Gitopia

Whitepaper

With the rapid growth of the decentralized ecosystem, there is an ever-increasing need for an open collaboration Platform.

This paper describes Gitopia's vision of a Decentralized Code Collaboration Platform and an ecosystem for developers.

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1. Introduction

Open Source Software has seen significant growth in the past few years. Almost every software we use today has some open source dependencies. Open source has revolutionized the software industry and has become a standard for software development.

A significant reason for the growth of open source today can be attributed to the emergence of Version Control Systems like git and Mercurial, and Code hosting platforms like GitHub and GitLab. These services have made collaboration between developers across the globe easier and more convenient.

The increasing popularity of git, and later, git hosting sites, incrementally reduced the barriers to participation in open source projects. With platforms like GitHub, no longer did potential contributors have to do things like hunt for the URL for the source code repository or work out how to generate a patch, and if necessary, subscribe to the right mailing list so that their patch email would get to the right people. Contributors can simply fork their copy of a repository with one click and issue a pull request from the appropriate branch when their changes are ready.

Code hosting platforms have empowered social coding and helped create global communities of developers. Sharing code freely and publicly has made it drastically cheaper and easier to build software, and tech innovation is surging as a result.

The code hosting platforms have become an invaluable education and business resource. Take the popular platform, GitHub, as an example. It is known to have the world's most

extensive collection of open source software. Beyond providing installers for countless applications, GitHub hosts the source code for millions of projects, meaning anyone can read the code used to create those applications. Also, because GitHub archives past versions of source code, it's possible to follow the development of a particular piece of software and see how it all came together. This has made it an irreplaceable teaching tool.

The popularity and benefits of the code hosting platforms have made them an integral part of software development. As a result, today's vast majority of open source development is done on popular code hosting platforms like GitHub and GitLab. The dependence on these platforms is worrying because they are centralized, and having open source development dependent on private companies' platforms is dangerous. It means that your code can become vulnerable depending on those companies' policies and needs. Centralized corporations are a problem for Open Source because it is against the fundamental core values of the open source movement.

There are several other problems with the conventional code hosting platforms, including:

- The monopoly of Centralized players
- Censorship
- Lack of community involvement in platform policymaking
- Lack of Transparency
- No incentive for users in platform growth
- Single Point of Failure
- No inherent open source incentivization
- Not tailored for Decentralized Ecosystem
- Lack of Collaboration Export

These problems are hurting open source development communities, so there's a need to reinvent open source development collaboration platforms.

Gitopia solves the shortcomings of existing platforms mentioned above, by providing a decentralized and developer-centric code hosting and collaboration platform that the users themselves govern.

Gitopia proposes a system that stores git repositories on a decentralized network, one that is highly accessible, censorship-resistant, and empowers communities to create, share ownership, contribute and govern their open source code.

Gitopia will reinvent open-source funding and make open-source software development sustainable. It will also incentivize open source contributors by creating a virtual and global economy around their work.

Gitopia's mission is to create a new paradigm for open source software development and decentralized collaboration where everyone is a stakeholder, innovators are rewarded, contributors are motivated, and users have power.

2. Terminology

- **Version Control System(VCS)** - Version Control Systems are process management systems that track and manage changes to a filesystem. Each change is maintained as a version, and users can track specific versions later

- **git** - git is a free, open source distributed version control system tool designed to track changes in computer files and coordinate work on those files among multiple people with speed and efficiency

- **GitHub** – Centralized Code Hosting and Collaboration Platform

- **Repository** - Collection of Source-code files/folders of various versions of a project

- **Commit** - An atomic update made to the Repository (view contains lines added and removed, also known as the diff)

- **Branch** - Separate development base

- **master/main** - This is the default branch on GitHub

- **Organization** - Companies/Individuals can form Organizations that contain multiple repositories in their view

- **Packfile** - git internally works with objects for commit, blob, etc. These objects exist in the user's system but transport of these objects might be expensive if the repo has many changes. Hence git compresses these objects into a single file known as a packfile. Packfiles are, in essence, multiple objects stored with an efficient delta compression scheme as a single compressed file

- **Pull Request** - If an individual wants to contribute to an open source project, the

flow on GitHub would be - Fork the Repository, Push changes to the forked repository, Create a Pull Request. The Pull Request is then assessed by the project maintainer and merged, or more changes are requested

- **Issues** - These are Bugs/Issues/Features/Enhancements filed/created/proposed by individuals or maintainers

- **Proposals** - Decentralized projects have to propose their improvements or features, or updates for a vote. Usually, only if the vote passes, the network acts on it

- **Destructuring** - Converting packfiles to objects

- **Lazy-Loading** - Loading objects as and when requested by the user

- **Clone** - Copying locally, usually with versioning, the source code of project/repository

- **TEE** - Trusted Execution Environment

- **Fork** - Copying the repository to a different user or organization while keeping the connection to be used for updating when the base repository updates

- **Remote** - Destination transport url for example git:// or gitopia://

- **TGE** - A Token Generation Event (TGE) is a business and technical act of limited duration that involves the technical generation of the token in a blockchain-based network, and its launch to the market

- **Validator** - A blockchain validator is someone who is responsible for verifying transactions on a blockchain. Once transactions are verified, they are added to the distributed ledger

3. Market Insights

The open-source software market has seen a big boom in recent years. More individuals, organizations, and companies are starting to realize the potential of open source and actively taking part in the open-source software movement. The open source software (OSS) movement has created some of our most important and widely used technologies, including operating systems, web browsers, and databases. Our world would not function, or at least not function as well, without open source software. **A 2008 study by The Standish Group[1] estimates that "free open source software is [saving consumers] $60 billion [per year in IT costs]."**

Code hosting and collaboration platforms have played a vital role in the growth of open source by bringing open source to the mainstream audience. These platforms create enormous communities which focus on developing and maintaining Open-source Software.

Developers from across the world use code collaboration platforms to connect, innovate and build software. In the past decade, around 60 million developers worldwide have used these platforms to create more than 300 million source code repositories. **GitHub, the leading player among these centralized platforms, is alone home to around 56 million developers worldwide and has more than 220 million git repositories on its servers[2]. In the last year alone, developers added 1.9 billion contributions and created 60 million new repositories on GitHub.**

Most of the popular open-source software projects today are developed and maintained on GitHub. While the big corporations have the necessary funding and resources, most open source projects are maintained by individuals in their spare time. However, it does require one's efforts, time and probably includes some overhead costs too. Monetary support undoubtedly helps drive the project development.

There are many different ways in which open source software projects get the required funding.

