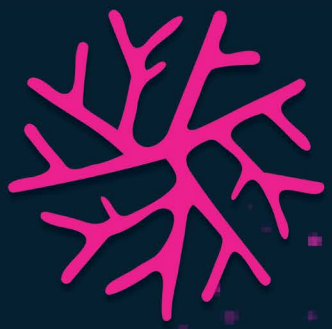

Synapse AI

AI economies on the blockchain

White Paper

V0.2.3

Abstract

Synapse AI
SYN Token
https://synapse.ai/

Synapse AI Inc.
v0.2.3 – Sept 29th, 2017

“The future is already here — it’s just not very evenly distributed.” -William Gibson

The future of the distributed and decentralized web (web3) is intelligent. There will be a universal intelligence layer running through and connecting all devices, services, and people. This intelligence must be accessible to everyone equally and as fairly as possible.

This intelligence will scale by, with, and through humanity. This task will be accomplished in stages, with each stage requiring its own economy. The SYN token connects these components and supports these burgeoning AI economies.

Instead of users training models and producing data for verticalized corporations, we believe in the future of the web will have three tenets: democratization, decentralization, and distribution. SYN’s work centers around these values.

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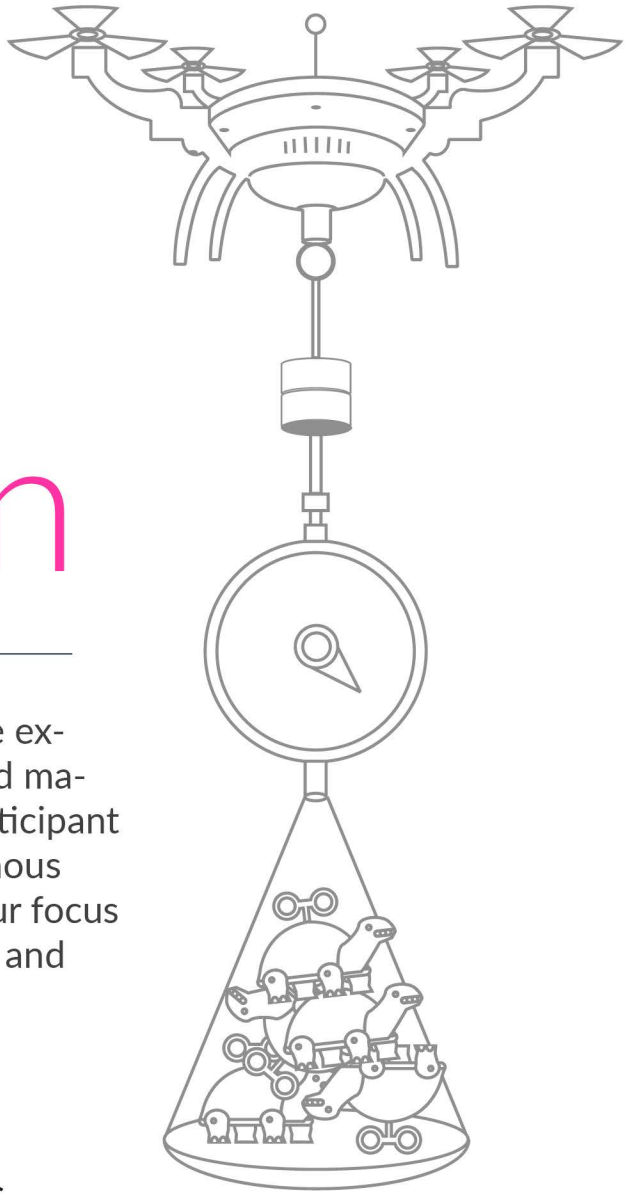
Value Proposition



We propose the SYN (Synapse) as a token of secure exchange between agents and their data, services, and machine learning models. We define agents as any participant in the network such as users, devices, and autonomous agents (bots, last mile robotics, etc). In particular, our focus immediately facilitates exchange of tokenized work and value around:

1. **Agents requesting, collecting, contributing, and brokering data**
2. **Agents training, confirming, and using models**
3. **Agent contracting one another autonomously**

In such, we create the world's network of global-scale intelligence gatherers, trainers, processors, and contractors that all other agents can access at any time. This accelerates a system that grows beyond the means of any single company's capacity.

