

A Decentralized Blockchain Bridge Ecosystem

Eric Muysen
eric@hyperbridge.org

Timothy Ko
timothy@hyperbridge.org

Joe Cullen
joe@hyperbridge.org

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Abstract

This paper provides an overview of the emerging blockchain landscape; the problems blockchain seeks to solve; and the issues that arise related to technical architecture, apps, currencies, and lack of interoperability between “bordered” networks. In summarizing the current status and growth trajectory of blockchain: its high level of decentralization; the rapid and multifaceted market participation; and the lack of coherence and usability, it becomes obvious that order must be brought to the chaos. Hyperbridge is the order, providing coherence and organization amongst the decentralized blockchain ecosystem. In essence, Hyperbridge is a platform; a suite of services comprised of an engine and extensions suited to the seamless navigation and utilization of a growingly fractured and segmented blockchain atmosphere. A Network Access Token will be used as a common currency to operate within Hyperbridge.

Executive Summary

Blockchain is poised to disrupt many industries by taking traditional centralized databases, with their inherent inefficiencies, and replacing them with distributed databases that introduce new levels of trust, transparency and immutability of data. Organizations around the world are developing specific blockchain solutions to problems in almost every industry. This problem-attack model proposes to ameliorate, and in some cases, eliminate, matters of inefficiency in established and stagnant industries, such as the ad-buying space and banking, while creating new interaction models for industries yet unborn, such as the internet of things (IoT). Democratization has resulted in choice and decentralization, and has created multiple platforms in which developers can launch products.

ETHEREUM, NEO, EOS, and BITCOIN, to name but a few, are unique blockchains with different value propositions, each clearly demonstrating utility. While developers tend to make rational and intelligent choices regarding which platform they use to build upon, this process has inadvertently resulted in the establishment of borders, creating blockchain “nation-states” in the process. The issue that arises from these platforms all serving as coding bases, is that the access mechanics necessary to interact and develop on these platforms requires specific computing standards, coding languages and currencies.

The aforementioned state of blockchain has resulted in a non-unified environment and an inconvenient participation experience; one that requires the ownership and management of multiple wallets and currencies to purchase, hold and utilize tokens on all platforms. Add to the process a sometimes arduous or costly fiat-to-crypto purchasing requirement, often through a centralized exchange, then the process becomes inaccessible to the point of excluding those not intellectually primed or financially invested in the blockchain sphere.

The non-unified environment also presents issues for developers. Ongoing participation rates, post ICO, must reach the volume necessary for full-realization of proposed business models. In short, developers who are unable to reach and integrate users into their interaction models will falter. By introducing prospective participants to blockchains and DAPPs, we will create the market-user condition necessary for success.

Blockchain requires a bridge between users and developers: a convenient, indexed marketplace and integration platform. Historically, maximum utility in the market placing of goods and services has been precipitated by aggregation, and through the convenience brought through ease of search and transactability. Think of the internet prior to search engines and online shopping before Amazon. The network effect is reliant on a user-base that seeks solutions, and a portal or platform to connect the seekers and providers of solution. Moreover, as blockchain is integrated into the established web viewing experience, solutions will be created to satisfy user concerns related to security and monetization of data. In this white paper we will detail how we will achieve this network effect through the creation of a bridging environment that incentivizes, simplifies, and secures both user exploration function, as well as developer product showcasing.

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1 Introduction

1.1 The Problem

With ICOs coming to market daily, an increasingly dynamic blockchain and cryptocurrency atmosphere is providing needed, industry-wide solutions. As such, investing in innovation has never been easier (by mid 2017, ICO crowdfunding had outpaced traditional venture capital¹), but rapid rate of investment growth has exceeded user participation. This disparity in growth rate results in a token value graph that demonstrates a speculative spike around ICO and a taper downward, to zero in some cases, as most tokens are not utilized, or as investors reallocate their investments. There are billions of tokens held and traded but how many of them are being used for their intended on-network or in-app purpose?

With some very basic investigation, it is apparent that the original utility designed into tokens is not currently accessible. In part, this is due to the absence of user volume, which is necessary to create the network effects and interactions proposed within projects. At present, token acquisition and holding are largely speculative, and most tokens will decline in value because they are not practically useful. Market value follows market utilization. As such, the token offering landscape will continue to expand at a rate that creates gradual dilution of value for most ICOs, as innovations outpace adoptees.

To achieve the blockchain network effect a coherent ecosystem, tailored specifically towards the integration of newly arising technologies, must be developed. In the long-term, as the structural foundation of data-reliant technologies shifts, blockchain will impact our everyday lives. In the coming years there are many problems to solve. Developers have no common marketplace to reach users; similarly, users have no common marketplace to browse applications. Broad spectrum use cases are primed to explode, but users and developers are waiting for a platform on which to meet.

On a macro-level, more support from the broader economy is required, but commercial interests will not integrate blockchain processes in the absence of users. Real world blockchain applications

1.2 Our Solution

Tailoring emerging technology to existing solutions is necessary to increase ease of use and promote adoption. We propose to implement such an ecosystem, the Hyperbridge ecosystem of blockchain-enabled users. Finally, there will be a unified point of access for users to view, search, manage and interact with their blockchain experience, while seamlessly using the conventional web 2.0 experience they are familiar with. In addition to the convenience of interacting with blockchain, users will find themselves empowered for the first time, gaining control of their attention, data, privacy, and computing power, with the opportunity to monetize these elements at their discretion.

By creating the user base, developers will finally have a ready audience to adopt the solutions they have created, and will create in the future. On the developer side, we will be providing all necessary tools and consultation to integrate blockchain and app solutions to our platform. The gulf between producer readiness and user availability will be bridged, as there will be a common platform on which to meet, thus the next era of information will begin.

