

# BotChain

An Efficient and Secure Enterprise Bot Management Platform Built on Blockchain

*Revision by Josh Reif and Crypto Launch Media Team*

## Executive Summary

To succeed in increasingly competitive marketplaces, employees must be aligned with company values, mission, and systems. Businesses suffering from poor communication, lack of knowledge sharing or collaboration, and ineffective feedback loops, are often the first to fail.

Talla's forward-thinking mission is to provide a comprehensive solution to these problems. Currently, these tasks are often shuffled between middle management without systems to effectively regulate them. Utilizing artificial intelligence and advancements in bot design and awareness, Talla is creating more powerful and less predictable bots. Ultimately, many of these bots will replace existing employee functions. However, as these bots become more intelligent and are given more power and responsibility, they will become more difficult to manage.

BotChain is Talla's solution to this new management challenge. Humans perform better when managed to improve performance, compliance, knowledge sharing, collaboration, and communication. Similarly, bots will require a platform to audit and nurture these capabilities.

BotChain is a bot registration, identification, audit, and marketplace platform built to utilize the public Ethereum blockchain. BotChain will provide a management platform for enterprise bots to ensure that businesses have a robust, efficient, and secure system. Bot builders will incorporate BotChain capabilities into their bots, so that businesses can utilize the management capabilities according to their needs.

The BotChain platform will provide businesses with bot management capabilities such as audit trails of bot actions (what they did and why), bot identity management, knowledge sharing, and skill sharing. These tools are essential to the construction of the best internal company communication systems, which will ultimately determine the success or failure of businesses across every industry.

*For purposes of this whitepaper, any reference to "Talla" refers to Talla, Inc. or any of its wholly owned subsidiaries that may, in the future, be the entity actively developing the*

*technologies described in this whitepaper, and responsible for the management of BotChain and distribution of BotCoin tokens.*

## **Table of Contents**

Executive Summary.....
Market Problems and BotChain Solutions....
Bot Definition.....
Market Overview.....
How BotChain Works.....
Competitor Analysis.....
Technical Elements of BotChain.....
Use Cases.....
Token Economics.....
Roadmap.....
Team.....
Summary.....
Acknowledgements.....

## **Market Problems and BotChain Solutions**

The \$50B industry of autonomous bots lacks the universal standards or protocols of every other major software industry.

*Lack of transparency:* There is no verifiable visibility into bot decisions and actions. These conditions limit growth and present significant compliance risks for corporations. BotChain solves this with internal audits, which track and log all bot actions.

*Fraud and theft:* The ICO industry is ripe with theft and fraud in addition to many other industries. BotChain mitigates this risk with bot identity and validation, key components to ensuring bot legitimacy.

Social engineering and phishing attacks have long been the weakest spot in enterprise level security. Bots can be programmed to assist in detecting and notifying about suspicious behavior by applying pattern recognition techniques, and collecting, analyzing, and recording possible evidence. This could prove to be a valuable complementary tool in assisting cyber-forensic efforts. The immutability of the blockchain distributed ledger furthermore prevents the possibility of spoofing bots by anchoring and validating unique bot identifiers, which cannot be replicated.

*Risks of regulatory compliance failures:* Employees are held to many regulatory standards, but as companies transition to bots, these bots will be required to maintain the same rigorous standards. BotChain’s audit and compliance protocols will allow companies to monitor and ensure their bots follow these standards.

*Rogue bot decision-making:* The semantic contents of human language expression and intention do not always ideally translate to machine logic, which may often result in faulty and unpredictable behavior.

Containing and setting boundaries of control to the autonomy of intelligent software agents and keeping track of the manner in which they carry out processes, as well as documenting and keeping record of what goes on, is crucially important for correcting and managing such errors and acquiring insight about the behavior of autonomous agents in different environments and settings.

OpenAI has demonstrated faulty reward systems, resulting in unpredictable actions and consequences. Blockchain records and systems will help correct and manage these errors.

*Restricted interoperability:* B2B companies often operate in independent marketplaces with limited sharing capabilities. BotChain’s ecosystem will allow sharing and transferability for bot add-ons and other upgrades.