3.1 Corporates in open source software

By being an active part of OSS communities, either by paying developers to contribute to open-source projects or sponsoring events or project initiatives, companies directly invest in their employer branding and expose their brand to large developer communities in a targeted manner. The main drivers for corporates contributing to open source projects are -

- Selling complimentary services such as training, technical support, consultancy and certifications.
- Building greater innovative capability and being able to offer new products, better or faster than competitors.
- Development and maintenance cost reduction through open-sourcing to an external community.

Microsoft, Google, Intel, and Facebook — none of which are open-source companies — actively contribute to various open source projects on GitHub. **Microsoft employees were the most prolific GitHub contributors in 2018, with approximately 7,700 unique contributions (and 4,550 total contributors in 2017). Google employees were also active on GitHub, making 5,500 collective contributions in 2018.** Many of these contributions helped improve smaller, independent projects, though most of them supported Google's own open-source software projects like Kubernetes, Istio, and Knative[3].

Today, almost every major technology company, from Facebook to Google, is written on the backs of open source software. Increasingly, these companies are building their own open source projects as well – Airbnb, for example, has more than 30 open source projects, and Google more than 2000.

3.1.1 Open Source Service Market

Open source service is a type of software where source code is released by the copyright holders for users to utilize, study, and modify. The users can deliver the software to anyone on any Platform. Globally, open-source services help the firm achieve IT strategic goals, improve performance, productivity, and maximize its efficiency. The major factors

driving the open source services market are accessibility of the source code to all the firms, low cost than the proprietary solutions, and simple interoperability. The open source services ecosystem comprises vendors, such as Red Hat, Accenture, Wipro, IBM, Infosys, Cisco Systems, Atos, HCL , HPE, Oracle.

The Open Source Services Market was valued at USD 12.68 Billion in 2018 and is projected to reach USD 66.05 Billion by 2026, growing at a CAGR of 22.94% from 2019 to 2026.[4]
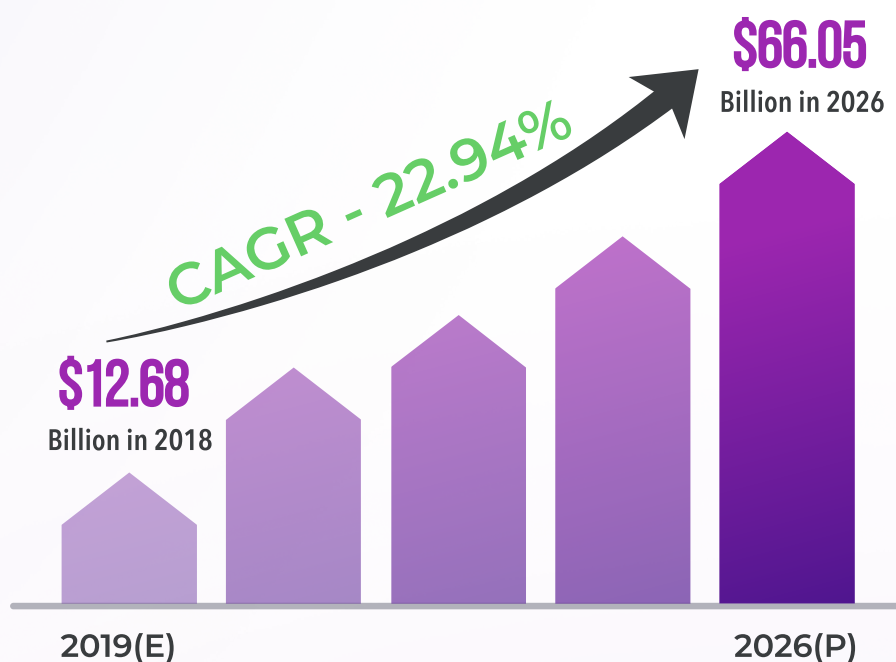
3.2 Open Source unorganized funding

The funds raised by open source projects go towards paying current contributors, covering the costs of running the project (such as hosting fees), or investing in new features or ideas.
The common ways in which open source projects find funds are explained below:

3.2.1 Grant Funding

Some software foundations and companies offer grants for open source work. This type of funding is carried out in batches; that is, the fund in question releases a certain amount of money each year, and it's spread out over multiple projects. Grant funding often allows you to plan and execute projects over an extended period.

Some of the foundations and organizations offering grants for open source work are:

3.2.2 Crowdfunding

The concept of crowdfunding of open source has been around for a while and can at times be the spark that makes a project take off.

There are different models of crowdfunding. The traditional crowdfunded project asks for funds given some budget and project proposition. If the project reaches the donation goal, you can receive extra benefits apart from the actual product.

Other models are more focused on the community, where members of the community pitch in a certain amount of money per time unit, e.g., once a month.

Gitcoin alone has contributed more than 19 million dollars for open source software development through grants and crowdfunding[5].

Some of the common crowdfunding sources are Patreon, Liberpay, Bountysource, Open Collective, Stakes.social, Tidelift, Issuehunt, xs:code, etc.

GITCOIN $19M in results

3.3 Decentralized Projects and Cryptocurrency

The growth of the decentralized projects and cryptocurrency market in the past decade has increased the interest of developers in open source software development. The cryptocurrency market has provided new opportunities for the growth of open source software. It has helped increase incentivization to work on open source projects through decentralized fundraising mechanisms and open trading markets. Currently, **the cryptocurrency market is a multi-trillion dollar economy and has one of the biggest shares in the open source funding market in the past decade. The cryptocurrency market is growing at 30% CAGR and is expected to hit USD 5 trillion+ by 2025**[6]. **The cryptocurrency market hit USD 2 trillion for the first time in April 2021**[7].

Open blockchain funding has opened new doors for developers to raise funds for their open source projects. Some of the popular ways are mentioned below:

3.3.1 Grants

Grants are one of the most popular ways in which new developers get involved in open source blockchain development. Cryptocurrency projects are issuing a lot of grants to increase developer adoption on their blockchain.

Crypto grants are an excellent way for developers to participate in open source software development and improve their knowledge while getting rewarded for their contributions.