We will develop and publish the application ecosystem, herein named Hyperbridge. It will be available for all major platforms: Windows, Mac, Android, and iOS. In the future, it is possible to publish for Xbox, tvOS, Vive, HaloLens, et cetera. In doing so, we will provide an improved user experience tailored to the operational capacities of those platforms.

1.2.1 Platform

Hyperbridge will initially launch as a desktop application capable of augmenting the standard web browsing experience, as well as managing the blockchain experience. To enable a broad array of functionalities and use cases we will be engineering a hyper-secure suite of identity and currency management features. Preloaded features will allow new users to quickly acclimate and monetize; while seasoned blockchain users will easily export their wallets and currencies into the app and use it to manage their blockchain life, whether that be trading, investment, research, or development. Wallets that hold, transmit and receive tokens and currencies will be easy to add to user profiles, and several of them will come preloaded upon download and installation of Hyperbridge.

In addition to a suite of pre-loaded features, the app marketplace will allow users to create distinct experiences based on their individual aims. Trading based features such as, price tickers, currency exchange integrations and news services will be present and installable in the app marketplace. Features related to data management such as VPN, user-permissioned data monetization, and monetized ad viewing will also be available for integration on the marketplace.

Though the initial application suite will be built by Hyperbridge, future application developments will not be exclusively proprietary, in that outside developers will be incentivized to build features for the platform. Our primary goal is to create an ecosystem that enables organizations to bring their blockchain solutions to market, and in the hands of users. We are building easy to use tools and specifications for blockchain/app developers that will be integrated into this ecosystem. Our specifications will be open source, free for anyone to integrate, re-use and improve.

1.2.2 Governance

Hyperbridge will make use of smart contracts for decentralized governance of the ecosystem. Governance will be in the form of a Republic with 11 seats. Initially, Hyperbridge Technology will hold all seats, with the goal of onboarding leaders in their respective industry, or

open it up to a vote. When all 11 seats are occupied, the Token Holders will gain primary voting rights over the members of the Republic. Voting power will be a 40/60 split, with the Token Holders having 60% (1,000,000,000 voting shares), and The Republic having 40% (666,666,666 voting shares). One NAT token will be worth 1 voting share. Republic seat holders (“Delegates”) are required to abide by rules of governing the ecosystem (“Constitution”). The Constitution outlining the specific standards of this model is in development and will be made available to the public before Delegates are appointed. Delegates can be voted in and out by majority rules. If a Delegate is going against the will of the community, other Delegates are incentivized to uphold the will of the people (or provide a sufficient argument to convince people otherwise) so as to protect their seat. We believe 11 Delegates is small enough to provide enough decentralization and balance, while being small enough to coordinate on changes to the system. We believe a 40/60 stakeholder balance provides the community with enough power so that if they need to use it they can, but not so much that it’s too distributed and unfocused. Most of the time, the Republic can operate without need for community voting. In rare circumstances, the community may need to vote for major changes or seat holders.

2 Marketplace

Hyperbridge will have an accessible and conducive marketplace for third-party developers. We are actively seeking to build integrations with both established and emerging players. Because of this dynamic, participatory and multifaceted environment, there are many possibilities for how users will design their specific experiences. Our marketplace will function similarly to the Google Play Store, Xbox Store, et cetera. Users will be able to purchase/upgrade features, using any supported wallet (initially Ethereum/Bitcoin). There will be a nominal Network Access Token fee for these transactions.

When a developer submits their app to the Marketplace, it won’t be immediately visible. Apps will become visible when they have positive support from the Republic. Apps do not require voting from the full Republic, but must maintain more positive votes than negative votes to be in the “published” state. If an app has more positive votes than negative votes, it will become visible in the Marketplace. In this way, only a single positive vote from a Delegate is required to publish an app. If an app initially received a positive vote from a Delegate, and later was found to be compromised, it only takes a single negative vote from a Delegate to be removed (as the positive value is only 1). However if the app has originally received 2 positive votes, it will require 2 negative votes to be removed (because the positive value was 2). This allows Delegates to efficiently moderate the Marketplace without over-deliberation, and while preventing manipulation by a rogue Delegate.

With the creation of a highly searchable app marketplace, users will be able to find, download and integrate applications for their desired use cases. We will now outline a few of those below.

2.1 Identity

Many of the more valuable use cases provided by emerging blockchain technology are dependent on reliable identification. Hyperbridge will support various identity providers (potentially Civic). Users will be able to add their identity, and apps will be able to integrate solutions that make use of a secure identity management protocol (e.g. for certification or license management) (see 2.6).

2.2 Data

The world is becoming increasingly concerned with privacy, and awareness for the value of data is at an all time high. According to the 2017 Global Consumer Trust Report², across major countries on 3 continents 86% of consumers had taken various action as a result of trust concerns. Since inception, there has been criticism over the way social networks and services on the Internet collate and monetize data, but concerns have been largely ignored. Following a rapid rate of increase in adoption of the services of data collecting entities, the public is increasingly conscious of securing their data rights. Companies tend to be averse to implementing data protocols that could upend their revenue models, and as such responsibility for securing data rights falls on the user.

Every piece of data a person sends and receives has value, and is monetized and commodified by some platform or another: be it Google, Facebook or Twitter. These internet giants make vast sums of money from your digital footprint, while also putting your security and anonymity at risk. Hyperbridge will integrate applications that manage access to data, ensuring that if data is collected and monetized, it is not done surreptitiously, and that it benefits the originator.

2.2.1 VPN

Central to the management of data rights is privacy. VPNs are now considered a basic internet security protocol. Beyond the general implication of data vulnerability related to everyday web browsing (e.g. banking, communication, entertainment) the high value nature of crypto-currency necessitates that very stringent protection mechanisms be in place, as to avoid hacking and theft. Hyperbridge will integrate secure data tunneling services that ensure information, both sensitive and innocuous, is protected end to end.