2. Introduction

Previously, people have given their data away to companies in exchange for centralized access to applications and services. Unfortunately, the models created to serve these users were domain-specific and typically locked away in walled gardens making it difficult to scale and create efficient marketplaces beyond that of these services. Once a model was created, the economies of the model rarely in turn benefited the suppliers of the data.

We are decoupling data and models from domain-specific applications owned by existing monopolistic corporations. By introducing systems of infrastructure that enable a competitive landscape of intelligent marketplace participants, this will provide value and benefit to all equally.

2.1. Monopolistic Data Aggregation

People are already contributing data and building models for services they use for free and devices that act as loss leaders. From social media to email, search, and fitness, people are building closed models for companies every day.

Facebook uses messaging data to train conversational models of “M”, their messaging chatbot. Users train sentiment models on status, articles posted, and ads. This training not only acts to provide feedback for the contributors of the content, but also help Facebook build personas of the user and their tastes. These in turn determine how to surface relevant content on the news feed, increasing engagement and creating a cycle of training.

Google’s entire business model revolves around users collecting, tagging, and training models for them. These models in turn act as multipliers for experiences in their products. Gmail trains their spam filters by having users tag spam. Search uses queries and click-throughs to correlate relevance and train personas for ads. Android uses location services to capture how, where, and when we spend our time offline.

Amazon uses viewing and purchase history to create models of related and recommended products for you and others. The profit generated from these purchases is then reinvested to build out their logistics and supply chain, further improving their infrastructure.

Fitbit uses your data to help model your health and fitness, and in return provides suggestions and recommendations to achieve your goals.

Square's business model is to simply resell purchase data to interested parties.

The one thing these companies have in common is that they own, or desire to own, the entire pipeline from device to application. They have a monopoly on data for training these models and gathering these insights. This is good for the company, but once the data is acquired, filtered, tagged, and models trained, the entire benefit goes towards the companies involved and not to the contributors who helped facilitate them. Opening up both the data and the models in marketplace formats for access and services, we can create syndicates that provide the most benefit for humanity as a whole. This can be achieved by allowing organic exploration and discovery of systems of insight and intelligence.

2.2. Potential Data Marketplaces

One can imagine that opening up a structured query language and marketplace for data from various agents would mean democratized access to data for a more competitive landscape. This opens up more potential for contributors to benefit.

Genomic data is the first class of data that could be amazing in the hands of researchers. They can identify potential patterned areas capable of benefiting preventative medicine for everyone. Marketplaces for identifying particular traits one might desire to amplify are a potential use case.

Financial data for quantitative trading also offers a wealth of opportunity for data collectors, filters, and brokers.

IoT sensor data in aggregate could provide more predictive insights to crop yield, climate change, and meteorologic patterns.

3. Architecture

3.1. Current Technical Layers and Stack

The popular web3 stack exists with a blockchain, a currency, consensus protocol, and upper layers that can support a virtual machine. Beyond this we see the evolution of infrastructure and protocols to support higher-level applications. At the moment there are several service providers in both the storage and compute space such as Storj and Golem respectively.

The foundational infrastructure of SYN is thematically similar to previous paradigms, with decentralization, federation, and distributed philosophies altering how the technology is both contributed to and participated in. Contribution and work are tokenized and act as currency for services to be rendered and will be discussed in 3.3. Tokens.

To facilitate the next evolution in computing experience, the next component in these web3 layers must be intelligence. To democratize intelligence, we must democratize and responsibly liberate data. So really we get two layers.

You could call our contribution to the web3 stack the “data + intelligence” layers.

3.2. Components

To provide a fair and balanced intelligence available to all equally, we must create AI economies that any agent can participate in and receive some reward for doing so. In return, we tokenize the work (collecting, filtering, contribution, training, utilization) to facilitate an economy between participants.

We’ll begin by abstracting out services that have only existed in scoped domains and we will create a system of distributed component services that work together to enable economies at different stages and phases.

3.2.1. Core

To facilitate AI economies, we must first identify the components in this multi-agent system.

3.2.1.1. Agents

Agents are any participant in the system. These can range from users to firms to autonomous agents such as bots and robotics. Agents represent association and ownership.

The difference between agents and other components in the system is that agents represent decision makers, consumers, and are capable of being contracted out to acquire data not currently inside the system. An agent is further defined by Wikipedia as “an autonomous, goal-directed entity which observes and acts upon an environment.”

Agents create and contribute to data pools for personal and public use. Agents can contribute to in-the-loop data labeling, classification, and model training. Agents can subscribe to and use services that expose models for users.