## **Bot Definition (aka “Intelligent Agent”)**

For purposes of this white paper, a bot is an autonomous agent that can independently make decisions based on inputs (including context) and take independent actions — both proactively and responsively. A bot may communicate with a human or it may communicate with other computer systems.

## **Market Overview**

As software becomes increasingly intelligent due to advances in bot design, artificial intelligence, and the more expansive use of contextual awareness (through increased adoption of APIs and IoT technologies), software will evolve to become both more powerful and less predictable due to its increased complexity. In addition, we’ll have thousands of intelligent agents collaborating to process millions of transactions. These changes indicate the vital need for a bot management platform.

Just as humans require oversight and audits in the workplace to facilitate performance, compliance, knowledge sharing, collaboration, and communication, bots will require a platform

to manage these capabilities. Blockchain technology provides the foundation for many independent, trustworthy peer-to-peer platforms. Talla's BotChain platform, built upon blockchain technology, will provide all support and management services for bots that will be utilized in enterprises across every industry.

Bots are intelligent software agents (i.e., chatbots, web crawlers, etc.) used for the automation of tasks in inter-connected environments and over the internet. Bots can also be seen as accounts operated by software (rather than people), which have AI features that can be programmed to serve a variety of functions (search, fetch and compute data, track updates, broadcast messages and trigger reminder alerts, integrate with other services, or pass instructions to the Internet of Things).

As these agents become more intelligent in handling increasingly complex tasks and make more independent decisions, they will subsequently become more difficult to track and manage. These changes will create new challenges as well as bring about new opportunities and emerging markets for servicing those arising needs.

Blockchains and the advent of Distributed Ledger Technologies (DLT) have provided a transparent layer for incorporating validated data and historical, tamper-proof audit trails that record the actions of participating actors on a network.

The convergence of these technologies is the overlapping region in which Talla's BotChain operates, aiming to deliver a network of autonomous agents tied to the fabric of the blockchain in laying the groundwork, with many other similarly involved companies and initiatives, for an eventual AI economy.

## **How BotChain Works**

The BotChain system is designed to support an array of future services for business bot developers. The BotChain system allows for the identity verification of a bot, so that its identity can be authenticated by any other entity it may encounter. The BotChain system also allows a bot to both create and store an audit trail of its actions and "thought process" of what the bot did and why. In the future, BotChain will also allow for additional services, such as sharing of knowledge and skills between intelligent agents. BotChain will serve as the common management infrastructure for the business bot market.

*The future of Bots (aka "Intelligent Agents")*

Bot management becomes more difficult as bots grow more intelligent and unpredictable, similar to how groups of independent actors (employees) need oversight to develop trust, communicate, coordinate, and share knowledge.

Therefore, we envision an infrastructure to support intelligent agents (bots) that include some characteristics:

- Bots will need a trustworthy identity
- Bots will need to be monitored for performance
- Bot owners will need a trusted audit trail
- Bots will need to communicate, collaborate, and negotiate with each other and people
- Bots will need an index of other bots
- Trusted knowledge will need to be shared between bots
- Trusted workflows will need to be shared across many bots
- Human-in-the-Loop work will need to be cross-referenced with data in order to improve bots on the platform
- Task completion will occur between multiple bots

### *Blockchain and Technology Convergence*

The convergence of technologies around AI, bots, blockchain, and context (IoT, etc.) will create the need for a common, peer-to-peer, trusted platform to ensure that bots can be managed effectively.

*Artificial Intelligence (AI):* The pattern recognition and prediction capabilities of software will improve over time, driven by advancements in artificial intelligence related technologies. This new software will make sub-second complex decisions based on multiple inputs that will be too fast and too multifaceted for a human to understand in real time.

*Bots:* Independent software agents (aka “bots” or “intelligent agents”) will utilize AI in order to become more autonomous, leading to more proactive and reactive decision-making within their environment. They will become more probabilistic — taking into account past experience and complex decision making in order to become more autonomous, sometimes leading to unpredictable outcomes.

*Blockchain:* The decentralized, immutable ledger will allow trusted, immutable transactions to enable services such as discovery, identity verification, audit, communications, collaboration, knowledge sharing among bots.

*Context (IoT+):* IoT technologies and APIs will expand the array of inputs and outputs available for bots to interact with the world. Additional inputs and outputs, along with the aforementioned advanced decision making, will increase their complexity and the need for a management platform.

