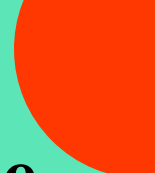# WHAT IS CERAMIC?

Ceramic makes building applications with composable Web3 data as easy as browsing a marketplace of data models, plugging them into your app, and storing, updating, and retrieving data from those models. When different applications reuse the same data models, their data is automatically interoperable. By decentralizing application databases, Ceramic makes data composable and reusable across all applications. Ceramic is a public, permissionless, open source protocol that provides computation, state transformations, and consensus for all types of data structures stored on the decentralized web. Ceramic's stream processing enables developers to build secure, trustless, censorship-resistant applications on top of dynamic information without trusted database servers.

Ceramic enables static files to be composed into higher-order mutable data structures, programmed to behave in any desired manner, whose resulting state is stored and replicated across a decentralized network of nodes. Ceramic builds upon and extends the IPFS file system and underlying persistence networks, as well as other open standards in the decentralized ecosystem, with a general-purpose decentralized content computation substrate. Due to Ceramic's permissionless design and unified global network, anyone in the world can openly create, discover, query, and build upon existing data without needing to trust a centralized server, integrate one-off APIs, or worry if the state of information being returned is correct.

Ceramic's global ecosystem of interoperable resources allows developers to build composable applications with unprecedented modularity, trust, and scale. As a result, Ceramic is the trusted foundation upon which a more connected, transparent, and user-centric internet is built.

At its core, the internet is a collection of applications running on stateful data sources – from identity systems and user tables to databases and feeds for storing all kinds of content generated by users, services, or machines.

Most of the information on today's internet is locked away on application-specific database servers designed to protect data as a proprietary resource. Acting as trusted middlemen, applications make it difficult and opaque for others to access this information by requiring explicit permissions, one-off API integrations, and trust that returned state is correct. This siloed and competitive environment results in more friction for developers and worse experiences for users.

Along other dimensions, the web has rapidly evolved into a more open source, composable, and collaborative ecosystem. We can observe this trend in open source software enabled by Git's distributed version control and in open source finance enabled by blockchain's double-spend protection. The same principles of open source have not yet been applied to content.

The next wave of transformative innovation will be in applying the same open source principles to the world's information, unlocking a universe of content that can be frictionlessly shared across application or organizational boundaries. Achieving this requires a decentralized computation network designed specifically for content with flexibility, scalability, and composability as first class requirements.

BENEFITS OF CERAMICS

Mutable data storage

Ceramic provides developers with a set of standard, open APIs for storing, updating, and retrieving data from the network. This helps to break down data silos, enabling all data to be openly accessible. Additionally, all data mutations on Ceramic are cryptographically verifiable and can provide auditability throughout all historical versions of a piece of data that has changed over time.

Data composability

Data on Ceramic is structured and stored in data models, which can be easily reused by different applications to share data between them. Data models are created by developers in the community, and the ecosystem

of data models is constantly expanding. Data models typically represent a single, logical application feature such as a user profile, a social graph, or a blog and developers typically combine multiple data models to create their application.

Developer experience

Building composable applications with Web3 data on Ceramic is simple. Install Ceramic, browse the marketplace of data models, plug these models into your app, and automatically get access to all data stored on the network that conforms to those data models. The community is constantly creating new tooling that make it easier to build, and expand what's possible with composable data.

Sign in with Web3

Ceramic uses the decentralized identifier (DID) standard for user accounts, which are compatible with all blockchain wallets. When using Ceramic in your application, users can authenticate with the Web3 wallets they already have, and can even control the same Ceramic account from multiple different blockchain wallets (cross-chain) if they'd like. Data models are typically account-centric, meaning that every user is in control of their own data.

Decentralization

The Ceramic network is decentralized and permissionless, allowing anyone in the world to spin up a node to provide storage, compute, and bandwidth resources to users and applications built on the network. Today there are no tokenized incentives for running Ceramic, but the community is exploring options.

Scalability

Ceramic's data network infrastructure is highly-scalable and can service use cases where a high amount of data throughput is needed. On Ceramic, every data object maintains its own state and nodes independently process stream transactions, allowing unbounded parallelization. This enables Ceramic to operate at worldwide data scale, which is an order of magnitude greater than the scale needed for decentralized finance.

HOW CERAMICS WORKS

Ceramic decentralizes application databases, making data universally composable and reusable across applications. The network consists of