Multiple cryptocurrency projects have issued grants over the past few years. The total amount of grants promised for crypto based projects has reached a staggering amount of 10 billion dollars. Some of the cryptocurrency projects and their grants are shown below:

COIN	ORGANIZATIONS	GRANT PROMISED SO FAR (IN $)
Bitcoin	BitMEX nexo BINANCE kraken	$200M+
Ethereum	ethereum community fund .network CONSENSYS ARAGON Protocol Labs	$250M+
Binance Coin	BINANCE SMART CHAIN	$100M+
Cardano	INPUT OUTPUT	$20M
Polkadot	POLYCHAIN CAPITAL web3 foundation	$30k to $100K per project Total amount not disclosed
Uniswap	UNI	$344M approx
Chainlink	Chainlink	$100K+ to a project
Stellar	Stellar	$6B
Vechain	vechain	$3K to $30K Total amount not disclosed
Tron	TRON	$1M
EOS	eos vc The EOS Foundation	$1.5M foundation grant $50000 per project + Rest undiscosed amount in funding

COIN	ORGANIZATIONS	GRANT PROMISED SO FAR (IN $)
Solana	SOLANA FOUNDATION	Undisclosed
IOTA	IOTA FOUNDATION	$43M
Waves	Waves Association	$10M
Tezos	Tezos Foundation	$37M
Cosmos	INTERCHAIN FOUNDATION	$212M holding 1M given as grants in Q4 2020
Aave	AAVE	Undisclosed
Avalanche	AVA LABS	Undisclosed
Algorand	Algorand FOUNDATION	$250M
Maker Dao	MAKER	Undisclosed
HBAR	Hedera Hashgraph	$700M
Zcash	Zcash Foundation	Undisclosed
Stacks	Stacks Foundation	$20M approx

COIN	ORGANIZATIONS	GRANT PROMISED SO FAR (IN $)
Polygon	Matic	Undisclosed
Ziliqa	zilhive	$5M
Mina protocol	MINA	$2.1M

3.3.2 Crowdfunding/ICO

Blockchain revolutionized crowdfunding by introducing ICOs — Initial Coin Offerings. ICOs or token sales are smart contracts based on distributed ledger technology (blockchain) designed to raise external finance by issuing coins or tokens. Instead of simply asking for money, blockchain projects often give coins in return. Here, investors exchange their currency for a coin that is part of the ecosystem of the blockchain-based start-up.

In fact, some of the most popular blockchain companies were funded this way. Until the end of 2019, over 5,600 ICOs have raised more than USD 27 billion[8].

4. The Problem

4.1 The Monopoly of Centralized Players

This is the most visible metric of centralized platforms. Open Source and Decentralization are the very proponents against monopoly, yet giant corporations exist at the center of the Open Source Ecosystem.

GitHub, the leading player among the centralized platforms, has over 56 million developers on its platform. These developers have created over 60 million repositories in the last year alone. With the number of developers entering Open Source increasing as well as the number of open source contributions rising, it is necessary to ascertain the permanence of GitHub.

Open Source exists only because of developers' millions of contributions, who expect GitHub to host their Open Source Code continuously.

With the major share of developers using GitHub for their projects, it creates a problem where now open source communities have no other option other than to host on GitHub to attract other contributors.

Some Decentralized projects understand the irony and are shifting to self-hosted alternatives.[9]

4.2 Censorship

Centralized platforms thrive on monopoly, which leads to easy censorship. Thus, GitHub's weakness is the ability for stakeholders to censor anything they see fit, at the detriment of developers.

For instance recently, **GitHub removed a popular Open Source Repository - youtube-dl** [10] and its public forks after getting a DMCA takedown notice from RIA. The decision led

to criticism and protest from youtube-dl users and the open-source community. Public attention to the takedown resulted in the Streisand effect and popularising the matter. Users reposted the software's source code across the internet in multiple formats. Twitter users posted images on Twitter containing the whole youtube-dl source code encoded in different colors on each pixel. In the end, GitHub had to reverse its decision and reinstate the youtube-dl repository back on the platform.

GitHub's move has made the crypto community quite suspicious of the platform, and some proponents are scared that government forces can take down cryptocurrency codebases like Bitcoin's.[11] This possibility has encouraged many developers to start looking at alternative platforms to host their code.

Due to the monopoly and heavy concentration of developers on GitHub, it is easy for Countries and governments to target GitHub to serve their political agenda.[12]

GitHub, in its run, has been the target of censorship from governments of many countries, including China, India, Russia, and Turkey, using many methods like local Internet service provider blocks and denial-of-service attacks on GitHub's servers[13]. GitHub has been eventually unblocked after backlash from users and technology businesses or compliance from GitHub in all of these cases.

Another instance of government involvement in censorship can be seen when GitHub banned users from Iran, Syria, Crimea, and other sanctioned nations from accessing portions of their service to comply with US trade laws.[14]

GitHub also censors to a large extent, due to the Scunthorpe problem.[15]

The Scunthorpe problem arises because while computers can easily identify strings of text within a document, interpreting words and complex phrases requires considerable ability to interpret a wide range of contexts, perhaps across many cultures, resulting in an arduous task. As a result, broad blocking rules may result in false positives, affecting innocent phrases. GitHub also fell prey to this.

Another prominent example of the censorship problem can be seen in how the Chinese government has targeted GitHub. The Chinese government, well-known for its

censorship of foreign services, has seen an explosion in open source development. The centralization of GitHub has allowed China to pinpoint and attack GitHub in several ways.[16]

4.3 Imposing Policies

The 'Open Source' phenomenon is a community-led movement, and GitHub has placed itself at its center over the years. However, the reality is that GitHub is simply a collaboration platform, while it is the developers who contribute code and build the ecosystem. Thus, GitHub ceases to have value without community-based developers' contribution and can be compared to Sourceforge if the collaboration element is removed. Therefore, **even though GitHub is being built by the community, this community has no say in product or policy decisions. Ultimately, this results in the GitHub community distrusting the platform.**

4.4 Openness and Transparency

The popular code hosting and collaboration services currently, similar to GitHub, are not open source. They do not care to be transparent in how they use our data and how certain features are implemented. We use these products without knowing how they operate and their effect on our privacy and other aspects of our lives. Service owners can freely alter the terms and behavior of a product without informing users.

4.5 No Incentive in Product Growth

Although GitHub has a monopoly over open source code collaboration, there is no incentivization mechanism that aligns the developers with product growth.

4.6 Security

The source code repositories on centralized platforms are at risk of unauthorized people's modification if their security is compromised. Malicious actors can modify the git repositories to include commits that can cause harm to the users. This can be fixed easily

in blockchain since all the modifications in blockchain have to be signed by the repository owner or the members with access to that repository.

4.7 Single Point of Failure

When you have all your code on a centralized platform, there's a single point of failure. That means that if they suffer a catastrophic event (like getting hacked, or there is a data leak, or they go bankrupt or announce that they're shutting down), all your code could be lost.

The many service interruptions[17] of the popular platform, GitHub, have shown that such a scenario is possible, and GitHub has a single point of failure.

By design of the platforms, each developer has a full copy of the repository. This means that there's little risk of data loss for a company that uses a service like GitHub. The problem arises when GitHub has been worked into the core of several companies' development processes.

For example, companies that have developers work locally and push their code to GitHub for deploys have no control over the infrastructure on which their code resides. If they wish to do a deployment, but GitHub is down, they are unable to deploy their code.

4.8 Open Source Incentivization

Open Source incentivization is done through sponsorship or wilful donations even though Open Source software is the backbone of almost every software. Moreover, since all cryptocurrency based decentralized networks are open source, open source incentivization should not be dependent on public donations but instead should be built into the economic design of the decentralized network.