Agents will use ontologies and indexes to query and identify points of interest inside the system, from keys, ownership, participation, wallets, services, pools, contracts, and requests.

3.2.1.2. Data Pools

Data pools represent single or correlated tagged/labeled data output from some source. Sources can be any type of agent or agents (aggregate), or can be syndicates of other data pools. General Access can be public or private, and can contain event (time, etc) constrained ACLs (Access Control Lists) with read and write access tokens for participants. Data pools can be static or dynamically updated, and contain a descriptive interface for their longevity. Data pools are accessed, contributed to, manipulated by all components of the system.

3.2.1.3. Models

Models represent the machine learning of behavior of some complex system. Typically these are neural networks, but are not limited in scope.

Models use data pools to acquire data to train models. Models have owners, and in turn may offer service entries to other models.

3.2.1.4. Services

Services are access points exposed through a set of schemas and APIs (Application Programming Interfaces) that allow agents, applications, and other services to contract utilities.

Services can be offered and negotiated across the marketplace. Services can be comprised of other services. Services represent models and data.

3.2.1.5. Ontologies

Ontologies/Taxonomies/Classifications organize the relationships between components. These can be public and private and created by any entity inside the system. These indexes create knowledge about relationships for lookups when establishing or negotiating actions. Ontologies can contain other ontologies, and can be both inter- and intra- ontologies. We might consider using the Domain-context-intent-action (DCIA) system for relevant resource lookups.

Ontologies can provide information about devices, interfaces, and data, as well as context and associate device information for machine learning models. This will be used as an index on what data is available, and what machine learnings models to use when.

3.2.1.6. Marketplaces

Marketplaces are open exchanges for participants to find and negotiate objects of value with one another, also known as an order book. Price for supply and demand of resources are set in open marketplaces. Once a suitable available deal is found, the contract is created and struck. The type of contract and details are dictated by the nature of the transactional services. A third-party scheme could provide the framework for the contracts.

3.2.2. Contracts

Contracts will be used to request and fulfill any transaction across the components. By tapping into Ethereum contract paradigms, we will be able to create any smart contract one might think of across the services.

3.2.3. Events

Events should be surfaced across interfaces to listeners subscribed to these events. This will require some pub-sub engine and dynamic table of subscribers. Event message format specification and hook point specification, when/where/what to event on, must still be defined.

3.2.4. Data Integrity

In order to ensure data integrity and quality, we must be able to define and identify both good and bad actors. There are multiple vectors for identifying and guaranteeing good behavior. The first is having data associated with reputable devices signed by the device manufacturer's keys themselves. We can further model bad actors on the network and identify them this way. We can use a reputation system for good actors and trust them to sign other good actors.

3.2.5 Security

Secure data storage and processing with secure enclaves will help protect data, along with further research and implementation of Trusted Execution Environments, and topics such as Fully Homomorphic Encryption, and Secure Multi-party Computation.

3.3. Tokens

Tokens are the main unit that represents an agreement of exchange between the two parties conducting some transaction. They can represent tokenized work from agents, or potential value of data repos, or utility of models themselves. Tokens transfer this value to the parties involved.

Tokens are kept in electronic wallets that can be stored and accessed by any component a part of the system.

3.4. The Future is Distributed

Web3 represents a fundamental shift in both ethos and technology. Decentralized, distributed, and democratized services are at the core of this movement.
For the first time the blockchain and cryptocurrencies provide incentive, consensus, and provenance and can be combined and leveraged by an open community ecosystem of contributors. These contributors can now be rewarded for their work, and further this model can be extended to facilitate the economies of data collection and model training we are building.

3.4.1. Ethereum

Ethereum has a robust community of developers concerned with distributed and decentralized services. The Ethereum platform provides contract services, a developing framework for smart contracts, and reasonable models of work and stake. It has enough volatility to make its chain useful.

3.4.2. Blockchain Utility

Blockchains have previously been used as a ledger to store transactional data, with the intent to keep a tally of wallet balances. Along with the ability to commit transactions, you can also stuff the commit with other data such as pieces of code that map to some function. It can represent some asset that can be transferred from one party to another. In addition, blockchains abstractly represent the state of some system.

The introduction of pegged sidechains has offered new potential in creating domain-specific chains tied to the master chain, that in turn could represent domain-

scoped states.