three core parts: a highly-scalable, decentralized infrastructure for data availability and consensus, a marketplace of community-created data models, and a suite of standard APIs for storing, updating, and retrieving data from those models.
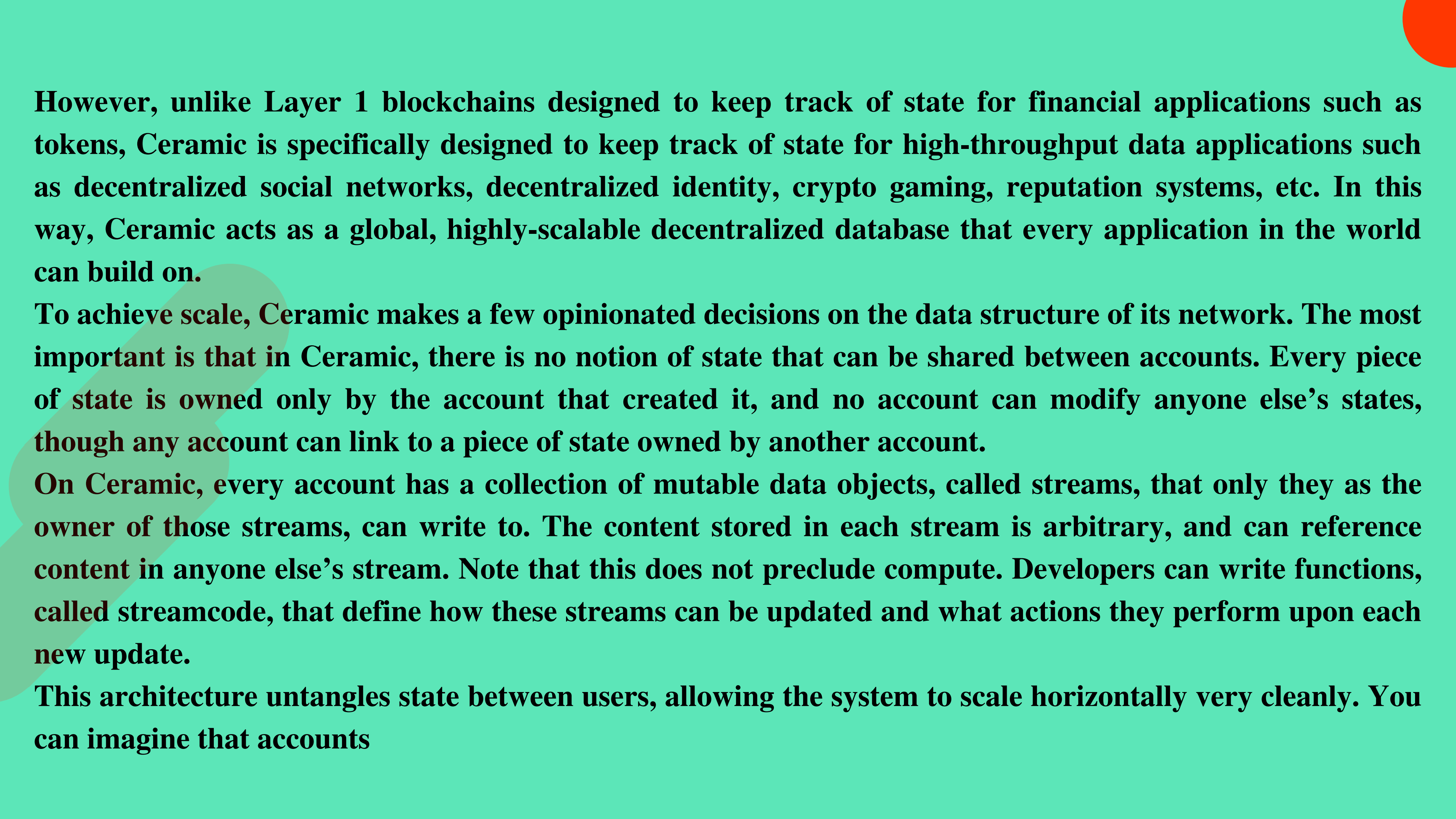
Core components

The Ceramic network consists of three core components:
1. Scalable, decentralized data infrastructure
2. Data models marketplace
3. Open APIs for data storage, update, and retrieval

Scalable, decentralized data infrastructure

The most foundational layer of Ceramic is its scalable, decentralized data network. The Ceramic network consists of a collection of permissionless nodes that work together to provide data availability for all states stored on the network, and work to come to consensus about those states every time there is a new transaction
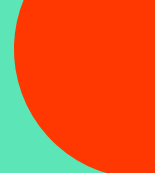
However, unlike Layer 1 blockchains designed to keep track of state for financial applications such as tokens, Ceramic is specifically designed to keep track of state for high-throughput data applications such as decentralized social networks, decentralized identity, crypto gaming, reputation systems, etc. In this way, Ceramic acts as a global, highly-scalable decentralized database that every application in the world can build on.

To achieve scale, Ceramic makes a few opinionated decisions on the data structure of its network. The most important is that in Ceramic, there is no notion of state that can be shared between accounts. Every piece of state is owned only by the account that created it, and no account can modify anyone else's states, though any account can link to a piece of state owned by another account.

On Ceramic, every account has a collection of mutable data objects, called streams, that only they as the owner of those streams, can write to. The content stored in each stream is arbitrary, and can reference content in anyone else's stream. Note that this does not preclude compute. Developers can write functions, called streamcode, that define how these streams can be updated and what actions they perform upon each new update.
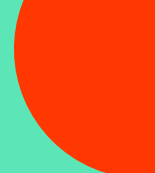
This architecture untangles state between users, allowing the system to scale horizontally very cleanly. You can imagine that accounts

1 - 1,000,000 are replicated on one set of Ceramic nodes, and accounts 1,000,001 - 2,000,000 are replicated on another. Theoretically, the network can be sharded all the way down to each individual user if needed without breaking composability. In order to ensure state verifiability and composability between user shards, Ceramic relies on a merkle tree data structure that aggregates transactions across all users, allowing any account to verify the integrity of anyone else's streams at any time.