4.9 Not tailored for Decentralized Ecosystem

The last decade has seen tremendous growth in the Decentralized Ecosystem. The

shift from Centralized and proprietary code to Decentralized networks and Open Source codes has brought the need for a tailored solution for communities to the forefront.

The current system that centralized players have designed includes code collaboration in a centralized environment with a top-down approach. Instead, the need of the hour is a bottom-up approach. While most of the collaboration flows should and still be the same, new flows such as requiring proposals, governance, and community base access should also be explored.

4.10 No Collaboration Export

The lack of collaboration export is a strategy applied by centralized players to tightly couple the collaboration workflows with their platform and decouple it completely from the source code. However, this is unarguably the greatest pain point faced by developers because their entire collaboration progress will be lost if their access to the accounts or repositories is restricted/removed. This is also a type of vendor lock-in that has no provision of migration to a different platform.

5. The Product

Gitopia is a decentralized code hosting and collaboration platform, built using open-source blockchain protocols. Synthesizing best practices in modern software development, Gitopia offers robust collaboration features on top of a decentralized storage mechanism.

Features of Gitopia

- **Permanent storage:** By leveraging blockchain technology, Gitopia provides its users with a permanent and easily retrievable home for their code.
- **Decentralized:** Gitopia will have a decentralized network of validators and stakers to govern and secure the platform. There will be no central authority in Gitopia.
- **Governance:** In Gitopia, all the platform-related decisions will be taken with the community's involvement transparently. They can vote on proposals and help shape the future of Gitopia.
- **Censorship Resistant:** There is no central authority that can take down any repository on Gitopia. Instead, the community decides the content policies and is responsible for platform moderation.
- **No Single Point of Failure:** There will be no disruption of service in Gitopia due to the usage of a decentralized network. The decentralized network of Gitopia will provide high availability and a stable network.
- **Secure:** The repositories on Gitopia will be secured by public-key cryptography and thus resistant to unauthorized usage and hacking.
- **Transparent:** The source code of Gitopia will be open source, and hence its workflows are out in the open for other developers to inspect.
- **Users will be stakeholders** of Gitopia and will get incentivized when the Gitopia platform grows.
- **Open-source incentivization:** Open-source incentivization will be integrated into the Gitopia workflow. It will be designed to motivate open-source developers to contribute to open-source projects actively.
- **Interoperable:** Gitopia will be integrated with the Cosmos IBC layer (Inter-Blockchain Communication) to establish interoperability between Gitopia's application layer and various other blockchains that are interoperable with the Cosmos IBC.

5.1 MVP Implementation

The MVP implementation of Gitopia mainly consisted of a git based Code hosting platform built using Arweave. Arweave is a blockchain that enables permanent, low-cost storage of regular digital data. Arweave provides us with permanent storage, where we pay only once for storage, and retrieve it freely forever. Arweave protocol and its incentivization mechanisms ensure that all the data are accessible permanently and do not depend on a centralized service provider's trust.

In the basic implementation of Gitopia, the objects were directly stored on Arweave even though processing the objects into packfiles and then storing them was more efficient. This was done due to the fact that processing packfile would have needed an intermediary server resulting in our application becoming more complex and heavy. Due to this although the Gitopia platform worked well as a Code hosting platform, it had some shortcomings.

5.1.1 Learnings from building the Gitopia MVP

In the MVP implementation of Gitopia on Arweave:

As a feature, git provides developers with remote helpers, which they can use to trigger custom logic right from the git command line. For eg. if a developer adds a GitHub remote starting with git://, the git cli works as usual with the git server.

However, when a developer uses Gitopia, and adds a Gitopia remote starting with gitopia://, the git command line looks for a helper named git-remote-gitopia in the user's system. If this tool is installed (we published it via npm), git forwards the sub-command (push, pull, etc.) to git-remote-gitopia for it to handle. On every code push, the cli tool git-remote-gitopia fetches the head ref from Arweave and pushes the new objects to Arweave. It also updates the branch's ref to the latest commit hash.

While this approach of pushing individual objects to Arweave gives a user the leverage to lazy load the objects on-demand on a web interface, it also restricts the larger repositories from working efficiently since these repositories usually have a lot of history which bloats up the initial upload size. In addition, this process also requires a

longer time duration to complete and is more expensive. For reference, the Linux repository has ~8,000,000 objects, and the total size of git objects is ~60Gb. Linux's compressed Packfile is around ~5Gb.

git allows us to use packfiles that compress these objects to make data transfer more efficient. However, if we use this approach and push packfiles of the new git objects on every push to Arweave, there are a couple of issues that arise:

On Clone

The user would need to fetch all the packfiles (total number of git pushes) for that particular repository from Arweave, making this process time-consuming.

On Web

The lazy loading of git objects would not be possible. The process of waiting for the download of all the packfiles to render the repository view on the web browser would result in a bad user experience since the waiting time can take up a few minutes in the case of big repositories.

Inference

- Arweave provides us with permanent storage, which we need to use optimally for storing packfiles.
- Gitopia needs a fast contract layer for state management of various actions performed by the user
- We need a compute layer optimized to perform git operations and other CI/CD actions.

5.2 Technical Challenges

Making a truly decentralized variant of a complex application like GitHub has a few technical challenges, as described below:

5.2.1 git Protocol

git uses a smart protocol when transferring objects between git client and the server. It figures out which git objects are needed and compresses them into an optimized Packfile format, in order to transfer git objects efficiently during fetch or push.

A decentralized variant cannot feature this optimization directly at the data layer, as data can be appended to the blockchain but existing data cannot be optimized. The MVP implementation used git objects, but it is not efficient when dealing with large repositories.

5.2.2 Latency

The introduction of a decentralized system results in latency issues, due to the delays in transaction broadcast and nodes arriving at a consensus. This latency results in a poor user experience and must be addressed.

5.2.3 Cross-chain interaction

Blockchains are optimized for a specific task. In order to design a complex app like GitHub, integration of various solutions is required to achieve this goal.

5.3 Gitopia Platform

Gitopia makes use of the following components to address the challenges mentioned above -

- A decentralized compute infrastructure that will handle the processing of packfiles. This will make the platform more efficient while dealing with large repositories.

- Gitopia chain will run on delegated-Proof-of-Stake (dPoS) based Byzantine Fault Tolerant (BFT) Tendermint consensus engine. This will solve the latency issues.

- To promote cross-chain interaction, Gitopia will be integrated with an Inter Blockchain Communication (IBC) layer.

6. Gitopia Architecture

The main components of Gitopia are -

A Gitopia main chain built using Cosmos-SDK. It handles app logic, access controls, and meta information related to git repository storage.