*Why is a blockchain needed for this solution?*

The blockchain allows for several capabilities that make it an ideal platform for bots:

- 1) *Trustworthy Network:* The blockchain can become a trustworthy networked supplier of services among many organizations building and operating bots.
- 2) *Transactional Guarantee:* A key characteristic of blockchain technology is the ability to solidify a transaction among one or many parties. Once a transaction is submitted within the blockchain environment, it has a high probability of execution.
- 3) *Immutability:* Monitoring what a bot did and why can be stored safely by a networked, trustworthy blockchain solution, making it ideal for single bot solutions or workflows involving many bots that may be owned by different entities.
- 4) *Shared Economic Value:* The work of maintaining a blockchain solution is done by multiple nodes that get paid fees for completing work. This creates an ecosystem that can maintain a fair cost structure for all parties.
- 5) *Community Involvement:* Companies that create bots also have an incentive to create and maintain a blockchain solution to serve their needs as a community.

*MVP At Launch*

The BotChain Minimum Viable Product at launch will be a fundamental platform for bot identity, utilizing a method to find and validate the identity of other bots. Bot developers will be able to register their bots on the BotChain. Other users and bots will be able to query the BotChain for available bots that exist on the BotChain. Also, bot identities will be validated. In order to access the BotChain for these features, BotCoin will need to be paid to the BotChain platform. These identity services will provide immediate value, while building the foundation for future BotChain capabilities.

*Validation for Access*

Users of the BotChain platform will need to possess some portion of a BotCoin to access the BotChain platform, as well as to deploy bots and interact with them. Users who do not possess any BotCoin will not be able to access the platform. A user may make their bots available to a separate set of end users (such as participants in a chat room), but the user is responsible for any fees in BotCoin charged.

### *Payment for Services*

Users of the BotChain platform will be required to pay fees for services provided by the BotChain platform.

Examples of service fees:

- 1) *Gas payments*: Payment to the Ethereum network nodes in order to build and maintain new blocks on the Ethereum network.
- 2) *BotNode Payments*: If nodes are implemented, payment to the BotChain platform may be made for work done such as storing and processing data.
- 3) *Marketplace Sellers*: Payment to marketplace sellers that provide access to a service on the BotChain platform.
- 4) *Operational Payments*: Payment to the BotChain administrator (currently Talla) as a fee to pay for maintenance and upgrades to the BotChain .

## **Competitor Analysis**

While numerous bot development companies flood the marketplace, it appears no other bot management platform currently exists to compete with BotChain. We aim to be the first mover in the industry.

## **Technical Elements of BotChain**

Presently, BotChain is a bot and knowledge base amalgam, which organizes and tags knowledge base entries in such a way that allows for machine learning models to be easily applied and added to chatbot functionality, providing better search via neural information retrieval methods, and building models for routing knowledge and information proactively around organizations.

The core ledger and some of the processing capabilities will run on the Ethereum ecosystem with a number of smart contracts for bot registration and installations already deployed in early 2018. The on-chain Ethereum components will be kept lightweight, mainly used for storing hashes of off-chain data, various off-chain computations, and pointers to addresses living off-chain.

An early phase off-chain server storing bot registry information was also deployed in January 2018, planning for the ideal long-term decentralized solution, and optimizing what is already available to fit that plan.

While the ultimate goal of BotChain is a shared blockchain infrastructure layer where all services are completed on a public blockchain, this sort of robust and flexible platform does not yet exist. Recognizing this, BotChain has developed a hybrid public/private blockchain solution that will allow users and developers alike to harness the power of blockchain.

The private blockchain solution will be a federated Ethereum fork, supported by verified developers and other verified agencies. For this service, small amounts of BotCoin spent for BotChain services is reserved for partners on the private fork.

By using an Ethereum fork, we can leverage the same key addresses as the public network, minimizing code changes and keeping the audit log streamlined. Since contracts deployed on the private network will have different addresses, a Bot Name Service (BNS) will be deployed on the private chain to provide a simple link between the public and private chain.

To maximize security, hashes of bot activities and certain actions will be periodically published to the public Ethereum network through a relay network. This will serve as a public hash stamp of all records recorded on the private chain, preventing any alteration of those records. In addition, as the public network evolves, BotChain will continue to develop and move services to the public network.

