rising gas fees and variable transaction times caused by scalability bottlenecks.

- **Low Gas Fees and Fast Transaction Times**

Making stable low gas fees and fast transaction times a constant is what decentralized applications need to offer a UX that's up to par with centralized competitors. Shardeum's messaging will emphasize its ability to always offer stable low gas fees and fast transaction times.

- **Low Barriers to Entry for Node Operators**

Shardeum aims for nodes to be run using a 4GB RAM setup. The hardware required to operate a Shardeum validator node will be low cost, enabling the network to be truly decentralized. Shardeum's GTM strategy will promote Shardeum's high level of decentralization and the ability for anyone to operate a node. The Shardeum community will grow to hundreds of thousands of node operators who will be a force in scaling the Shardeum ecosystem.

- **Positioning**

- **The Premier L1**

Shardeum positions itself as the premier L1 by being the only dynamically state-sharded smart contract platform to offer true linear scalability and decentralization. Humanity seeks the best experiences and users/developers will gravitate to Shardeum to experience the best UX a smart contract platform can offer.

- **Most Developer and User Friendly**

Shardeum will reduce barriers to entry to onboard developers and users by being the most developer and user friendly L1. Developers can easily port EVM applications to the Shardeum network, write smart contracts in Solidity/Vyper and continue using the same tooling. Users will have the same interface experiences they're accustomed to with stable low gas fees and immediate finality.

- **Only L1 to Offer Sustainably Low Gas Fees and Decentralization**

Shardeum is the first and only smart contract platform that offers low gas fees even when network usage grows while maintaining true decentralization. Users and developers will gravitate to Shardeum due to the promise of a decentralized network with stable low gas fees and fast transaction times.

- **India's First L1**

CoinDesk recently referred to Shardeum Co-Founder, Nischal Shetty, as "Perhaps the most prominent face in crypto in India.". Shardeum will position itself as the first mainstream L1 in India and win a majority market share in the world's largest democracy.

- **Place**

Globalization is important to Shardeum and it plans to be adopted in all regions of the planet that have internet access and regulations that allow the usage of cryptocurrency. Shardeum will target the USA and India and quickly expand to other markets. Shardeum will be listed on major exchanges that are accessible in all six continents to ensure global distribution of SHM. The Shardeum Foundation is led by experienced marketing executives who will use marketing tactics such

as pay per click marketing, content marketing, social media marketing, event marketing, paid media marketing, SEO, PR, affiliate marketing and partner marketing. Shardeum will measure KPI's in each market and scale investment in channels with the best performance to optimize ROI.

■ **United States**

The USA is the second largest democracy in the world, has the highest GDP in the world, is home to leading academic institutions and its currency is the world's reserve currency. As a world leader Shardeum believes it's imperative to be the leading L1 in America. Shardeum will heavily invest in PR in America, partner with American organizations, fund American startups building on Shardeum, attend most major conferences in the US, partner with student organizations at American universities, partner with American influencers and target the US with digital marketing tactics.

■ **India**

India is the largest democracy in the world with a population of 1.38 billion. No mainstream L1 has been founded in India. CoinDesk recently referred to Shardeum Co-Founder, Nischal Shetty, as "Perhaps the most prominent face in crypto in India.". There is a major opportunity for Shardeum to lead the L1 market in India and be the first mainstream L1 to come out of the country. Shardeum will rapidly scale a marketing campaign in India including organizing meetups, hosting conferences, partnering with leading organizations, investing in PR campaigns, partnering with Indian universities and funding Indian startups building on Shardeum.

■ **Other**

Shardeum is not limiting itself to the US and India. While Shardeum believes the US and India are important markets to win it will also target other markets such as Canada, Mexico, Brazil, Vietnam, Nigeria, Venezuela and all markets that allow the use of cryptocurrency. In saturated markets Shardeum's GTM strategy will focus on acquiring the developers of popular dapps who seek stable low gas fees and fast transactions. In emerging markets where blockchain is primarily currently used for gaming and P2P transfers Shardeum will focus on acquiring a strong native ecosystem of developers and users due to low transaction fees and immediate finality.