- A Decentralized compute infrastructure which handles packfile processing and CI/CD.
- A redundant data storage using Arweave.
- IBC interface for blockchains to tightly integrate their development workflows with Gitopia.
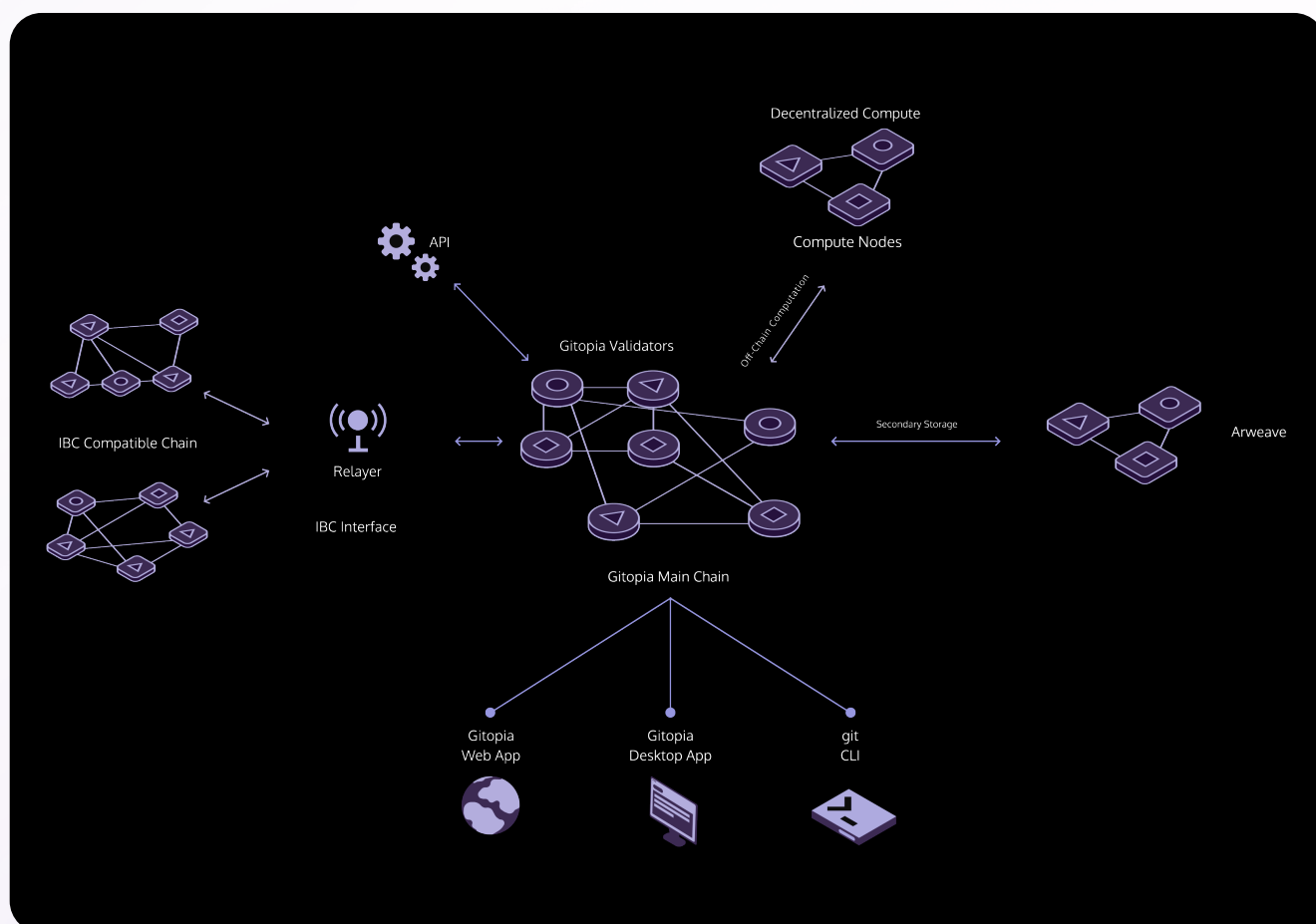
6.1 Gitopia main-chain

The Gitopia main-chain is an application-specific blockchain optimized for decentralized source code collaboration. It is built using Cosmos-SDK and will run on delegated-Proof-of-Stake (dPoS) based Byzantine Fault Tolerant (BFT) Tendermint consensus engine.

The Gitopia main-chain will be interoperable with other chains via the Inter-Blockchain Communication Protocol (IBC).

The Gitopia main-chain will also be secured by a distributed set of Validators and the native Gitopia token, $LORE.

The main chain will be responsible for managing the application state and enforcing access controls. It will handle the following requirements -

6.1.1 User to address resolution

Users can reserve usernames associated with their public address. This will be better for user experience, as there won't be a need to work with large and hard-to-remember public addresses. Additionally, users can also transfer their reserved names to other users if they wish to do so.

6.1.2 User, Organization, and Repository settings

User
User-specific configuration and encrypted secrets will be managed under this contract.
- Follow/unfollow users
- Add/modify encrypted secrets

Repository
All the Repository-related settings, like Ownership and access controls, are managed under this contract. This will ensure transparency and will provide an audit log for all repository related actions.

Some examples of actions controlled by the owner include:

- Transferring Ownership of a repository
- Giving write access to new users
- Revoking existing access

Organization

All the Organization related settings, like Ownership and access controls, are managed under this contract. The way decision-making happens in a repository managed by a user is different from the way it happens in a repository managed by an organization. While the user creates an organization, all further actions would need approval from other members of the organization.

A typical organization workflow:

- User creates an organization
- Owner adds another member
- The addition of any new members requires approval from all existing members
- Removal of an existing member also requires voting
- Decision-making in any repository managed under an organization requires the consensus of members. This ensures that there is no need for a third party to resolve disputes since it's hardcoded in the contract.

6.1.3 Application Workflows

Collaboration workflows are defined in the contract, making Code collaboration workflows like approval, merging, and closing of pull requests executed in a transparent manner. For example, an individual can set a user-defined checklist (code quality, build status, etc.) in the contract for a pull request to be merged, which no one can override unless the checklist is modified via voting by the project stakeholders.

6.1.4 Governance Workflows

Governance in org/repo:

- Voting on proposals
- Management of project treasury
- Giving write access to a new user
- Revoking existing access

Governance in Gitopia:

- Voting on Gitopia Improvement Proposals
- Management of community fund
- Setting platform fees

6.1.5 git references

On every git push, git references for the concerned branches are updated on the chain. Only authorized users will be able to update the references and this can be audited easily.

6.1.6 Meta information related to git repository storage

All code pushes are stored optimally as Packfiles and the decentralized compute infrastructure will be responsible for processing these packfiles and caching them for faster retrieval. This ensures that the front-end app receives loose git objects for faster rendering of the file browser, and git clients receive a single compressed Packfile to reduce the amount of data transferred.