Data models marketplace

The second core component of Ceramic is its vibrant ecosystem of open source data models created by the community, which serve to unlock cross-application data composability. Data models are novel abstractions that unify how similar types of applications store and retrieve state from each individual user on the network. For example, you can imagine that every decentralized Twitter implementation would run on a few shared data models: one for each user's tweets, one for their social graph, one for their DMs, etc. By adopting the same underlying data models, applications are able to natively interoperate on the same data.

Ceramic takes a community-driven approach to creating these data models, allowing any developer to easily define, share, and reuse their models with other developers in the ecosystem. As more data models are created by the community, we will see a continuous expansion in the quantity and variety of applications that are built with composable data.

Composability done this way also makes the developer experience better. Building an application on Ceramic looks like browsing a marketplace of data models, plugging them into your app, and automatically gaining access to all data on the network that's stored in these models. No longer will every single developer need to worry about bootstrapping their application with their own siloed users and data, making it easier than ever to go from idea to implementation.

Open APIs
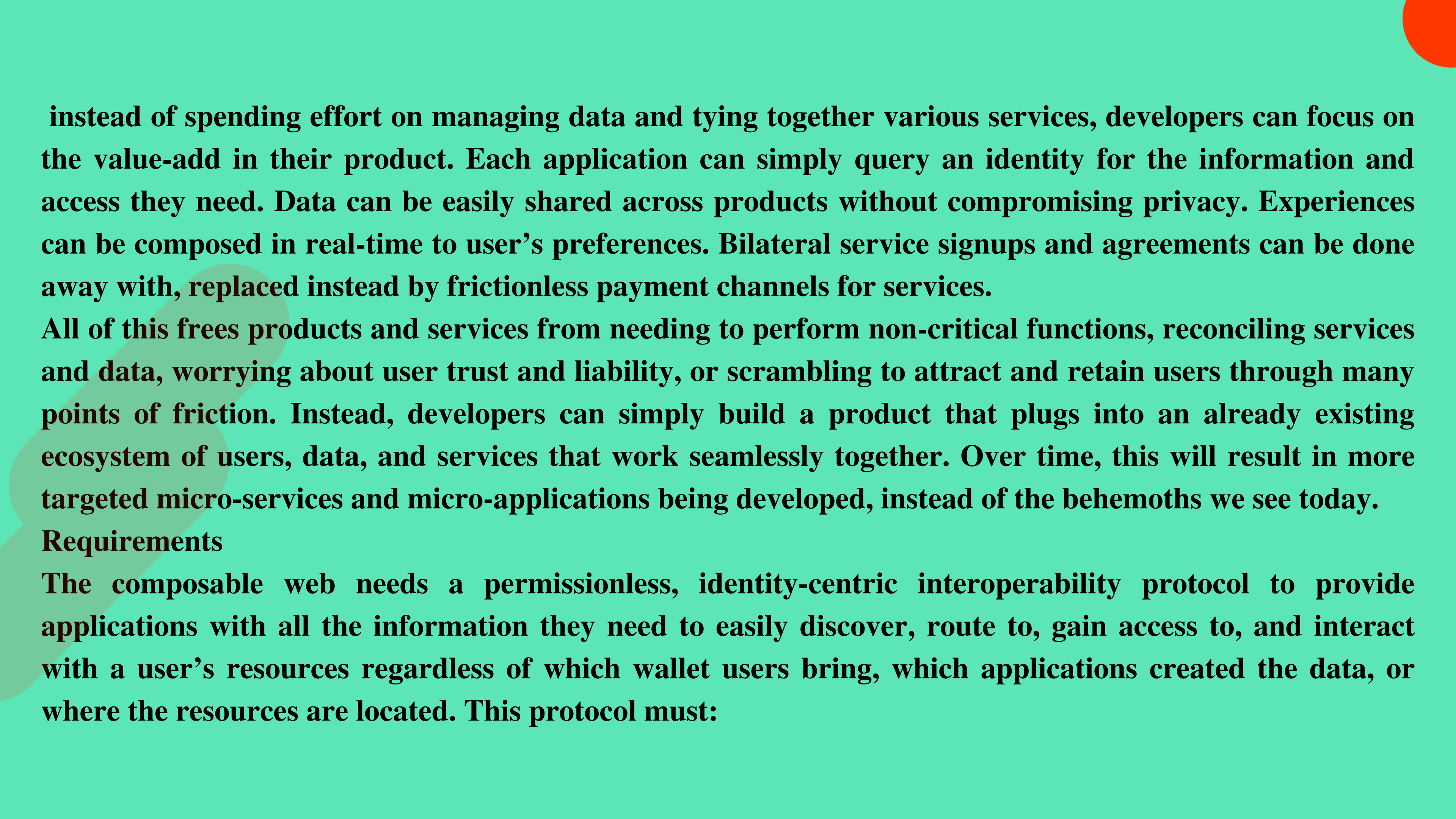
The final core component of Ceramic is its permissionless, open APIs for storing, modifying, and retrieving data from the network. By standardizing, generalizing, and opening these APIs up to every developer in the world, Ceramic enables developers to build on top of shared resources stored on the network without fear of centralization, censorship risk, or lock-in.