Consensus is an integral part in agreeing on what chain is valid. Currently proof of work is done, but there is a desire to move to proof of stake on these systems. Consensus is a feature of the distributed and decentralized nature of the underlying peer-to-peer technology deployed.

While blocks are static, one can imagine deploying multiple chains where one represents total transactions, with a completely static block, and a complementary chain with dynamic blocks that represent the current state of the agent transactions on the first chain.

We might be interested in creating a chain with both public and private parts, as well as static and dynamic parts, mirroring much of what applications themselves look like.

A dynamic poly-chain approach might be best to separate concerns for state, security, access, transactions, storage, and contracts.

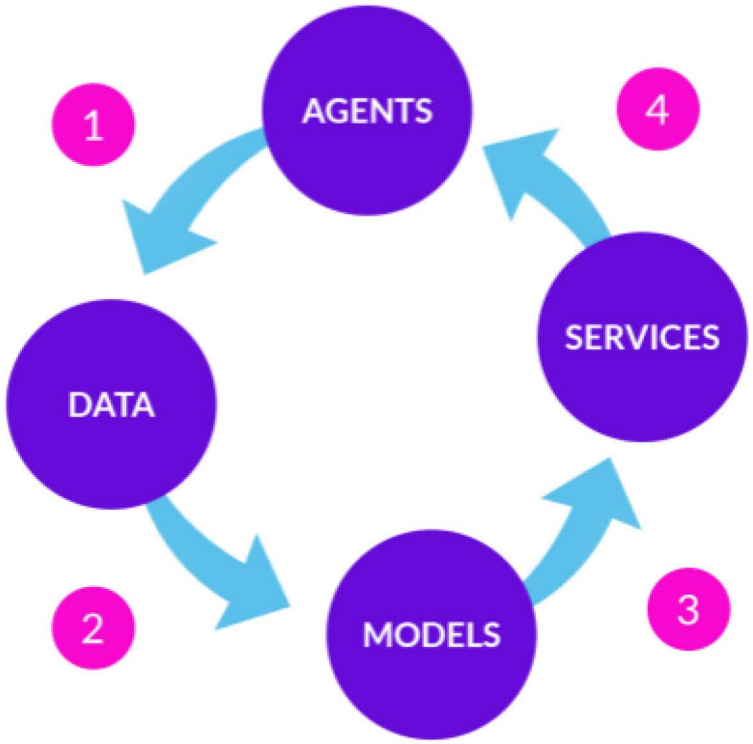
A first phase approach would be to establish a blockchain for storing access, provenance, contracts, and balances.

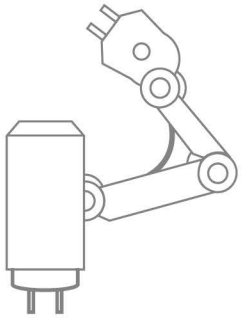
3.5. Marketplaces and Economies

Marketplaces exist to match supply and demand of some resource. Marketplaces act as a component of an economy. Economies can be thought of as the frontend application of a backend marketplace. Economies emerge as an application that leverages a marketplace.
3.6. Ecosystem and Partnerships
To facilitate some of the component architecture, we will need to partner with existing infrastructure players such as storage, processing, and perhaps reputation over identification services.

A possible partner for storage is Sia, for computation is Golem, for identity is Civic.

4. Launch Phases



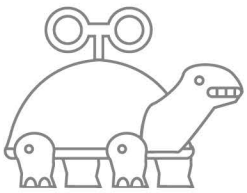


1. Agents

Agents look to fulfill smart contract and ad-hoc data queries.

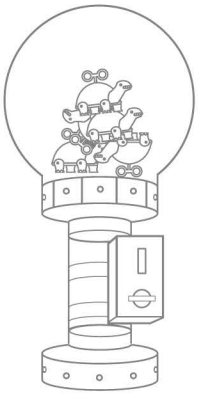
2. Data Pools

Groups of data that are available for use to all users.



3. Models

Machine learning models are created and trained using these data pools.



4. Services

These models are in turn offered back to agents through micro services.

4.1. Phase 1. Agent to Data

The purpose of facilitating agent to data transfer is the first step in building this system. Allowing agents to store and retrieve data from their own data pools is the first step. This will require storing provenance and access controls on the blockchain.

Additional features of this phase include the ability to create a marketplace, contracts for fulfillment and ad-hoc queries, ontological database, license management, and secondary data pool creation.