The BotChain team is also developing a number of blockchain smart contracts to support chatbots and other intelligent agents' use of the blockchain. First to be developed are bot identity and activity summary contracts. The identity contract will allow bots to be quickly deployed to BotChain and easily discovered by other bots. Activity contracts will record each bot action in a provable transaction log and publish summaries of these actions from the private chain to the public ledger.

In order to support the BotChain ecosystem, improvements will be made to the BotChain technology platform over time as led by the BotChain leadership team, including members of the BotChain ecosystem. Below is an example of a platform path that the BotChain leadership



team may explore. Based on tech changes and future community feedback, it could be implemented in a different way.

To create the shared infrastructure for Intelligent Agents, IOT, and Artificial Intelligence, BotChain will develop the services on a blockchain solution. This will include services and applications for the support of developers and users, blockchain services, and smart contracts to provide bot identity and secure communication channels. A native token called BotCoin (BOT) will be developed to pay for services leveraged on the BotChain platform.

The BotChain will contain a Service Layer to provide a base level of functionality and shared infrastructure for all users. This will include a number of applications and developer support products that will face the BotChain blockchain services. These services will be initially developed by BotChain, but will be left purposely open to 3rd party developers to develop on the shared infrastructure layer.

While the ultimate goal of the BotChain is a shared blockchain infrastructure layer where all services are completed on a public blockchain, this sort of robust and flexible platform does not yet exist. Recognizing this, BotChain has developed a hybrid public/private blockchain solution that will allow users and developers alike to harness the power of blockchain.

The private blockchain solution will be a federated Ethereum fork, supported by verified developers and other verified agencies. For this service, small amounts of BotCoin spent for BotChain services is reserved for partners on the private fork. By using an Ethereum fork, we can leverage the same key addresses as the public network, minimizing code changes and keeping the audit log streamlined. Since contracts deployed on the private network will have different addresses, a Bot Name Service (BNS) will be deployed on the private chain to provide a simple link between the public and private chain.

To maximize security, hashes of bot activities and certain actions will be periodically published to the public Ethereum network through a relay network. This will serve as a public hash stamp of all records recorded on the private chain, preventing any alteration of those records. In addition, as the public network evolves, BotChain will continue to develop and move services to the public network.

The BotChain team is also developing a number of blockchain smart contracts to support chatbots and other intelligent agents' use of the blockchain. First to be developed are bot identity and activity summary contracts. The identity contract will allow bots to be quickly deployed to BotChain and easily discovered by other bots. Activity contracts will record each bot action in a provable transaction log and publish summaries of these actions from the private chain to the public ledger.

The BotChain platform is designed to meet the needs of business bot developers and business users alike. The BotCoin token allows for users to pay for the services of bots instantly over a blockchain network and incentivizes developers to accept (and develop more applications for) BotCoin as more and more agents are deployed on the network.

## High-Level Architecture

### *External Services*

BotChain provides a host of external services that provide easy access to users of all types to the platform. While these are standard to most applications, BotChain will provide robust support to users of its infrastructure.

### *User Login*

User onboarding and login features will provide secure access to the BotChain infrastructure. Users can establish two-factor authentication to provide additional security. Developers may also request API access keys, which will be securely tied to their user accounts.

### *Marketplace*

Developers may list their intelligent agent services in BotChain's marketplace. This creates a multi-developer store for customers to compare and shop for services.

### *Data Portals*

Intelligent agents use varied sources of data to accomplish their tasks and therefore must have streamlined access to external sources. BotChain provides a simple data portal service to provide access to deployed bots. This makes connecting external data to chatbots easier than ever before. Simultaneously, by imposing a standard data validation and security controls we can greatly reduce cyber risks.

### *SDK*

As BotChain aims to be the infrastructure for all autonomous and intelligent agents, we are providing a comprehensive software development kit for free. The SDK provides complete documentation, simple recipes, and guidance for making BotChain-compatible bots. Through this, developers completely unfamiliar with distributed ledgers will have their chatbots up and running on the blockchain in a matter of minutes.

### *Services Cloud*

To fully utilize BotChain's blockchain solution, additional services have been developed to support bots. These services are provided to partners seeking to deploy their bots on the BotChain.