6.2 Decentralized Compute Infrastructure

The compute layer will be responsible for the processing of the packfiles. The compute infrastructure will process these packfiles into:

- a single packfile available for users to clone
- destructured packfile (i.e. git objects of the above single pack file available as loose git objects, to serve the web app and lazy load the file browser view efficiently).

The decentralized compute infrastructure will also be responsible for:

- CI/CD workflows
- Code quality check
- Unpacking git loose objects for optimized rendering at the web app

6.3 Inter Blockchain Communication (IBC) Bridge

The blockchain ecosystem is generally seen as a divided ecosystem of siloed decentralized networks that are unable to communicate or exchange data with each

other, resorting to tribalism and competition instead of cooperation.

Gitopia will be integrated with the Cosmos IBC layer (Inter-Blockchain Communication) in order to establish interoperability between Gitopia's application layer and various other blockchains that are interoperable with the Cosmos IBC.

Gitopia has a tremendous amount of utility in the open decentralized cryptocurrency ecosystem, as nearly all networks in the ecosystem reserve a certain portion of tokens to incentivize community based development. Gitopia offers these decentralized networks the ability to use Gitopia's decentralized repository management to establish transparency and provability of code contributions from community based developers who are incentivized with network reserves. The IBC also offers a cross-chain payment channel (which is secured by the Cosmos Hub) that these networks can utilize to fund bounties/issues/proposals on Gitopia.

6.4 Redundant Storage Layer

The redundant storage layer will allow users to store their repository on other data stores for an extra layer of security. The users can use Arweave or any other data storage facility of their choice.

Arweave Gitopia IBC Bridge

When Arweave is being used as a redundant data storage solution, the cost of storing data should be paid via AR tokens. However, having the user exposed to multiple tokens is not user-friendly.

To have all platform activity managed via LORE token, Arweave Cosmos IBC Bridge must be introduced. This bridge will enable Gitopia and other projects in the cosmos ecosystem to use IBC. This way, we can tightly couple IBC with Gitopia to provide a seamless developer experience.

7. LORE Token

Gitopia is a proof-of-stake chain built on Cosmos-SDK that leverages LORE Token (LORE), a native utility token, as the primary means to govern, secure the blockchain, and provide a default mechanism to store and exchange value.

LORE Token will act as the reserve currency in the Gitopia ecosystem while ensuring the platform's public blockchain's economic security through staking.

We are implementing a phased rollout to enable Gitopia Tokenomics Model to compensate collaborators on the network properly. The plan is phased out in 2 steps:

- Stabilize the staking set to establish economic value for LORE Token with the launch of Mainnet.
- After this initial phase of network bootstrapping is complete, we'll begin work on the Gitopia Economic model, which will incentivize collaborators and stakers to participate in the network long-term.

7.1 Token Utility

The token holders can use the LORE token for the following purposes:

- To bootstrap engagement on Gitopia
- To create Validators and staking
- To participate in Gitopia's governance
- As a mode of exchange for frictionless transactions to host code and collaborate
    - It should be very minimal and should not introduce friction.
    - Is only introduced to prevent spamming
- To sponsor/tip a user developing and contributing on Gitopia
- To fundraise for projects hosted on Gitopia
- Medium of payment and exchange for code collaboration on Gitopia

7.2 Validators and Stakers

Validators play a pivotal role in the network by provisioning new blocks and processing transactions. They earn LORE tokens for their service. Validators earn newly minted LORE tokens for provisioning new blocks, while they earn a transaction fee for processing transactions.

Token holders who don't wish to be validators themselves can earn a share of validator rewards by delegating their tokens to any of the network's validators. The percentage of the revenue allocated to token holders will be proportional to the number of tokens staked. The validator also charges a commission on top of that.

Token holders also share the risk when delegating their tokens to validators. Therefore, it is advised for token holders to do their due diligence on the validators they choose before staking. In case of unsolicited behavior from a validator, a portion of their staking, including those of their delegators, is slashed.

7.3 Governance

Existing solutions don't involve users in their policy making, leaving users with no option but to comply with policies due to a lack of alternative solutions.

In Gitopia, all the platform-related decisions will be taken with the community's involvement in a transparent manner. Tokens will be distributed to the community overtime to ensure the decentralization of voting power.

Some examples include:
- Setting platform fees and other incentivization mechanisms.
- Platform moderation

7.4 Token Economics

LORE Token is an Inflationary supply token with a genesis supply of **500,000,000 LORE** and a maximum supply of **1,711,136,432 LORE**. Inflation halving happens every two years

and the maximum supply cap is expected to be reached by the year 2033. Stakers of LORE will be able to earn approximately 35% staking rewards for the first two years.