GITCOIN CERAMICS PASSPORT

Despite the benefits of cloud services, SaaS tools, and API businesses, building a fully featured product or service is still extremely complex, fragile, and limited. Even simple apps require deploying and maintaining a backend, securing and managing user identities and data, and tying together a tangle of APIs and services. Choices made early often lock developers in to long term relationships with technology providers, which vendors exploit. Making a product's value-add interoperate with other products and services is often difficult and unpredictable. All of this is because infrastructure, information, and access control are needlessly replicated and siloed for each individual application.

To combat these problems of duplication, fragmentation, and insecurity, the internet needs a flexible public infrastructure where participants can store verifiable information that is universally discoverable and accessible across all applications. By keeping identifiers, their associated data, and services in the public domain instead of on siloed application servers, they can be accessed by all participants across the web. In this model, participants directly define and control their resources, share (or not) these resources with others, and bring their identities and metadata across experiences.

In addition to giving users more agency and control, this model dramatically simplifies the experience for developers as well.

instead of spending effort on managing data and tying together various services, developers can focus on the value-add in their product. Each application can simply query an identity for the information and access they need. Data can be easily shared across products without compromising privacy. Experiences can be composed in real-time to user's preferences. Bilateral service signups and agreements can be done away with, replaced instead by frictionless payment channels for services.

All of this frees products and services from needing to perform non-critical functions, reconciling services and data, worrying about user trust and liability, or scrambling to attract and retain users through many points of friction. Instead, developers can simply build a product that plugs into an already existing ecosystem of users, data, and services that work seamlessly together. Over time, this will result in more targeted micro-services and micro-applications being developed, instead of the behemoths we see today.

Requirements

The composable web needs a permissionless, identity-centric interoperability protocol to provide applications with all the information they need to easily discover, route to, gain access to, and interact with a user's resources regardless of which wallet users bring, which applications created the data, or where the resources are located. This protocol must:

1. **Permissionlessly register an interoperable identity (DID);**
2. **Privately control this identity with multiple private keys;**
3. **Publicly associate public keys and accounts to this identity;**
4. **Publicly or privately associate resources to this identity;**
5. **Set permissions for resources;**
6. **Perform access control to resources;**
7. **Interoperably sign and/or encrypt information; and**
8. **Revoke private keys, public keys, and permissions for resources.**

EXPLAINED IN PICTURES

Visit https://passport.gitcoin.co
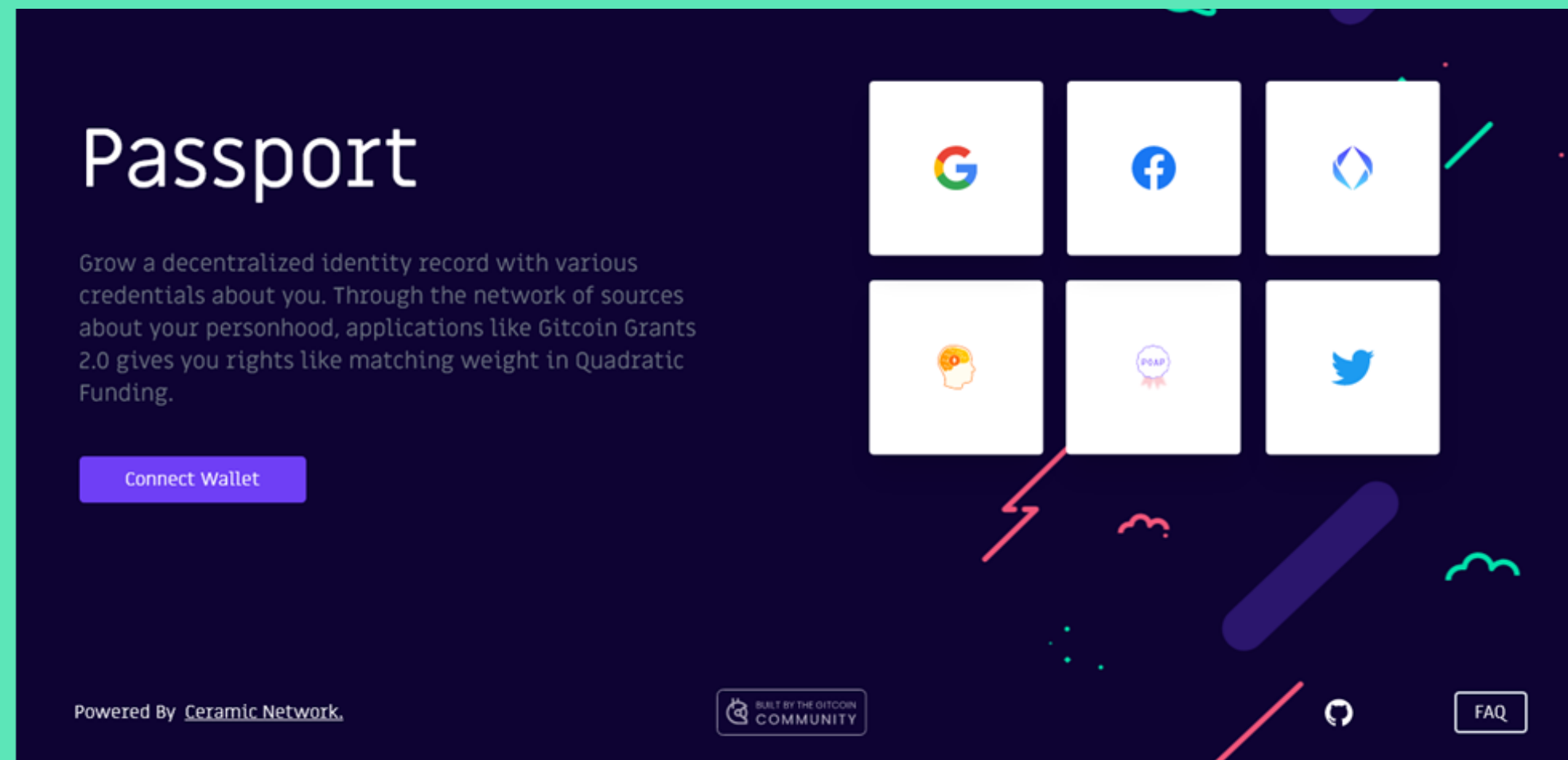
Scan the barcode to connect wallet