4.2. Phase 2. Data to Models

The Data to Models phase allows machine learning models to be trained by granting access through a contract on the blockchain. This creates provenance on who contributed what data and when, and could be used to facilitate more sophisticated compensation mechanics.

Additional features of this phase would be distributed computation of models, rating and verification of accuracy of models as measures of classification and prediction.

4.3. Phase 3. Models to Services

Converting the training and storage of models into workable services available on open markets is the next phase.

Additional features include automated provisioning and scaling of containered enclaves.

4.4. Phase 4. Services to Agents

Once the services have been provisioned they must be announced as accessible distributed services available to particular devices under particular contexts.

Additional features include automated and manually managed and metered API gateways, and more sophisticated methods of rewarding participants through provenance.

5. Roadmap

5.1 Initial Coin Offering Schedule

Site Live
Sept 1, 2017

Pre-sale
Sept 18, 2017

ICO starts
Oct 21, 2017

ICO ends
Nov 21, 2017

5.2 Product Development Schedule

Phase I
Spring 2018

Phase II
Summer 2018

Phase III
Fall 2018

Phase IV
Winter 2018

6. The Future

The future for Synapse is wide open. Disrupting the current verticalized incumbents will have a huge impact on how things will be built, the experiences we have with our devices, and how we can benefit from further participating in technological development.

6.1. The Stack

We see a diverse ecosystem of many services acting symbiotically to support device functionality and intelligence. It's easy to imagine an operating system that fully supports decentralized and distributed services out of the box, and local decentralized exchanges with off-chain transactions supporting various token based services working together.

6.2. Partnerships

While we expect to participate on the protocol layer, acting as a platform for other companies and startups implementing their services on top of ours, surfacing up pieces of information relevant to the user through a unified identity service that keeps track of wallet balances would be great.

Smartphone manufacturers, to display a running balance of value acquired through our services alongside the traditional UI elements would be super interesting.

Companies that can sign to verify their data as well as their customer's data can contribute and update existing ontologies.

6.3. Impact

Providing open access to both data and machine learning models generated by agents has some interesting effects. People and companies will get compensated for their ambient and explicit data for the first time in a public order book. The utility of the models built on top of this data will be tracked and verified by the participants who can also benefit by their contributions.

Human in the loop acquisition, verification, filtering, and model making will be a huge part of the future of work as automation becomes more prevalent and intelligent.

The system we're building also goes a step beyond this, eventually allowing autonomous agents to requisition and facilitate without intervention of model making helping to automate a future of

discovery.

It is in our nature to reason solutions, identify systems, create models, and build tools to leverage those models. It is also only natural to assume that we must build something that can do this better and faster than we can. It is most likely in our genes, this inescapable calling to build a machine that can perform these tasks and unlock the answers to age-old questions such as “Why are we here?” and “What does it all mean?”

This identification will shift humanity’s purpose and will change economies to afford systems of discovery. It will reward those that participate in these new economies.

As the industrial and technical revolution evolves, so has man’s reliance on automation and the emergent features of intelligence. With the advent of practical use cases of AI, we’ve stumbled into a paradigm shift from how can machine help man, to how can man help machine. Mankind continues to fill in the gaps where labor is cheaper or more capable than technical implementation. However, technological advancement eventually catches up with us, driving out the need for human labor. This displacement frees human resources to find a new system to model and leverage, tools to build, and optimizations and efficiencies to achieve.

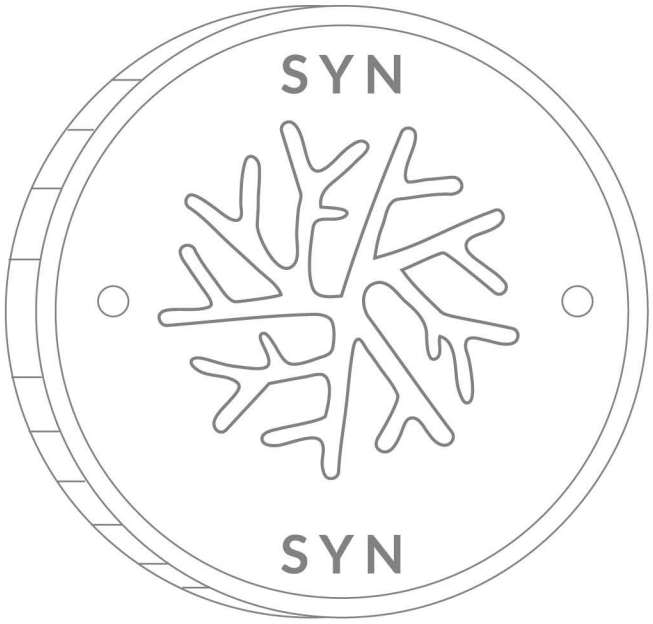
The future of labor involves creating economies around active and passive data collecting and model training. Contracting labor by organizations and autonomous agents, tokenized potential and utilized work, model training, qualification, and utilization, along with the contracts that bind them, will be the foundations of these new economies.