Partnerships

- **What is the nature of the relationship between Shardeum and Shardus? How do you plan to share resources and ownership over joint**

development, IP?

Shardeum is given an irrevocable, perpetual license to use the Shardus software and future versions of the software in a commercial product. Permissionless blockchains license Shardus by distributing 1% of their network's coin to Shardus (ULT) holders. Shardeum has licensed Shardus and will be distributing 1% of SHM amongst ULT holders. As Shardeum's protocol layer is built using Shardus the Shardeum Foundation will contribute to Shardus improvements. Shardeum does not intend to hold any IP other than copyrights and trademarks to its name and logos which will be held by the foundation in a defensive way to ensure others cannot stop Shardeum from using it.

Community

- **Links to all your social and community channels (twitter, discord, slack, telegram, etc)**

[Twitter](#), [Discord](#), [Telegram](#), [LinkedIn](#), [YouTube](#), [Reddit](#)

- **What has been the community's growth over the past year?**

Shardeum was publicly announced on February 2nd, 2022. As of March 24th, 2022 Shardeum currently has 8,552 Twitter Followers, 3,648 Telegram Subscribers, 4,646 Discord Members, 364 LinkedIn Followers, 495 YouTube Subscribers and 93 Reddit Members. In total Shardeum has amassed 17,618 organic community members across all channels with \$0 in ad spend within 50 days of launch.

- **How do you engage with and grow your developer community? Hackathons, etc?**

Developers want to build on a smart contract platform that can scale and constantly deliver low gas fees and fast transaction times so they don't have to concern losing their community when throughput capacities are reached. Shardeum will invest in tactics such as:

- Fund grants for developers building with Shardeum
- Host demonstrations with student organizations at universities worldwide
- Weekly open developer community calls
- Sponsor hackathons and major conferences
- Direct outreach to founders of popular decentralized applications
- Global ambassador program and meetups
- Partner with academia
- Partner with non-competing ecosystem partners and tap into their audience

- Utilize gamification with SHM rewards for various competitions
- Digital marketing and media campaigns
- Influencer marketing with industry leaders as spokespersons and ambassadors
- Partner ventures, MVP and partner support
- WOM creation through organic and paid PR

Competition

- In-depth competitive market overview, including Solana, Algorand, Dfinity, Avalanche whose TPS and cost at scale are on par with Shardeum

The networks mentioned in this question aren't sharded and will reach a TPS limit where they can't scale further. Shardeum has conducted a comparison of sharded L1's which can be reviewed in the [Shardeum Litepaper](#).

Financials

- Projections/Token economics model
 - 51% Community - Lockup period of 15-30 years for node rewards
 - 18% Sale - 3 month cliff then 2 years linear vesting
 - 15% Team - 3 month cliff then 2 years linear vesting
 - 11% Foundation - unlocked at Token Generation Event (TGE)
 - 5% Ecosystem - unlocked at TGE

Fundraising

- Detailed use of proceeds
 - 35% Marketing
 - 30% Product, Tech & Design
 - 10% Ecosystem/Bus Dev
 - 10% Operations
 - 10% HR, Finance, Legal
 - 5% Research

Round 2 Questions

Document Request

- **Technology Licensing Agreement Between Shardus and Shardeum**

The guidelines for how the Shardus token licensing works is provided here:
<https://github.com/Shardus/shardus.github.io/wiki/Shardus-Token>

The actual license file can be found here:
<https://shardus.com/license/>

- **Org Chart With LinkedIn Profiles**

- Omar Syed - Tech
 - Andrew Foster
 - J Mohamed Zahoor
 - Aamir Syed
 - Thant Sin Toe
 - Jai Raj Rana Magar
 - Sameer Siddiqi
 - Kaung Myat Thu
 - Ahmed Iqbal
- Nischal Shetty - Business
 - Shahzad Nathani
 - H Swaminathan
 - Gregory Hemmer
 - Ramprasad Vinayagamoorthy
 - Priyanka Sharma
 - Chandresh Jain
 - Subbiah Alagappan

- **1-3 Year Projection Model**

A projection model is not prepared at this time.