Team	20.00%
Community Incentives	15.00%
Seed	12.50%
Treasury	12.00%
Strategic Offering	8.93%
Resource Incentives	7.00%
Ecosystem Partners	7.00%
Validator Incentives	5.00%
Marketing	5.00%
Advisors	4.00%
Pre-seed	3.57%
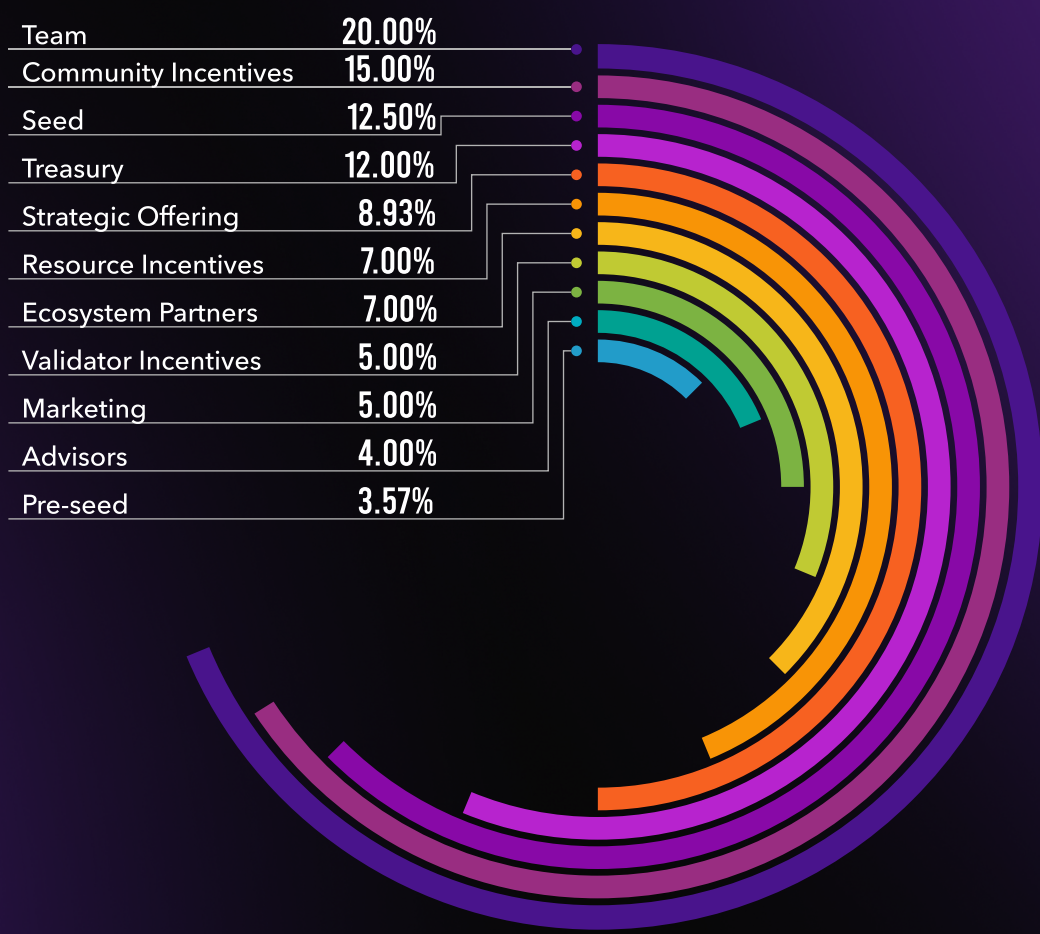
PURPOSE	TOKEN ALLOCATION	% OF TOTAL SUPPLY
Pre-Seed	17,850,000	3.57%
Seed	62,500,000	12.50%
Strategic Offering	44,650,000	8.93%
Team	100,000,000	20.00%
Treasury	60,000,000	12.00%
Community Incentives	75,000,000	15.00%
Marketing	25,000,000	5.00%
Ecosystem Partners	35,000,000	7.00%
Resource Incentives	35,000,000	7.00%
Validator Incentives	25,000,000	5.00%
Advisors	20,000,000	4.00%
TOTAL	500,000,000	100.00%

7.5 Token Release Schedule
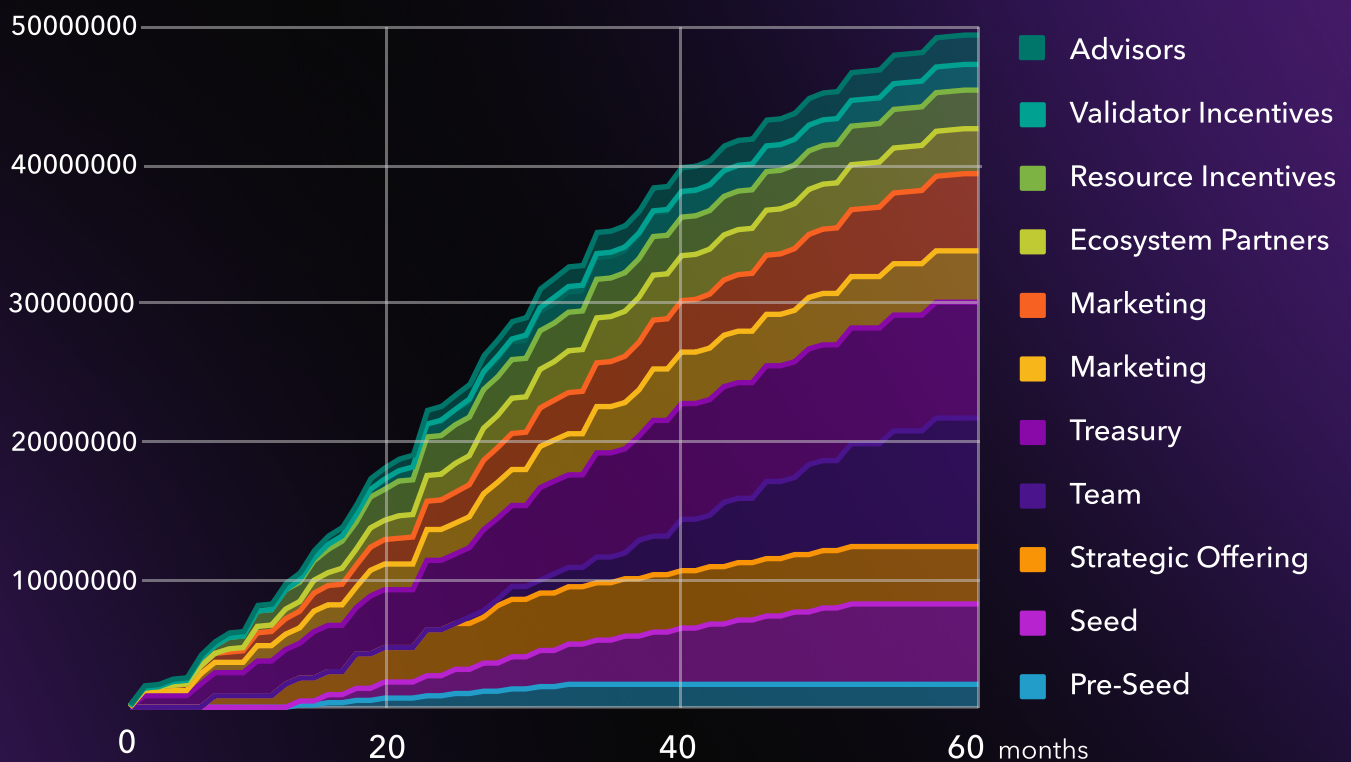
ROUND	RELEASE SCHEDULE
Pre-Seed	12 months vesting after TGE, 5% unlock every 2 months post vesting till 50 months post TGE
Seed	12 months vesting after TGE, 5% unlock every 2 months post vesting till 50 months post TGE
Strategic Offering	6 months vesting after TGE, 20% unlock every 5 months post vesting till 26 months post TGE
Team	24 months vesting after TGE, 5% unlock every 3 months for 12 months, 10% unlock every 3 months till 57 months post TGE
Treasury	4.1% unlock at TGE every 2 months till 24 months, 3.3% unlock every 2 months for next 24 months, 2.5% unlock every 2 months till 54 Months post TGE
Community Incentives	1.6% unlock every month till 59 months post TGE
Marketing	1 month vesting after TGE, 10% unlock every 4 months till 37 months post TGE
Ecosystem Partners	2.8% unlock every month for first 9 months, 2.1% from 10-29 months, 14% unlock every month from 30-39th month, 0.7% unlock every month till 59 month from TGE
Resource Incentives	3 months vesting, 2.8% unlock every month from 3-8 month, 2.1% unlock every month from 9-26 month, 1.4% unlock every month from 27-57 month post TGE
Validator Incentives	5% unlock every month for first 6 months, 3.75% unlock every month from 6-23 months, 2.5% every month from 24-34 month post TGE
Advisors	10% unlock every 4 months after TGE

8. Value Addition

8.1 Open Source Incentivization

Existing platforms don't have built-in incentivization to sustain open source projects. Gitopia includes this incentivization mechanism via the LORE token.