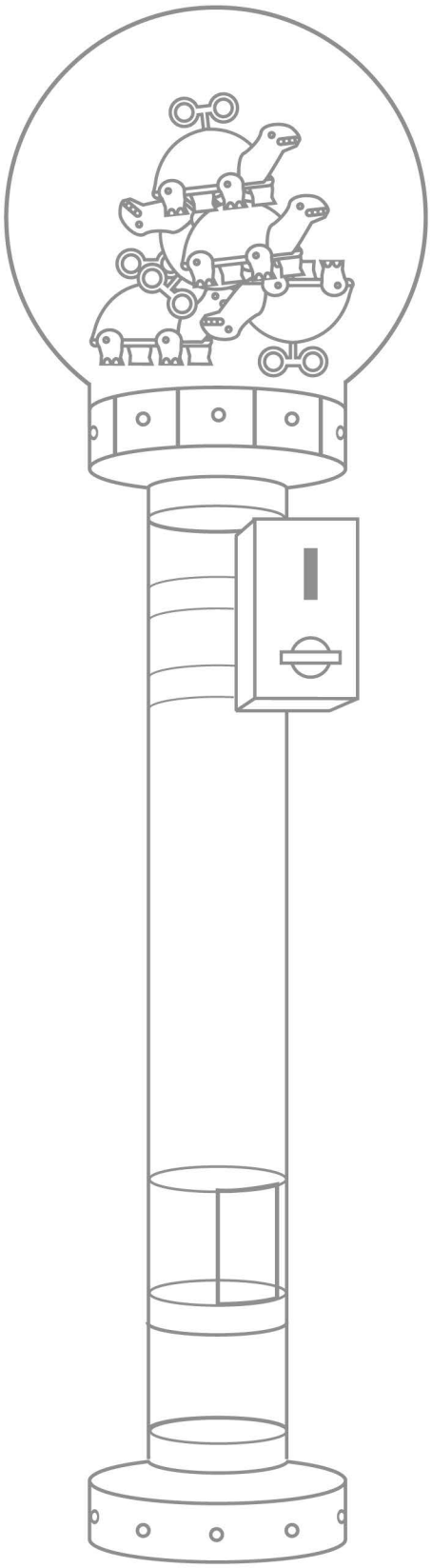
A day in the life of a human agent might look very on-demand based on their capabilities that meet the current market demands. From delivery, to skill share, to knowledge work, they would be on call whenever they want. Based on models of interest and patterns of learning, they might even be sponsored to get educated by an agent that requires their input.

The world will be a very different place. SYN is there to support these new economies and connected systems.

7. Initial Currency Offering

The initial coin offering will feature the sale of an ERC-20 Token built from an ethereum smart contract. The token auction will continue for 30 days or two days after a 50 Million dollar soft cap is reached. The token will be honored as a 1:1 tradeable asset in the case of a currency change.





7.1. Token distribution

- **33% Token Sale**
- **33% Developer Fund**
- **33% Company**
- **01% Token Sale Costs**

A total of 1,000,000,000 tokens will be generated. One-third of those will be for sale. One-third will go towards a developer fund to help kickstart the ecosystem. And one-third will be assets the company holds.

7.2. Pre-sale mechanics

The presale is tiered and each tier has a different valuation per tier, thus a different discount per tier. Once a single tier is full, a new tier is unlocked. The pre-sale will help set the floor for the public token auction.

7.3. Token auction mechanics

The public auction is a variant of the English style auction with specific parameters that help incentivize bidding, and penalize gamification.

The public token auction will provide a set number of lots with a set number of tokens per lot.

Buyers are allowed to bid to purchase a lot.

Lots are awarded in descending order at the end of the token auction by both first come first serve to the highest bidders. Since there is a static amount of lots, ordering by bids in descending order allows us to determine if a bidder has fallen out of the auction.