QR Code | Desktop

Scan QR code with a WalletConnect-compatible wallet

Copy to clipboard
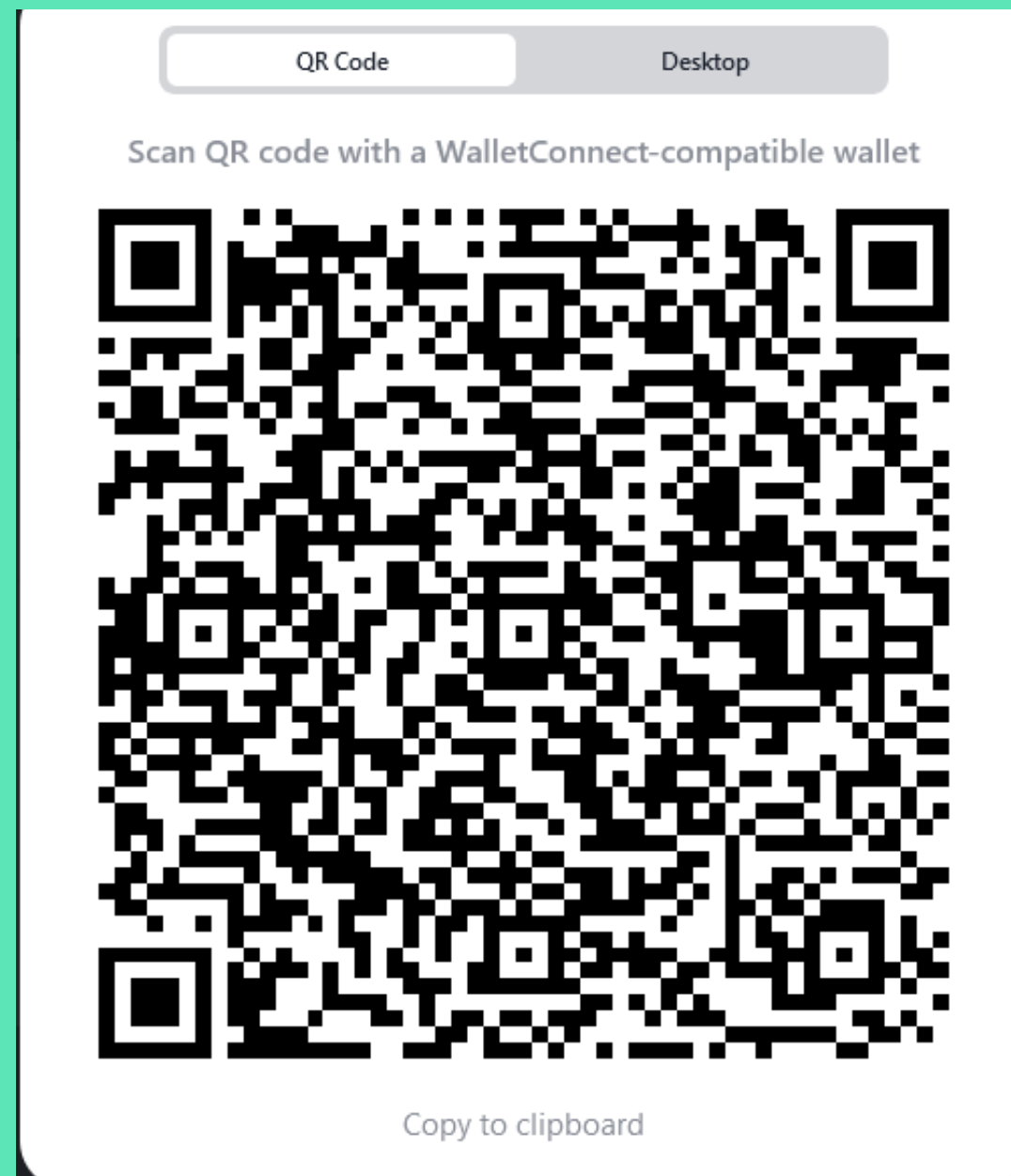
Click on your desired options to connect your wallet