### *Deployment*

Bots selected from the marketplace will be configured and deployed from the services cloud. Before each bot is deployed, a variety of actions must be completed: a public and private blockchain address must be assigned, the address must be registered to an Organization Channel contract, and additional smart contracts may be transacted or be registered against. The BotChain deployment services solution streamlines this activity.

### *Key Store*

Blockchain transactions require a private key to sign and commit transactions. A managed key store and wallet service is provided to allow bots to easily transact on the blockchain solution, while minimizing the risk of lost or compromised keys. With these addresses, bots can securely record their actions, be identified by users as authenticated, and even pay for secondary services on BotChain. Addresses will be generated using Hierarchically Derived Keys, allowing for the Organization Channel to quickly identify all associated bots.

### *Bot Actions*

BotChain provides a simple bot action interface, where bots can request services and actions from either BotChain or other bots deployed on the network. This service provides a simple query feature for bots to discover other intelligent agents and services. Bots will be able to query the BotChain to discover other bots based on characteristics such as name, capabilities, etc., or those needed to complete a secondary action through the Organization Channel.

### *ETL & Oracle Service*

An extension of the Data Portals, BotChain provides a simple Extract, Transform, and Load service layer. Various data feeds, including bot actions and external data sources, can be transformed through the service. In addition, the hashes of raw and transformed data can be published to the BotChain, creating an immutable record of the changes that occurred to the data.

Once a data portal and ETL layer has been established, the BotChain treats these as an oracle service. Users may choose to publish information to the blockchain with a low-cost publishing service. This will allow BotChain intelligent agents to interact with non-BotChain applications, and will also allow developers more flexibility in how they source and report data.

### *Admin Services*

Each user will have an admin service feature based on their user role. While the admin service layer provides typical user functionality, it also doubles as a user interface for control contracts issued on the blockchain. In a simple GUI, users can view the Organization Channel contract for both private and public blockchains, alter the time between cross-chain and summary hash publishing, deploy more or kill existing bot services, add additional registered users or contracts, and more.

### *Relay Network*

To facilitate communication on the Hybrid Blockchain implemented by BotChain, a cross-chain relay and other tools will be developed to ensure the unaltered and easy transaction between chains. This is not a full bridge between networks, but rather a communication channel that seeks to enforce message formats between the private and public Ethereum blockchain implementations.

### *Event Listeners*

Event listeners monitor a smart contract or address for certain transactions and calls an action in return. This can be used for reporting activities across the Hybrid Blockchain, or triggering functions in response to certain activities. BotChain's event listeners will monitor both the public and private chains, allowing for reporting actions across both.

### *Cross-Chain Communication*

Communication between the two blockchains of the Hybrid Blockchain is coordinated through a cross-chain communication channel. This channel enforces that all activities on the private blockchain are recorded via a hash to the public blockchain, including both the individual bot's activities and a snapshot of the entire blockchain.

### *Hybrid Blockchain*

The Ethereum network cannot yet support the high volume of transactions necessary to record all activities a bot performs. To meet these needs, BotChain will implement a hybrid blockchain

solution, consisting of a private Ethereum instance with periodic publishing to the public Ethereum. This allows BotChain to transact at the volume necessary with the same signatures and transaction formats as the public network, while maintaining auditable records for a fraction of the transaction cost.

### *Private Blockchain*

The private Ethereum blockchain deployed by BotChain will have no fees for transactions and will use a federated consensus algorithm. Partners will have the option to be a confirming node. For this service, they will receive a small amount of BotCoin from transactions occurring on the Ethereum public network.

This solution allows BotChain to run a higher number of transactions that would otherwise be infeasible on the public Ethereum network. In addition, the private blockchain will be needed in order to create and manage platform specific “bot contracts”.

### *Organization Channel Contract*

Organization Channel (OC) contracts aggregate the activities of numerous bots deployed by a user. This consolidates all of a user’s bots to a singular contract, while allowing for complex bot activities and smart contracts to run without interference from the platform. The OC contract also allows for BotChain to load balance the activities of bots via blockchain—as each bot records their activities, the BotChain can assign new tasks to underused bots.