2.2.2 Monetization / Basic Income

Due to the current economic framework related to data consumption versus data creation, a disparity is obvious given that the group that creates data, that is then sold to marketers, sees no economic benefit from the process. As billions of dollars is generated from the sale of data,

compensation is due. Although theorized as a basic right¹, the maintenance of privacy and protection of personal data has and will remain a user responsibility. Institutional support of data rights still lacks, as protections and equity models have not been built in to this largely corporate sphere. From privacy to fair compensation for the use of your data, we contend that equal data monetization will be the vanguard of the next era of internet rights, but as with privacy, it must be initiated and facilitated from the user end. Hyperbridge will actively work toward this goal of fair data monetization, as personal information collected through the platform will be designated, at the user's discretion, for monetization.

Mining and/or staking of users' computing capacities or tokens will also be available at the user's discretion, enabling further optimization of user's latent capacities for income generation. Users will be given an easy-to-use flow to begin mining, with more detailed options for power users. The user can simply choose the resources they want to allocate to mining, and they can rent their resources. A nominal amount of NAT will be required as a fee. Initially the fee will be recorded locally and charged in one pass when sufficiently accumulated, however in the future will use a persistent and economical state channel.

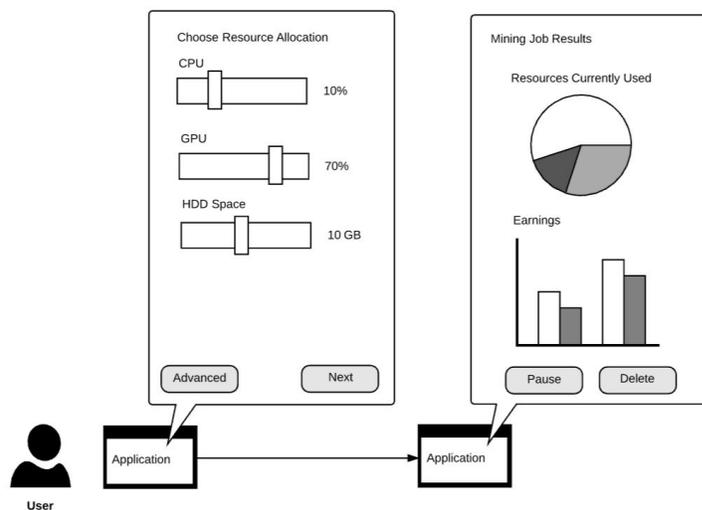


Figure 1: Basic UI for renting computing resources and monetization results.

¹ *CHARTER OF FUNDAMENTAL RIGHTS OF THE EUROPEAN UNION*, Article 8 Protection of personal data, “Everyone has the right of access to data which has been collected concerning him or her, and the right to have it rectified.”



Figure 2: Advanced UI for renting computing resources defining exact flow taken.

2.2.3 Attention

We are now seeing services designed to return the value created through data to those that have created it.

Attention swapping seeks to replace traditional web advertisements with ones coming from a blockchain publisher network, such as the Basic Attention Token (BAT). It will allow users to configure how they would like advertisements displayed, how often, and how much they would like to earn on a specific number of impressions. To facilitate a user-centric experience, Hyperbridge would show, ad view frequency, history and publisher pool matches.

BAT is the first of many potential participants within this space. We will seek to integrate whomever will benefit users most, striving to work with those that demonstrate the most potential for market adoption.

2.4 Recommendation Engine

Currently, there is a lack of interoperability and communication between entities and organizations, or services, that house impressions of user profiles and tastes. Going beyond the inefficiencies that come from having to constantly establish new profiles as new services emerge, there is a call for a streamlined and congruent user profile, that maintains user data along a multitude of channels. The benefits of more permanence and transportability is that user identity can build and evolve over time versus having to consistently re-establish tastes and preferences. In addition, it sets the user up for more meaningful and targeted marketing engagement.

In the early 2000s, the way the world consumed music changed dramatically. People went from physical discs, to completely digital, to completely online. Many services were created trying to capture this burgeoning market: Spotify, Rdio, iTunes, Google Play Music, etc. Shortly after, services were created to analyze and profile music for their users, so they could keep track and share the

music they listen to and also receive suggestions (e.g. Last.fm, Pandora, etc.). In the last decade, there has been rapid switching between different services; however, each time the user loses their data, history, favorites, et cetera. Each of these services is a black box, and the ones that are not require custom integration. There is a trust problem within this space.

A solution to this dysfunction and inconvenience can be solved through blockchain. If music providers saved data on the blockchain, trusted services could access that data to improve customer experience. Services could analyze recent listening habits across all blockchain connected services and give better artist suggestions, local concert ticket sales, new albums in the marketplace, and other ancillary services. Using Hyperbridge will facilitate this reality.

How can this be achieved? Spotify could record listening history into NEO, while Ticketmaster encodes ticketing history into Stratis. Hyperbridge would create a transaction on the Ethereum network that has a reference identifier to the history on both NEO and Stratis, indicating the person on Spotify also has associated ticket history on Ticketmaster. It could include granular permission, that the user has allowed.

In the absence of blockchain integration, unique user preferences and profiles can be set up independently, but will never achieve the seamlessness and specificity of user experience made possible through a blockchain enabled recommendation engine. The vision is to have blockchain function in such a way that effort and inconvenience is shifted from users to an intuitive recommendation engine.

2.5 Smart Home

Society is quickly moving towards a persistently connected Internet of Things (IoT). For nearly every device in existence, somebody is building connectivity into it. Since Hyperbridge is connected to all major blockchains and deployed on all major platforms, it is in a unique position to service as a place to manage and communicate with smart homes and devices.