Available Wallets

✕

Get Started

Connect your wallet

Connecting your wallet is like "logging in" to Web3. Select your wallet from the options to get started.

Ledger

Coinbase
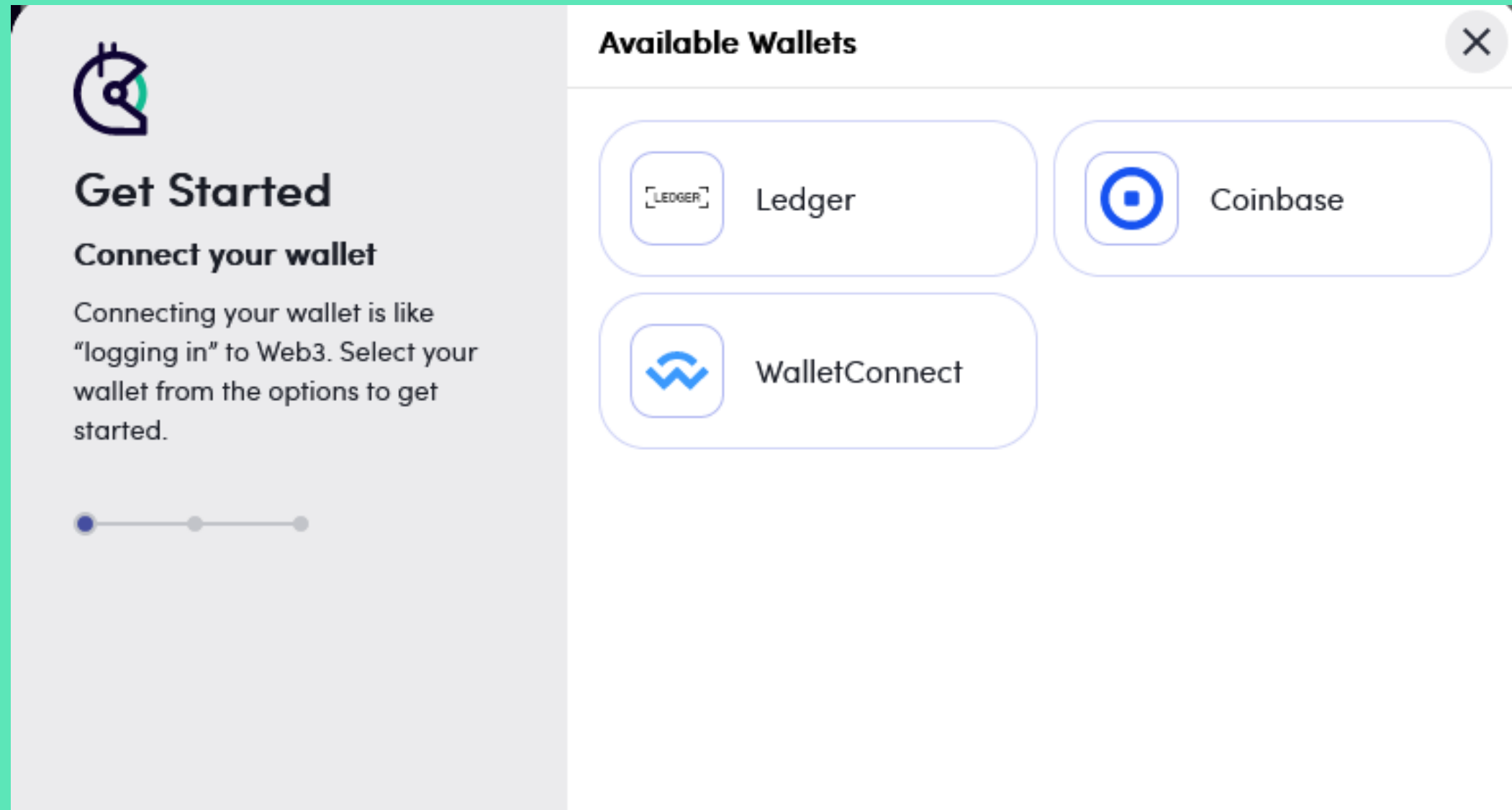
WalletConnect

Connect your identity by signing in and confirming your wallet ID

Facebook Facebook name Connect account	**Google** Google Authentication Connect account	**Twitter** Twitter name Connect account	**Github** Github name Connect account
Bright ID Bright ID name Connect Account	**POAP** POAP Verification Connect to POAP	**Ens** Ens name Link to ENS	**POH** Proof of Humanity Connect PoH