Bots will be deployed and registered to an OC contract, locking them to the registered user. This provides immediate tracking of a bot once deployed, while also maintaining an auditable record of the bots activities. Bots report to the OC contract by signing transactions containing the Merkle hash of their information.

### *Bot Identity*

Bots will be assigned a child key of an HD parent key, allowing for bots to be provably associated with an organization and recovered without needlessly complex key stores.

Upon deployment, Bots are immediately registered and authenticated on the BotChain. While the address assigned to the bot provides a simple reference, additional identifying details are recorded. The bot type, deployment manager, user, publisher, and any access credentials necessary to access data feeds are organized into the bots Merkle hash (also called a “root hash”). Through this structure, bots can not be easily traced to a single activity or use case, unless the user is provided the proper nonce and child leaf node.

This allows the bot to remain pseudonymous on the network, but also able to seek out and positively identify other bots, once it has been provided the correct information.

### *Merkle Roots*

BotChain encodes bot information on both the public and private network into a Merkle Root. This process is similar for both Bot Identity and Summary Hash functions, though Summary Hash does not require an additional nonce for obfuscation.

This allows the BotChain to commit verifiable information to the blockchain in a low-cost and highly structured way. By knowing the proper leaf node to review, bots can quickly identify other bots for a task, confirm the activities of another service, or accept trusted input from a previously unknown actor.

### *Public Blockchain*

BotChain will periodically publish information to the public Ethereum blockchain, leveraging the collective security of the network.

### *Organization Channel Contract Mirror*

On the public Ethereum blockchain, an Organization Channel contract will be published at the same time as the deployment of the private Organization Channel contract. Each will have their counterpart's address registered to them in a private variable, creating a known association between these accounts.

### *Summary Hash of Bot Actions*

Summary transactions of bot actions on the private Ethereum network will be collectively hashed and published to the Organization Channel contract on the public Ethereum network. This will create a permanent and unchangeable record of the actions committed on the private chain.

The hash will be structured in a Merkle Tree, with a designated leaf node for the bots actions and another leaf node for a hash of the entire private blockchain. Since these hashes can be verified on the private blockchain, this creates an immutable record of the private blockchain on the public blockchain.

## **Use cases**

The applicable use cases are vast enough to be able to integrate into any system that is currently using bots. Some of the use cases BotChain was designed to solve long term:

1) *Bot identity and validation*: One early problem that arose was bot spoofing, often used to steal cryptocurrency during ICOs. Using blockchain to validate bot ownership on a distributed bot network that bot companies all control democratically, makes a lot of sense. As bots become more pervasive and engage in more cross-company transactions, it becomes clear there will need to be a validation mechanism.

2) *Bot audit and compliance*: When employees are part of compliance processes like SOC2, HIPAA, or ISO standards, they have to demonstrate compliance, and those demonstrations have to pass an audit. As bots start to do work for us and are part of these processes, how will they demonstrate compliance? How will they be audited? The digital certificates we are generating to store on the BotChain are proof of what happened in every bot instance.

3) *Control boundaries and constraints of autonomy*: When reinforcement learning models are deployed in bots and their autonomy grows, how do we know they will do what we want them to do? OpenAI has demonstrated that sometimes reward functions are faulty and lead agents astray in surprising ways. Recording everything on a blockchain and requiring voting standards for certain actions, all help contain and limit bots to a certain level of acceptable autonomy and decision making.

4) *Shared Marketplace for Bot Add Ons*: In general, every B2B company has their own marketplace. What if the bot ecosystem can evolve differently? A shared standard and open marketplace controlled by no one, but influenced by all bot providers, is only possible with a distributed ecosystem, and a blockchain is perfect for that. As artificial intelligence progresses, and bots become more complex, there will be opportunities for third parties to release skill and knowledge modules that can upgrade a bot's brain.

5) *AI Security*: The threat malicious and faulty software poses to modern society has long been recognized by computer security experts, and BotChain could prove a valuable tool for the emerging discipline of AI security. By providing a platform for recording the logic and sequence of actions performed by autonomous agents in an immutable and tamper-proof fashion, BotChain will allow for easy auditability and quick corrections of possible flaws before they can propagate further. This way, some of the basic ingredients in building larger scale and more general AIs can first be clarified and gradually optimized on the BotChain platform. Various modules could also be refined, stored, and upgraded.