2.6 License Management

As technology adoption has grown, and more platforms enter the space, there has been greater support for multi-platform solutions. Software and games can now be deployed to Windows, Mac, Xbox, PlayStation. However, they are still licensed through central authorities like Microsoft, Sony, EA Games, Valve Corporation, etc. These authorities issue their own product serial keys, that are not compatible with other platforms. As a result, consumers are forced to repurchase the same product on more than one platform. This is another trust issue, and blockchain is poised to remedy it. Because of issues of trust between centralized databases, and integration difficulties between non-standard, cross-platform APIs, license issuing authorities will not likely communicate with each other to grant product usage on multiple platforms. With the blockchain, however, they can all operate with the same shared state, allowing them to service customers who own a product, even if not purchased through their licensing servers. This results in more freedom, better options, and savings that are passed down to consumers. This type of service will be in demand as

awareness spreads and industry leaders are pressured to maintain their competitive edge over the market.

Hyperbridge will act as a gateway for the biggest providers in the license management space, working with these oracles on integrating, either with our own smart contracts, or through an official partner offering similar services. These oracles can choose which oracles they trust to distribute licenses in their Trusted Oracle Group (TOG). We will also develop an official extension for the application that supports license management (i.e. digital assets) on the blockchain. Third-party developers will also be able to create their own extensions if they wish.

Below is a diagram detailing how we envision this will work:

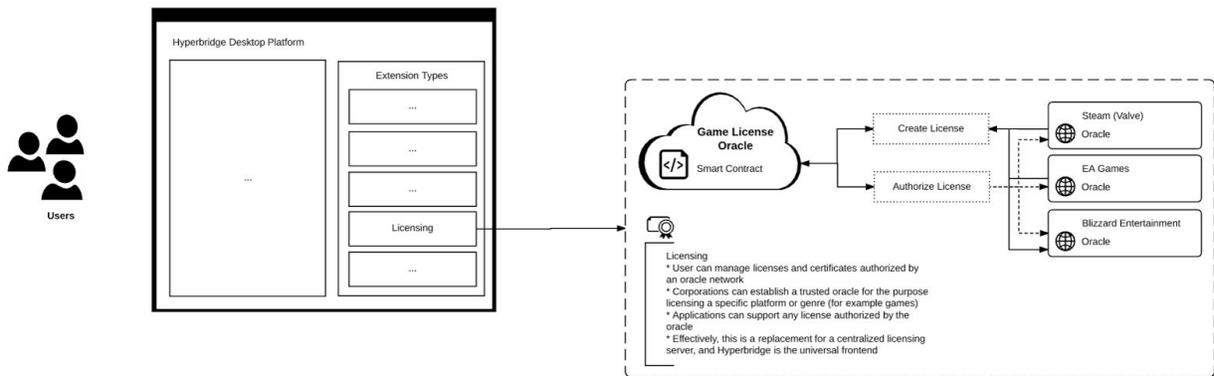


Figure 3: Example interaction of a Game License Oracle in the platform.

3 Proposed Integrations

3.1 Wallets

Hyperbridge will come with wallet support for Ethereum, and eventually all major blockchains. Many wallets exist to solve this problem, and they do the job well enough, but this functionality will need to be built directly into Hyperbridge to operate effectively. In addition, we may support existing wallet applications, such as Exodus or Jaxx.

Wallets will have the capacity to auto-detect specific blockchains and utilize the currencies necessary to operate within the environment. Trusted wallets on the Hyperbridge network can securely send funds to each other in ways that avoid the losses incurred in erroneously sending cryptocurrency to non-existent addresses, as Hyperbridge identity-linked wallets can operate trustlessly.

The following are proposed for near-term integration: Bitcoin, Ethereum, Litecoin, NEO, Monero, and Ark. See the Roadmap for details on future development plans.

3.2 Existing Network Improvements

Hyperbridge will act as support for specialty networks, bridging web experiences with the blockchain. Below are some hypothetical specialty network bridging use cases.

Example: GameCredits - Websites can detect if the visitor is Hyperbridge-enabled, and if so, let the user play a game integrated within the GameCredits network, enabling connection with their in-game items and so on. If they are not Hyperbridge-enabled, the website can suggest they download and install Hyperbridge. Using GameCredits network, it can save the user's progress, achievements, friends and more, automatically. Game platforms may be able to analyze the player history and give better recommendations.

Example: ChainLink - Hyperbridge could act as a frontend for the ChainLink network, which seeks to provide the backbone of coordinated oracle services. Such a service would work in tandem with our goal of improved license management and more. On a high level, users would be able to manage their chainlinks, and introspect them for more information on the oracles. For example, the user can simply paste the Chainlink URL to setup the weather network they trust, or local government food approval, etc. In this way, the app can adjust to people anywhere in the world.

4 Architecture Overview

4.1 Network Access Token

Hyperbridge will issue an ERC20 standard token on the Ethereum network, Network Access Token (NAT). There will be a limited supply of 1,000,000,000 NAT tokens. Hyperbridge will allow basic features entirely without NAT, however users will need NAT to access premium apps and features.

All precautions will be taken to secure the limited unchanging supply of NAT. We will take all precautions to secure the tokens, however in the unfortunate event of a hack, we have prepared a plan. If a significantly large sum of NAT has been stolen, minted, or burned, Hyperbridge will reissue the tokens on a new smart contract to represent the authentic token state of a point in history before the hack took place. Hyperbridge will then need to work with integrations to migrate to the new contract. In the future, it's possible Hyperbridge will support NAT on more blockchains than Ethereum. If this is to happen, Hyperbridge will not inflate the number of tokens. A smart contract would be created for new blockchains, with 0 NAT, and users will be given a way to convert the NAT they own on Ethereum. At any one time, there will only ever be 1,000,000,000 tokens across all blockchains.

NAT will have various uses in the Hyperbridge ecosystem. NAT will be required for specific operations within the ecosystem, including:

- Premium features (such as built-in VPN, mining, etc.)
- Unlocking marketplace apps
- In-app purchases/upgrades
- Publishing apps
- Fees from transactions, mining, and other non-basic operations

There will be a number of contracts in the Hyperbridge to facilitate the operations of the ecosystem.