Incentivization will aid in the funding of open source projects and promote the growth of the ecosystem, as well as recognize maintainers and contributors for their efforts.

8.2 DAOs Governing Code

Currently, even decentralized projects are not entirely decentralized at least in terms of development. Commit access to the codebase is controlled by a few developers and actual stakeholders are in the dark regarding the changes that will get pushed to the code.

To counter this, Gitopia will integrate DAO's with source code to bring transparency to the development process. This approach will further give more visibility into and involve stakeholders in the process of software releases.

8.3 Actionable Open Source Licenses

Licenses are an important component of open source software. An open source software without a license is not safe to use. Without a license, there's nothing stopping the author from coming after you and suing for royalties if you start using it. The only way to actually make code open source and freely available is to attach a license to it.

But here too there are problems. Open source licenses are subjective. Their interpretation depends on the technical usage of the licensed software. Therefore, it's difficult to determine the legal risks of using open source software, especially for developers, who are not usually legal experts.

Consider the recent case of Uniswap[17]. Uniswap has licensed the third iteration of its code bank in an apparent move to ward off would-be copycats. With the license, no one can copy Uniswap's code base wholesale. It remains a large departure from the open-source nature of most cryptocurrency projects. The community is split on how to view this decision of Uniswap.

What uniswap has basically done is prevent copy cats from using their code and taking away their potential profits. Uniswap used a Business Source License which restricts anyone from using their code in production for 2 years after which it is open to use.

While some believe Uniswap made the right decision with the new license since Uniswap's competitors were easily using the code that the developers at Uniswap had worked hard for. Others disagree with this move since the new license goes against the principle of open source software and it will stifle innovation since the key criteria that drive innovation is competition.

Although the move by Uniswap with the new license can help them stop competitors from taking advantage of their code, it will be hard to enforce the license in the whole decentralized system.

The problems here are the -
- Trickling down of profits made by all the users who copy the code which is not passed down to the original authors.
- It is tough to enforce licenses on all copycats in the decentralized system.

Gitopia plans to solve both of these problems in its platform. Gitopia plans to have all users informed about the open source license on the codes they clone and work on through contracts. Gitopia also plans to make sure that the original creator of a code gets proper royalties through the platform's open source incentivization scheme.

9. Road Map

2021

- Start developing Gitopia blockchain built with Cosmos-SDK
- Start engaging with initial set of validators
- Develop specific compute infrastructure for processing git Packfiles
- Launch first version of Gitopia Webapp
- Release the git remote helper for Gitopia
- Release the GitHub mirror action for easy migration from GitHub
- Onboard and incentivize 100 open source projects

Q2

- Gitopia Web wallet release
- Gitopia Explorer release
- Gitopia staking service launch
- Exchange listings of LORE token
- APIs, Documentation, and public release
- Validator set expansion
- Ecosystem partnerships
- Launch Indexing and analytics services

Q3

- Launch Gitopia Desktop app
- Release IBC interface
- Implement Cosmos-Arweave bridge

Q4

- Release organization/Repository governance
- Support CI/CD integrations
- Release static code analysis

Q1

2022

10. Team

Parth Oberoi

Founder

Parth is an entrepreneur, programmer, and open source contributor. He started his open source journey with Google Summer of Code, contributing to the syslog-ng project. And once he got exposed to the decentralized ecosystem, he saw the possibilities in this new space. He incorporated Tech Trap and began consulting for decentralized projects. It is during this time, the idea of a decentralized code collaboration platform evolved.

Faza Mahamood

Founder

Faza is a software developer interested in upcoming technologies like decentralized systems, machine learning, etc. He has also participated in Google Summer of Code, contributing to the GDAL project of OSGeo. He has experience working in the Data Analytics and Developer Assessment industry. He got convinced to work in the new-emerging decentralized ecosystem by Parth and has never looked back ever since.

Snehil Buxy

Head of Product Design

Snehil is highly experienced in developing products involving rich UI/UX experiences. Before joining Gitopia, Snehil was a Founder and Head of Design & Experience at Mudrex. Mudrex is a Y Combinator incubated crypto trading platform. Before that, he co-founded Housing.com and was the Head of Product. Housing.com is a popular Indian online real estate listing platform. He is also an alumnus of Indian Institute of Technology, Bombay.

Kushagra Singh

Marketing

Kushagra is a software engineer turned marketer. He has worked for multiple Blockchain projects in the past under his own Blockchain growth consulting company Neptune Blockchain. Neptune blockchain helped protocols in adoption from writing whitepapers, token economics, community growth, mainnet launch and product adoption. Prior to Gitopia, Kushagra was working with CoinDCX as a Senior Growth Hacker. He played a crucial role in the company's growth in the Indian and Global markets and gaining over a million users.

Stian Sandsgaard

Product Design

Stian is a product designer with 11 years of experience in the corporate and startup industry. He specializes in UX and UI design, as well as having experience in animation and VFX. In the past, Stian has worked with multiple brands across the globe including fortune 500 companies. The clients he has worked with include Samsung, Berkshire Hathaway, Blizzard, Adobe, and GoFundMe to name a few.

11. Advisors

Jesper Noehr

Founder of Bitbucket

Jesper Noehr brings with him his valuable experience working in the Source Code Collaboration industry. He is also the founder, and former CEO, of Bitbucket. He has experience working with a plethora of technologies, for companies such as Opera Software, Atlassian (Bitbucket), and a couple of hedge funds. His field of expertise includes cryptocurrencies, system design & architecture, high scalability/reliability, distributed systems, quantitative trading & economics.

Zhi Hao Loy

Senior Associate Dentons Rodyk

Zhi Hao Loy is advising us on the Legal front. He is highly experienced in FinTech, Blockchain & Distributed Ledger Technology, Corporate Finance and Capital Markets. He has worked with big names in the decentralized industry.

12. Conclusion

Gitopia is determined to create a decentralized code hosting and collaboration platform that allows users to create, manage and share their open source projects without concerns of censorship, service outages, or any of the existing problems with the centralized platforms.

Gitopia envisions developing into a platform where users' concerns and experiences matter and openness and transparency exist naturally with its community-driven governance approach.

Gitopia aims to be the place where enthusiastic and altruistic developers from across the world come together to build the world's best open-source software. Gitopia's open-source incentive program by providing incentives will ensure that the developers are kept motivated to contribute to open source development.

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