- **12-24 Month Budget**

- 12 Months - \$ 12M
 - \$ 4.2M - Marketing
 - \$ 3.6M - Product, tech & design
 - \$ 1.2M - Ecosystem/Business Dev
 - \$ 600K - Research

- \$ 2.4M - HR/Finance/Legal/Operations

Team

- **Do you have community and ecosystem expertise on your team, can you please share the bio for this person/team?**
 - Nischal Shetty, Co-Founder & Committer at Shardeum
 - Founder, WazirX (10M Users, \$45B Vol.)
 - Founder, Crowdfire (20M Users)
 - Forbes 30 Under 30
 - 1000+ days of #IndiaWantsCrypto Twitter campaign advocating for regulations
 - 15+ years of work experience
 - Priyanka Sharma - Committer
 - Senior Manager Marketing & Communications, WazirX
 - Helped build and scale WazirX social media community
 - Twitter - 582.7K, Telegram - 246K, Instagram - 97.1K, YouTube - 67.3K, Facebook - 41K, LinkedIn - 27.6K, Reddit - 3.5K
- **Near term hiring plans**

25 developers within 6 months. VP People, VP Public Relations, VP Finance, VP Content

- **List of advisors and their contractual relationships**

Shardeum has no advisors at this time and has not yet actively pursued advisors.

- **Active candidates for active open positions**

Shardeum doesn't have a list of active candidates or advertised open positions. Hiring will begin once the seed round is complete.

Product and Technology

- **Product architecture overview (if provisionals have been filed hopefully you will be ok sharing this without an NDA)**

Diagrams have been included near the end of this document displaying the overall Shardeum network architecture in addition to the components inside a Shardeum validator node. Shardeum cannot yet provide more info within Shardus as provisional patent applications are currently being prepared. Once the patents are filed added

details can be shared without requiring an NDA.

- **What is your approach to testing software?**

Shardus/Shardeum have some unit tests and a CI environment setup to run PR submissions through linters and some unit tests. However, there is still a lot that requires spinning up a network and putting it through smoke tests. Also some tests need to be run manually and others need to be run for a long period of time and are difficult to automate.

- **What percentage of code is unit tested?**

Functions which can be tested in a standalone environment are all covered. However there are many parts of the code where it is impossible to test in isolation. A lot of coverage comes out of Shardus' various semi automatic functional/smoke test tools. During development Shardeum/Shardus also runs the nodes in DEBUG mode which provides lots of logs and reports from the nodes and helps to trace down hard to reproduce failures.

- **How do engineers split their time between writing new code and ensuring there is not too much technical debt (i.e. investing in QA, fixing bugs)**

The team currently goes through iterations of adding new features and then focuses on testing, debugging and fixing the code to ensure the features are working. It would be nice to have a larger team where there are more resources dedicated to Q&A.

- **How does your current architecture affect transaction fees?**

There are many features that are designed to help sustain low fees.

- **PoQ consensus** - A very simple and cheap (in terms of compute cost) consensus algorithm
- **Lightweight consensus nodes** - Consensus nodes off load history to archiver nodes allows them to be lightweight with low resource requirements leading to lower operating costs.
- **Optimized network size** - There is no need to have 10,000 nodes when the network usage is only 10 TPS; once there is sufficient redundancy and sufficient nodes to handle the load additional nodes add cost without adding much benefit. Shardeum is able to detect the load and intelligently autoscale while ensuring sufficient redundancy so that the network size is optimized; this leads to less fees paid to consensus nodes and translates to lower transaction fees.
- **Sharding** - Allows the ability to increase the network capacity just by adding more nodes. Networks which are not able to increase the capacity will become saturated if they become popular and usage approaches capacity. This leads to

bidding on transaction fees. By increasing the capacity our network is able to keep fees low.