- Data Storage Smart Contract
- Token Pool Smart Contract
- Token Reserve Smart Contract
- Constitution Smart Contract
- Marketplace Smart Contract
- User Profiles Smart Contract

4.1.1 Data Storage Smart Contract

Hyperbridge will use a smart contract for the organization of user data. When a user synchronizes their data, Hyperbridge will first encrypt their sensitive data and insert it into IPFS. It will then execute this Ethereum contract with a reference to that data blob and some metadata (for organization and searching). User sensitive data will then be removed from their local machine. During synchronization, this contract will be checked for new changes. During migration, the full history will be downloaded from this contract and used to collect data for migration to the destination blockchain.

4.1.2 Token Pool Smart Contract

Inside the application, users will be able to buy NAT in exchange for ETH (that they've deposited to their wallet). They can purchase immediately based on the previous day auction price, or they can contribute to the auction, and their tokens will go into the daily pool, where the NAT token price is calculated based on the demand (how many ETH have been sent). Conversely, users will also be able to sell their NAT for ETH at market price, or contribute to the daily pool. At the end of each day, Hyperbridge will contribute to the pool if it's low (see 4.1.4 for details).

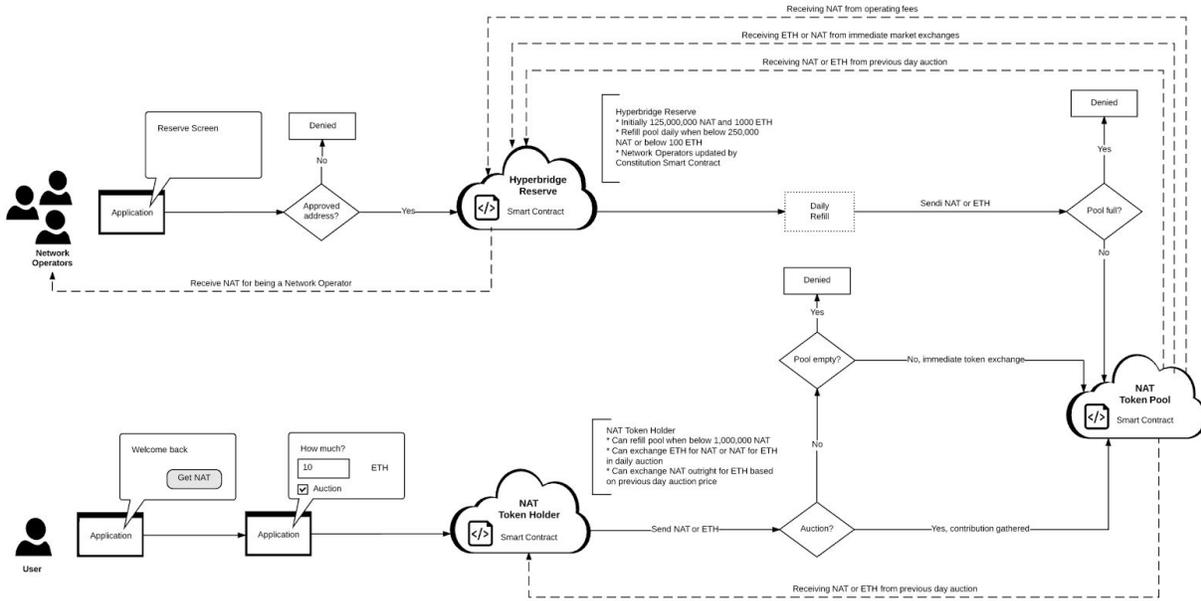


Figure 4: Operation of the Hyperbridge Reserve with Token Holders and the Token Pool.

4.1.3 Token Reserve Smart Contract

After the Token Generation Event, the Token Reserve will be funded with 125,000,000 NAT and 5% of ETH funding. The reserve is used to refill the Token Pool daily, so that NAT tokens are always available for sale inside the application. Refilling will only happen when pool is below 250,000 NAT or below 100 ETH (see 4.1.2 for details).

4.1.4 Constitution Smart Contract

Governance of the Hyperbridge ecosystem will be decentralized, as described in section 1.2.2. This smart contract will allow staking of NAT tokens as a vote for a Delegate. Other smart contracts in the system will check the 11 Delegates defined in this contract to determine governance rights.

4.1.5 Marketplace Smart Contract

All the extension information such as the UUID, name, bytecode reference, version, et cetera will be stored in a smart contract, which will ensure the immutability of the extension source code and features. The marketplace in the Hyperbridge platform will be a browser for the approved extensions in the smart contract. Users can pick the extensions they desire, and the the installation details will be fetched through a call to the smart contract.

4.1.6 User Profiles Smart Contract

Hyperbridge user profiles will be stored in a smart contract that includes their personal information such as ID, name, et cetera. In addition, users can store their private keys such as wallet keys or extension specific access keys. All data will be encrypted to ensure the security of the user's data. Users can only decrypt their own data with their own private key, and 2-factor authentication if enabled (see 4.2.4). After installing an extension, the UUID will be added to an extension list in their profile, in addition to metadata such as the version of the extension. The user will be asked for the permissions they are willing to give to the extension, and the selected permissions will be stored in the smart contract data. The user can revoke or opt out of these permissions at anytime.

4.2 Application Framework

The Hyperbridge Application Platform is a powerful [computing platform](#) capable of being extended by third-party developers. Users can install extensions. Extensions can interact and utilize the Core Framework through the Extension Bridge over an API communication layer. The Core Framework comes with a number of components, as seen in the diagram below.