Verify your identities

Facebook

Facebook name

✓ Verified

Google

Google Authentication

✓ Verified

Twitter

Twitter name

✓ Verified

Github

Github name

✓ Verified

Bright ID

Bright ID name

✓ Verified

POAP

POAP Verification

✓ Verified

Ens

Ens name

Link to ENS

POH

Proof of Humanity

Connect PoH

Score your trust bonus to match the needed point for verifications

Ceramic is passionate about creating easy-to-use building blocks for Web3 data. That's why they partnered with Gitcoin, a team that shares a similar vision. Gitcoin is on a mission to empower builder communities to build and fund public goods. Today, they launched Gitcoin Passport as a decentralized identity verification utility, using Ceramic to store personal credentials and make them portable across ecosystems.

Gitcoin adopts this new application as part of the active Grants Round 14 to verify the unique personhood of contributors in the Quadratic Funding matching program. If you're contributing to Gitcoin Grants, go to the Trust Bonus page in your profile or Gitcoin Passport to verify your unique personhood band, in turn, increase your matching.

What is Gitcoin Grants?

Gitcoin Grants is the largest Quadratic Funding application in the Web3 space, processing over $1.5mm/quarter in funding for a variety of hackathons, bounties, and open source projects. Quadratic Funding is the mathematically optimal way to fund public goods in a democratic community.

During every grants round, projects undergo a crowd funding campaign that is matched with funds according to the Quadratic Funding algorithm, where the number of contributors matters more than amount funded. This pushes power to the edges and away from whales who may have simply donated a much higher amount. In public goods funding, this ultimately creates more democracy.

The Importance of Sybil Resistance and the Trust Bonus

While Quadratic Funding is the most optimal way to democratically allocate funds to projects that a community cares about, it is susceptible to Sybil attacks. In Gitcoin Grants, the Sybil attack means that a user spreads their funds across multiple wallets and donates to the same project. Since Quadratic Funding weighs the number of donations over the total amount donated, attackers can game the system to receive a larger slice of the QF matching pool.

To build in Sybil resistance, the Gitcoin team asks users to verify their "proof of humanity" by proving ownership over various accounts and data. Gitcoin Grants integrates with a variety of identity providers (Proof of Humanity or BrightID), Web2 services (Google, Twitter, or Facebook), and Web3 accounts (ENS). Users who verify their identity through a number of these mechanisms are eligible for a 'Trust Bonus,' allowing their contributions to be assigned a larger weight in the matching calculations.