When a bidder has fallen out of the auction, their bid will be returned to them minus two (2) times the gas they paid for the transaction. This incentivizes people to bid competitively, and penalizes those that would game the txPool.

7.4. Token Disbursement

Token disbursement will happen sixty (60) days after the public auction.

8. Team

8.1. Core Team

Dan Gailey / CEO

RadBots, Baqqer, Make:, e.Ventures

Passionate about machine learning, and artificial intelligence, Dan is a huge proponent of ambient intelligence and how it will complement our lives.

Dan holds degrees in Electrical Engineering (autonomous robotics), and Computational Chemistry. Previous work has been with the National Center for Physical Acoustics, Make Magazine, e.Ventures, in addition to launching Baqqer, Asteria, Techendo, Pule, and others.

Nathan Ross / COO

RadBots, Viewics Healthcare, Sprint, Yahoo!, US Bank

Nathan has over a decade of experience building and growing products. He has worked with consumer products, enterprise solutions, data-focused technology, and everything in-between.

Nathan's education includes degrees in Business Management, Business Marketing, and Advertising Art Direction with a focus on Interaction Art Direction.

Jamie Cushenan / Blockchain Developer

Baqqer, BoS Game Studio

Starting programming at a young age, Jamie has always be fascinated by data and technology, which led him into game development after college. Since then, Jamie has continue to learn and expand his insights into machine learning, cryto, and blockchain technology.

Jamie has a degree from Ulster University in Software Engineering.

8.2. Advisors

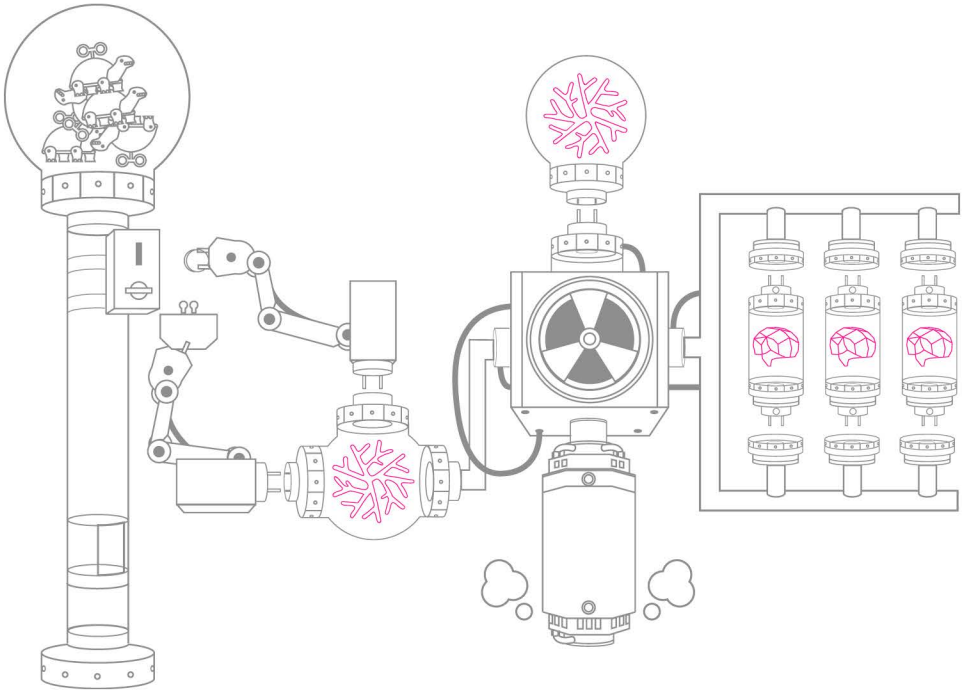
Howard Rheingold

Author, Stanford, Institute of the Future

Jackson Palmer

Founder of Dogecoin

9. Disclaimer



The Smart Contract System concept, the underlying software application and software platform (i.e. the Ethereum blockchain), is still in an early development stage and unproven. There is no warranty or assurance that the process for creating Tokens will be uninterrupted or error-free and there is an inherent risk that the software could contain defects, weaknesses, vulnerabilities, viruses or bugs causing, inter alia, the complete loss of ETH contributions and/or Tokens. Additionally, there are other risks associated with your acquisition, storage, transfer and use of Tokens, including those that SYN may not be able to anticipate. Such risks may further materialize as unanticipated variations or combinations of the risks set out in the terms of service.