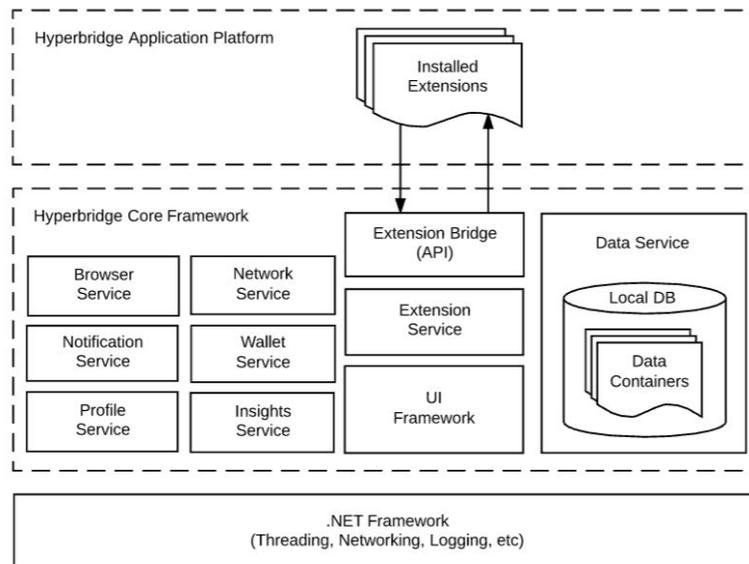


Figure 5: Architecture of the Hyperbridge Application Platform.

4.2.1 Extension Security

When extensions are loaded by the app, the bytecode representing them is scanned to validate they contain no malicious behavior. Additionally, extensions are limited in what operations they can access in the main application.

4.2.2 Bytecode Validation

Apps are built into bytecode, and thoroughly validated for security before execution within Hyperbridge.

4.2.3 Access Control

When Hyperbridge boots, it will load installed extensions. These extensions are notified by the initialization event and given access to approved capabilities specified by the user. Of the two main approaches to securing computer systems, the one most familiar is Access Control Lists (ACL), where the access permissions are defined on the object in question (e.g. a file) and in terms of defined agents (e.g. user accounts). The object-capability model turns this on its head and represents the capability to access a resource as a bearer token, which itself can be copied and transmitted. This is a computer security model: capability describes a transferable right to perform one (or more) operations on a given object.

Users can manage the capability permissions of extensions within the desktop app. The app will send an unforgeable reference (uref) in an event to the extension, granting it the capability of certain objects. For example, the app would send a message to the Wallets extension, allowing the capability to call the Wallet Service objects' Add Wallet operation.

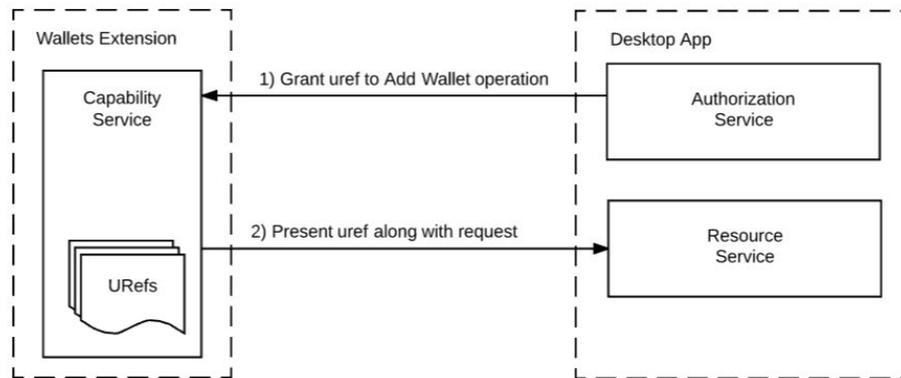


Figure 6: Authorization between an extension and the desktop application.

4.2.4 Data Containers

Data containers will be encrypted with 2-factor authentication, using a physical hardware wallet, such as Trezor or Ledger.

4.3 Desktop Application

The Hyperbridge Application Platform is a powerful [computing platform](#) capable of being extended by third-party developers. Users can install extensions. Extensions can interact and utilize the Core Framework through the Extension Bridge over an API communication layer.

4.3.1 Blockchain Synchronization

Hyperbridge will by default store data in a local database, and provide an option to sync data to the desired destination blockchain on a periodic interval or manually on demand.

4.3.2 Migration Assistant

Hyperbridge will come with the ability to migrate data between blockchains. Initially we will support IPFS, but as more options become available, users may want to switch. They may also want to store different data on different providers. Hyperbridge will allow storing Data Containers separately across various providers (see 4.2.4). There will be basic and advanced modes available.

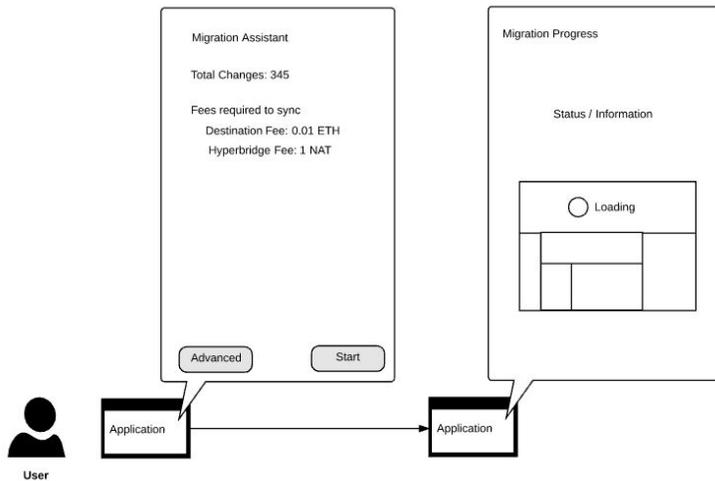


Figure 7: Basic UI for a data migration assistant.