Introducing the Decentralized Proof of Personhood Passport

While the Trust Bonus helps to minimize the impact of Sybil attacks, it isn't the end solution. Gitcoin has long subsidized these payouts (called a Fraud Tax) to ensure that no grant has received less than it was supposed to due to any detected Sybil attacker. Since Grants Round 7,
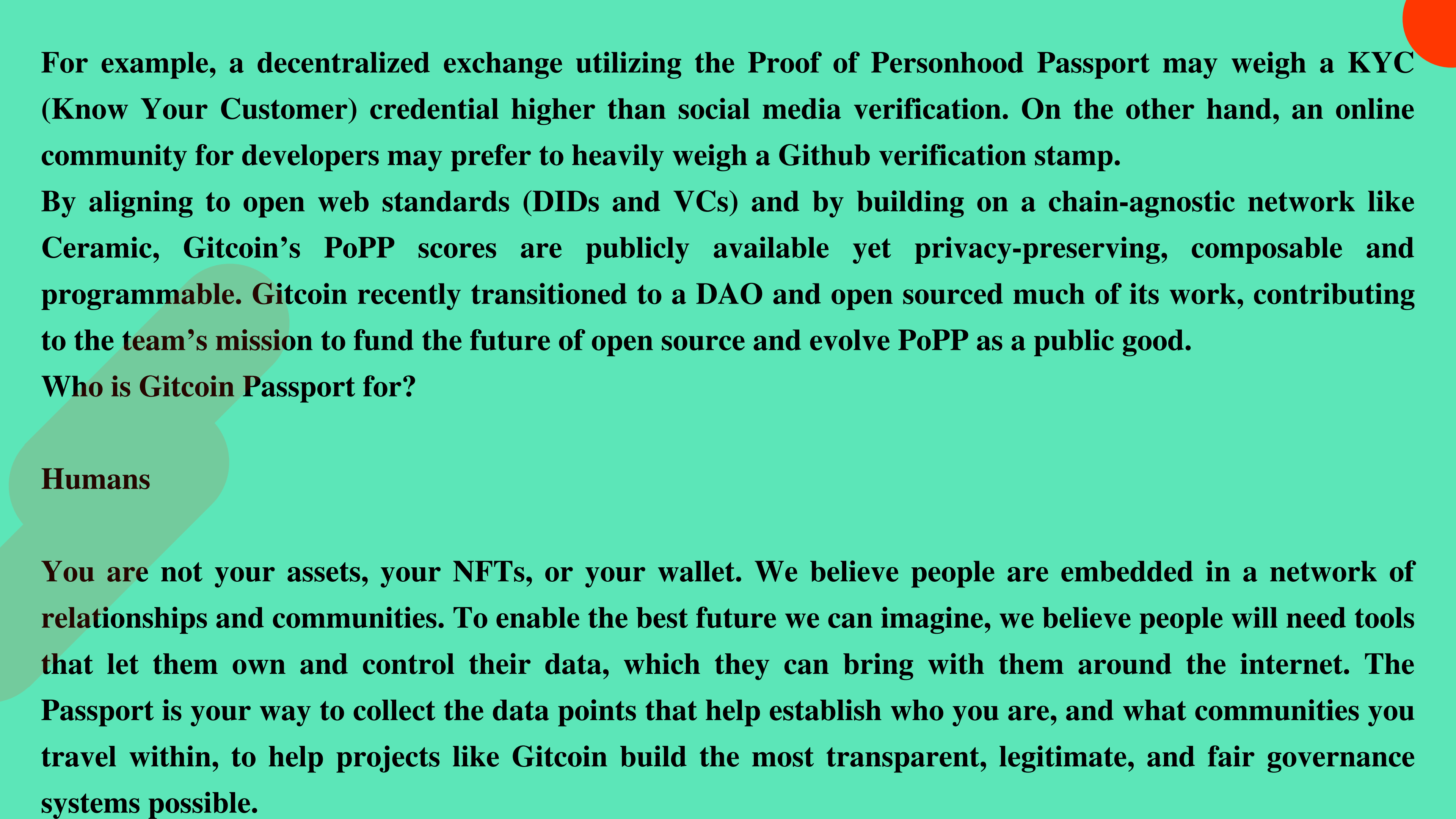
identity verification has evolved to take several variables into consideration, including training a Machine Learning model to detect adversarial behavior. By introducing these mechanisms, between Grants Rounds 9 to 11, the Fraud Tax paid out by the Gitcoin team has decreased from 6.6% of the pool to about 0.6%.

Now, for Grants Round 14, Gitcoin is unveiling a new proof-of-identity system, the Proof of Personhood Passport built on Ceramic. the Proof of Personhood Passport aggregates the top identity providers across Web2 and Web3 into a single transportable identity that proves one's personhood.

The Proof of Personhood Passport leverages Ceramic to link a user's Ethereum address to a Decentralized Identifier (DID) which enables them to control streams of data on the network. As users verify their identity with various trusted third-parties, the Proof of Personhood Passport signs and issues "stamps" to the user's Passport that publicly attest to the user's claims. Behind the scenes, these are Verifiable Credentials (VCs) that are stored on the user's Ceramic streams. These credentials are then used to calculate a weighted Personhood Score that secures the Quadratic Funding mechanism.

Gitcoin is launching the Proof of Personhood Passport as a decentralized utility and soon, as a public good, allowing any team to assign custom weights to issued credentials and calculate their own Personhood Score.

For example, a decentralized exchange utilizing the Proof of Personhood Passport may weigh a KYC (Know Your Customer) credential higher than social media verification. On the other hand, an online community for developers may prefer to heavily weigh a Github verification stamp.

By aligning to open web standards (DIDs and VCs) and by building on a chain-agnostic network like Ceramic, Gitcoin's PoPP scores are publicly available yet privacy-preserving, composable and programmable. Gitcoin recently transitioned to a DAO and open sourced much of its work, contributing to the team's mission to fund the future of open source and evolve PoPP as a public good.

Who is Gitcoin Passport for?

Humans

You are not your assets, your NFTs, or your wallet. We believe people are embedded in a network of relationships and communities. To enable the best future we can imagine, we believe people will need tools that let them own and control their data, which they can bring with them around the internet. The Passport is your way to collect the data points that help establish who you are, and what communities you travel within, to help projects like Gitcoin build the most transparent, legitimate, and fair governance systems possible.

Projects

Play to Earn, Professional reputation and accreditation, and Digital Democracy all rely on one human one account systems to function. Currently, this is an open problem space, and the Gitcoin Passport is our first best attempt to establish a standard way to bring evidence of personhood to these systems. Integrating the Passport into your application will help you lower your surface area for Sybil attacks, and enable new mechanisms for accrediting accomplishment, and new mechanisms for governance, all while building re-usable "reputation legos" that your users can take with them around the Web3 ecosystem.

Communities

Helping your community members self declare their membership with the Gitcoin Passport is a powerful new way to build toward the Decentralized Society. There are powerful new democratic mechanisms that can help the whole ecosystem thrive by giving users the ability to collect provable and secure datapoints that represent not just their identity, but their identity as it is revealed through its connection to communities. If you are a community that has a membership base that would be interested in using the Passport.

the new identity management