- **Why have any standby nodes at all? i.e. why autoscale down? If you have extra nodes in the network then the load can be evenly distributed between all nodes? Or will that cause too much of an overhead in terms of rebalancing shards?**

The main reason for attracting standby nodes is because they help increase the level of decentralization and help to increase the security of the network.

The reason Shardeum scales down the network is to help keep the network operation costs low as this will lead to lower transaction fees.

Unlike static sharding where there is a huge amount of rebalancing when merging and splitting shards, dynamic sharding has a very small amount of rebalancing but happens when nodes are added or removed.

- **Can you please provide a screenshot of the test coverage report for your Shardus codebase?**

See the screenshots near the bottom of this document.

- **Can you please provide a screenshot of the Shardus contributors page in GitHub (we are looking to see how distributed the codebase development is)**

Shardus uses GitLab (switched to support an alternative when Microsoft acquired GitHub) and it does not have a similar page. The closest thing is a members page which you may access here: https://gitlab.com/groups/shardus/-/group_members. Besides the tech team members listed above and past members of the team there are no outside contributors; yet.

- **Can you share a few code files that are non-proprietary so we can get an understanding of code quality for Shardus?**

There are several repos within Shardus which are open for viewing and should provide sufficient examples of our code: <https://gitlab.com/shardus>

Product Demo

- **Live product demo (we can run a node, but would prefer to see a demo from an engineer who understands the totality of your system and can show off the features you have built to date)**

Please join the prelaunch public demo of Shardeum Alphanet on Monday April 11th at 11 AM CT. After each quarter Shardus does a public demo of some of the features built during the prior quarter. The event videos are posted on the Shardus YouTube channel.

Please watch recordings of a Shardus [linear scaling demo here](#), reaching [5k TPS with 1k nodes here](#) and the first [demonstration of Shardeum here](#).

The Shardeum team is happy to schedule a private demo for you to further discuss if needed.

Fundraising

- **List of committed investors and amounts for current round**

Participants of the round will not be disclosed until the foundation is formed and funds have been received from said participants.

Tokenomics

- **Token Launch documentation**

Token launch documentation is not prepared at this time.

- **Token lockup details - what percentage of tokens do investors get at TGE? Please confirm vesting schedule**

Investors receive 0% of tokens at TGE. Upon TGE a 90-day cliff begins. On day 91 investors begin receiving SHM on a daily linear vesting schedule over a 2 year period. This schedule also applies to the team allocation.

Note that the word token is used here to refer to the Shardeum network native coin used to pay transaction fees called Shard with the symbol SHM.

Token Use Case and Utility

- **Describe in detail token architecture, use case and utility**
 - Shardeum has a fixed supply of 508 million Shard (SHM) with 51% allocated for node mining rewards over the next 15 to 30 years
 - Used to pay transaction fees
 - Staked by validators to run the node; can be slashed
 - Earned by nodes for contributing resources to the network
 - Used to grow the ecosystem of developers on Shardeum
 - Incentivise community contributions to Shardeum

- **Please describe Inflationary/deflationary policy?**

Shard (SHM) is deflationary. There will be a total supply of 508,000,000 SHM. At TGE 51% of the token supply will be allocated to node mining further reducing the available supply to approximately 248,000,000 SHM. Within this, the amounts allocated to the team and sale are vested over 2 years with a 3 month cliff.

- **What is your plan for token liquidity? CEX? DEX?**

Shardeum plans to list SHM on popular CEX's in every market where cryptocurrency is legal in addition to listing on popular DEX's. As the CEO of WazirX Nischal is well networked with leading exchanges.

Shardeum plans to use a portion of funds raised to onboard a few market makers. Shardeum is open to raising some portion of the capital from potential market makers to add stronger incentives for them to help bring SHM liquidity in the market.

Shardeum plans to raise a portion of the capital from like minded exchange founders and exchange backed funds. While this would not guarantee a listing, it will help SHM in the long run to build more credibility amongst various exchanges.

- **Describe in detail the mechanism of how all ecosystem members are incentivized to participate in the token based economy?**

51% of SHM is reserved for node mining. Since the hardware requirements for running a Shardeum node would be low, a large number of people will participate and earn SHM.