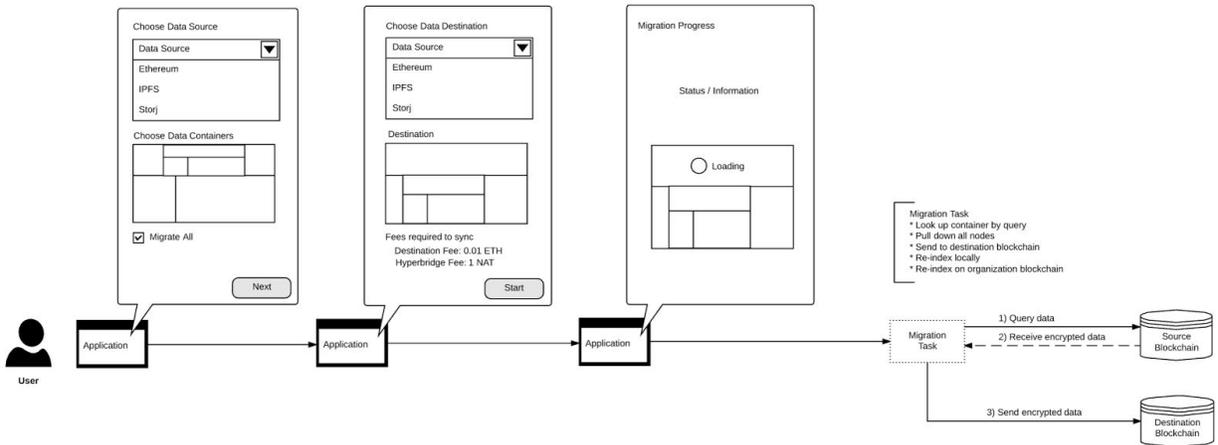


Figure 8: Advanced UI for control over exact steps taken in data migration.

4.4 Mobile Application

Hyperbridge will port the desktop application to mobile, initially with a subset of features. As there are limitations on mobile operating systems, Hyperbridge will only be able to support integrations via Inter-App Communication (e.g. URL scheme appname://hyperbridge). In the case of large data, assuming the application has gone through proper authentication, it will be given a reference to the tree of data on the associated blockchain (see 4.1.1).

4.5 Browser Extension

Hyperbridge will automatically detect your browsers and suggest an associated browser extension to install that will improve the user experience. Initially it will support Google Chrome, Firefox and Internet Explorer support will be added in the future. Inversely, the Hyperbridge Browser Extension will detect if you have the desktop app installed, and if not, require the user to install it. The official Hyperbridge Browser extension only pipes data to the desktop app, and as such does not do any processing.

Below is a diagram showing how the browser will communicate with the Hyperbridge Application Platform running in the background.

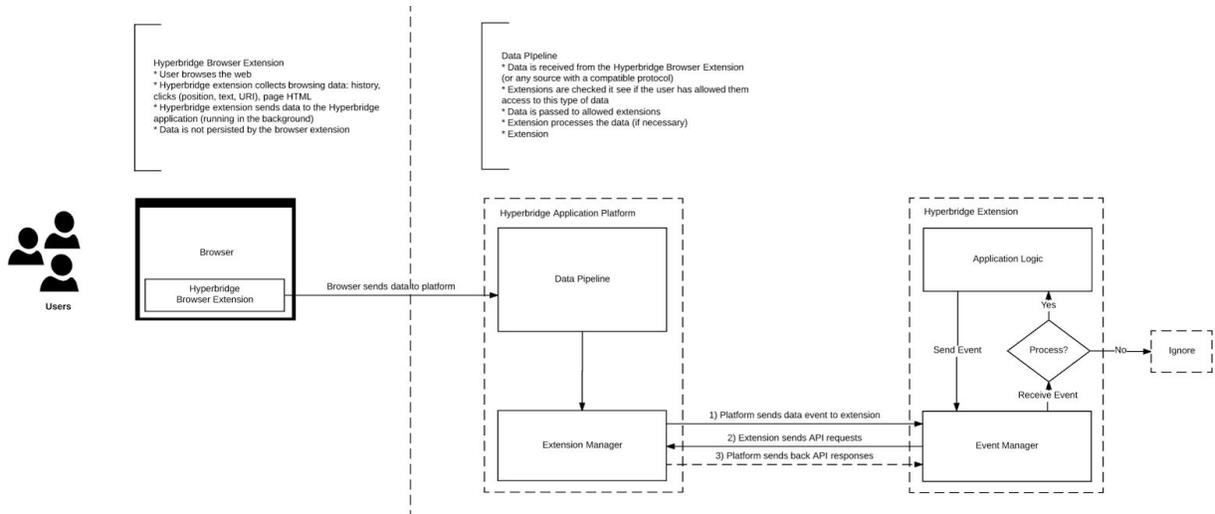


Figure 9: Utilization of data gathered during a user browsing experience.

4.5.1 Integration

Apps will be able to integration into the Hyperbridge ecosystem in 3 ways:

1. Official Hyperbridge extension
2. Website (via a Hyperbridge-enabled browser)
3. Inter-app communication

All of these integrations will use a standard API (defined in section 5.2).

4.5.2 Commands

The Chrome extension will send commands to the desktop app, which will figure out which extensions need to know about them and have permission to know about them. The extension's OAuth token will be checked to see if it has permission to access that command.

Please see Section 5.2.1 for more information.

5 Extension Development

Organizations and independent developers will be provided tools to develop custom extensions for the application ecosystem.

5.1 Extension Creation

To build an official Hyperbridge extension, developers will need to download the development tools for the Windows or Mac operating system. The Extension Starter Kit comes with

all the tools needed to start building a Hyperbridge Extension (See 3.2). Extensions are written in C# (currently 4.6), although C/C++ could be compiled into a shared dynamically linked library (DLL) to be used as well. The starter kit includes a customizable build pipeline for exporting extensions used in Hyperbridge. Each extension has 1) the resources bundle and 2) the compiled source bundle. After the extension has been created, it can be uploaded to the blockchain using the tool provided. Alternatively, we will provide instructions for uploading directly to the blockchain manually.

It is possible to upload an extension to the marketplace that is not using the official development tools. There are 3 types of extensions that can be uploaded.

1. Official Hyperbridge extension bundle
2. Website hyperlink
3. App schema hyperlink

5.1.1 Resource Bundle

Hyperbridge Development Environment will include assets you can reference in your extensions, and you will be able to include your own custom assets as well.

5.1.2 Source Bundle

Hyperbridge Starter Kit will compile C# into an bytecode known as Common Intermediate Language (CIL) and package it into a source bundle for use in the Hyperbridge application. This bundle can be loaded into the Hyperbridge application manually via the filesystem or URI, as well as through the Hyperbridge Extension Store once published.

5.2 Protocol

The Hyperbridge ecosystem will use the JSON.API standard for all communication. All commands documentation can be found in the Hyperbridge API Documentation.

Apps will be able to communicate over this protocol in various ways, for example:

1. Developer builds an official Hyperbridge extension using the Hyperbridge Starter Kit, which provides a communication library.
2. Developer builds a custom app, and uses Inter-App Communication with the standard API.
3. Developer builds a customer website, and supports Hyperbridge-enabled browsers using the Hyperbridge Browser Extension.
4. Developer builds a custom browser extension, and uses Native Messaging with the standard API.

5.2.1 Commands

Both the desktop app and the extension have a message broker (also called message bus or message queue) that sends and receives JSON messages, called commands. This is similar to libraries like RabbitMQ or ZeroMQ.

Commands will come in from the desktop app and browser extension. The desktop app will figure out the extension has the permission to know about the command and pass it along. It uses the extension OAuth token for the permission check.

Additionally, the desktop app will send commands to the extensions from time to time. For example, during startup or when the user takes action.

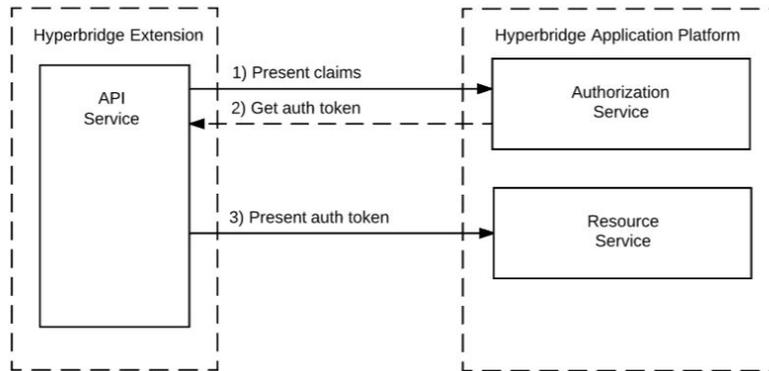
When the extension receives a command, it deserializes it, and determines if and what it should do with it. Each command's value is an encoded string of valid JSON API which can be deserialized into C# objects.

5.2.2 Authorization

Authorization in Hyperbridge will be done with the [OAuth protocol standard](#). OAuth allows us to provide secure authorization to Hyperbridge capabilities to external apps. OAuth is used by leaders in the tech industry, including Google, Facebook and Apple. The steps for client authorization are displayed below:

- The client presents some claims to the Authorization Service, including identity and the id and scope (capability) of the service it wants to access.
- The Authorization Service checks whether the client is authorized, and if so, creates an access token which is returned to the client.
- The client then presents this access token to the Resource Service (the service the client wants to use).
- In general, the access token will only let the client do certain things. In our terminology, it has been granted a limited set of capabilities.

The above provides an introduction, for further details please reference the [official OAuth documentation](#).



6 Neur Network Integration

Hyperbridge has partnered with NeurSciences LLC to act as an exclusive entry point to the Neur network through the Neur wallet. The Neur wallet will manage:

1. Cash in all major traded currencies
2. Cryptocurrencies, including NeurCoins and NeurTokens
3. Bank and Store Credit Cards
4. I.D. Cards, Licenses, Passports
5. Discount and/or incentive Coupons
6. Loyalty, Status Cards, Membership Cards
7. Event Tickets
8. Transit Passes, Transportation Tickets/Boarding Passes
9. Expiration, Appointment and Event Calendars

NeurSciences LLC will hold their ICO in February 2018, Hyperbridge will receive proceeds from the ICO for the development of the Neur integration.

7 Security Services

7.1 Certification Service

Hyperbridge Technology Inc. will offer certification for entities interested in bridging with our ecosystem. Certification will give users confidence in the authenticity and security of the provider's app. Contact partners@hyperbridge.org for more information on this service.

8 Long-Term Technical Strategy

8.1 Security Auditing

We will undergo regular security audits for the Hyperbridge software. We will use TLA+ software to run exhaustive testing and verification against our systems.

8.2 Standards Committee

A committee of the leaders in the blockchain and related technology space will be formed to oversee the progress of the open source specifications. We will work closely with regulatory and standard bodies, including but not limited to ISO, IEC, and W3C.

8.3 XR (VR/AR/MR)

Hyperbridge foresees great applications of the blockchain in the mixed reality space, and intends to be proactive. Hyperbridge can already be built for Virtual Reality, Augmented Reality, and Mixed Reality; however, it is not currently our focus to support such development officially. Eventually users will be able to connect their blockchain realm into their everyday life in the form of a heads-up display (HUD).

9 Existing Solutions

Hyperbridge is not currently aware of any similarly positioned players in the blockchain space. In the technology world, Hyperbridge takes a unique approach not yet offered.

10 Conclusion

Hyperbridge will be the transformative user and developer platform, bringing blockchain to the masses. As an application ecosystem, marketplace, management environment and developer toolkit, Hyperbridge is the unifying element, that the blockchain needs. Think of Hyperbridge as the connection to your blockchain life. When you surf the web, you are now a blockchain-enabled user. Through your blockchain-enabled browser, websites can interact with the Hyperbridge platform. In the beginning, it will allow you to control access to the data you produce, and in the near future, third-party developers will want to utilize your data to provide you with innovative blockchain solutions.

Acknowledgement

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