5% of SHM (excluding 11% from foundation reserve) is specifically reserved for airdrops and application developers. Shardeum will incentivize existing protocols as well as new protocols to build on top of Shardeum and reward early developers with SHM.

Shardeum will organize a business development team to target institutions to build on

Shardeum, acquire SHM and remain invested in the ecosystem by adding SHM to their balance sheet.

- **How does the governance process work?**

The Shardeum Foundation in Switzerland shall serve as the operating entity for the orchestration, development and deployment of Shardeum, as well as for the issuance of the project token. As per Shardeum's OCC (open, community driven, collaborative) guidelines, the community can contribute ideas and suggestions in the governance and development of the Shardeum ecosystem through a DAO like community consulting body. The governance of Shardeum would eventually transition to a DAO later, with the foundation executing the DAO decisions.

- **How does the value accrue to the token?**

SHM is a fixed supply coin. This ensures it is deflationary and there is no dilution for token holders.

SHM is used primarily for transaction fees and for staking. Growth of the network helps increase these use cases which in turn helps accrue more value to the limited SHM available.

As the network TPS increases, SHM will be used in larger proportion to pay for gas fees. This increases the circulation velocity of SHM.

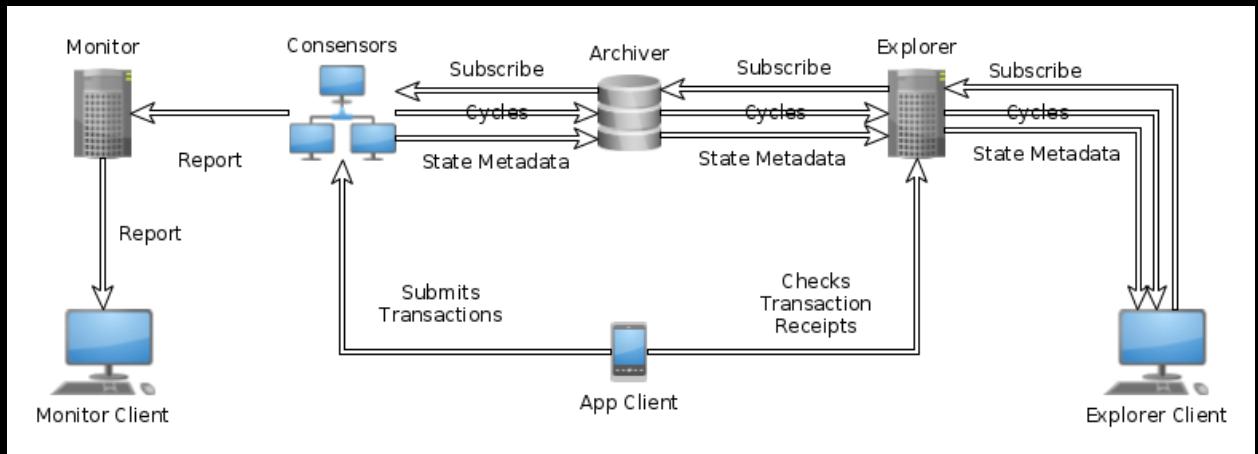
To support the increase in network TPS, more nodes will be needed. To run more nodes, miners will need more SHM. This reduces the circulating supply of SHM from the market.

SHM will most likely also be locked in dApp contracts to provide collateral for stable coins, liquidity for AMM and other DeFi uses. Thus increasing TVL on the Shardeum network will result in appreciation of SHM value.

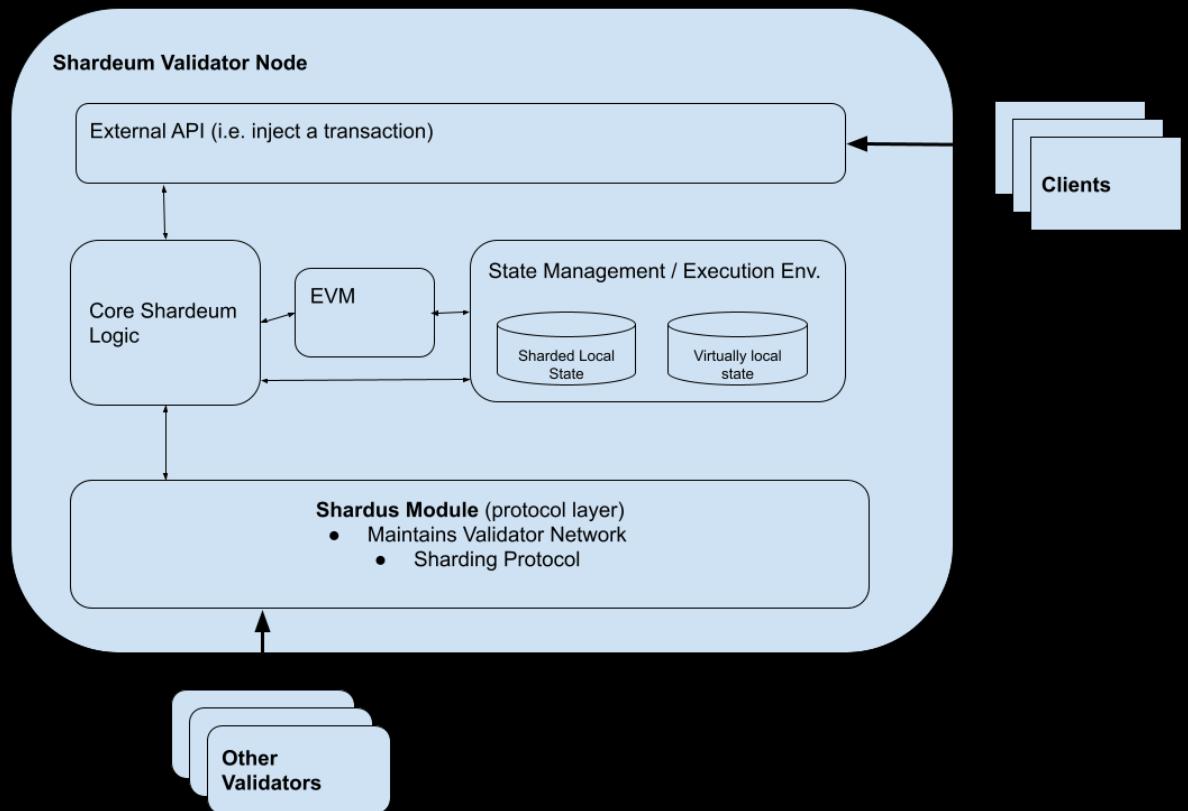
Documentation

- **Shardeum Architecture Overview**

(Consensors is another term Shardeum uses for validators)



- **Shardeum Validator Node**



- **Screenshots from Test Coverage Runs**

This is a test coverage report from jest lib inside shardus/core.

Example of a smoke test. Features checked: spin up the network, load test, data in-sync check and stop the network.

PASS test/main.test.ts (52.073 s)
Smoke Testing to the Shardeum Network
✓ Start a new network successfully (75 ms)
✓ Process txs at the rate of 2 txs per node/per second for 1 min (48700 ms)
✓ Data is correctly synced across the nodes (20 ms)

File	% Stmt	% Branch	% Funcs	% Lines	Uncovered Line #s
All files	64.28	33.33	85.71	66	
testUtils.ts	64.28	33.33	85.71	66	21,27,36-52,70-71

```
Test Suites: 1 passed, 1 total  
Tests:       3 passed, 3 total  
S snapshots: 0 total  
Time:        52.163 s, estimated 53 s  
Ran all test suites matching /test/|main.test.ts|.
```

- Shardeum/Shardus also has very cool network monitoring tools that are used to evaluate what is happening in a live network and identify failed nodes and other issues. This can be viewed in action in our quarterly demos below.

<https://youtu.be/yJPKpJz32mY?t=223>

<https://youtu.be/v9RtsTtfEp0?t=2481>