*Bot Registry and Identity Validation/Attestation*

As autonomous agents (bots) do more work for us, we run into a problem—how do we know a bot is who it says it is, can do what it is asking to do, and is owned by who we think owns it? As phishing operations that spoof emails and web pages become more widespread, so does bot spoofing.

An immutable ledger provides a way to validate and authenticate software agents as well as verify data integrity and quickly investigate/analyze any issues or anomalies that may arise. One of the primary features of Botchain is the ability to register a bot to obtain a unique bot identifier. When the bot instantiates itself, its public/private keypair identity can be verified in the same fashion as any other kind of message or piece of data that requires security. The BotChain becomes the ledger of bot instances that allow for validation during conversations, requests, and interactions with other bots.

### *Audit and Compliance on the Blockchain*

As any given industry grows, compliance to some established standards and common best practices becomes necessary as it permeates large enterprises. And as the bot industry grows, and bots are involved in doing more work for organizations, they may be parts of workflows that require compliance to certain standards. A bot may be part of a workflow that requires HIPAA compliance or SOC2 compliance. How do we verify these bots are indeed compliant? In the near future, audit firms will likely perform audits on bots and other autonomous agents in much the same way they do for financial statements and human workflows.

To address this, BotChain allows for the creation of digital certificates of many types that can be stored on a blockchain for immutability and be provided to auditors to sample and confirm compliance. These digital certificates will be one-way cryptographic hashes of the state of the bot at that time.

For example, your digital certificate could be a hash of the following attributes:

BotBrainVersion, Creator, Authorized By, Talking To Bot/Human, Task. In other words, what version of the bot brain were we using, who created it, and who authorized it for this task? Who was the bot interacting with at that time, and finally, what was it doing? Hashing all of these to a blockchain that is an immutable record makes auditing easy.

In the future, bots will develop their own economy, complete with sets of smart contracts and communication channels forming all kinds of inter-bot transactions. Making them accountable to humans through audit, compliance, and tracking of their work is important, and an especially useful blockchain application.

### *Other Possible Scenarios and Applications*



By having access to large data sets and leveraging vast historical data, computational power, and well-adjusted machine learning techniques continually re-calibrated against internal parameters, bots can be optimized and continually improved to produce the desired, reliable performance for a given task and answer plain language business queries within minutes rather than months.

Chatbots will likely fulfill many customer support functions to repetitive support requests (Pareto Principle: 80% of the people asking questions refer to the 20% of the information repeatedly provided), and historical audit trails stored and indexed on blockchained registries will be particularly helpful in modeling bot behavior and creating programmable bot templates.

Chatbots have the potential to substitute many apps and web-based services in a more personalized fashion, easily adjusted to specific needs. Semantic composition in Natural Language Processing, when provided with a wealth of authentic, high-quality data, can contextualize information aggregated from multiple sources, and particular bots can profile as functioning authoritative oracles, given the range of constraints they are programmed to operate in and not deviate from.

By optimizing results to fit concrete requirements, bots can be seen as autonomous economic agents in the sense of cutting costs and minimizing friction, thereby providing valuable services to a vast number of businesses and industries.

At their core, autonomous software agents are intended to simplify and navigate complex systems, in order to provide direct and precisely weighted responses to specific queries by computing and intelligently structuring the outputted answers in a clear-cut and intelligible form.

Additional resource allocation and probability model examples:

- Airlines.
- IT help desks.
- Economic Trend Predictors.
- Fraud Detection via pattern recognition.

## **Token Economics**

BotCoin will conform to the ERC20 specification as the standard token contract it will follow. It is anticipated that forty million BotCoin tokens will be generated and distributed in a one-time Token Generation Event (TGE), after which no further tokens will be minted, and any remaining undistributed tokens will be burned.

Up to 55% (22 million) BotCoins will be available for public distribution with BotChain retaining 45% (18 million) tokens to support development efforts, operations, and compensate advisors, partners, and customers. The 45% of retained tokens will be broken down as follows: 10% will be retained for Talla (BotChain's administrator presently), 15% held for team and stakeholders, and 20% held for partners and advisors. Talla may change token allocations at its discretion.

[insert token distribution chart]

BotChain is intended to draw and encourage developers of Bots, AI, and other such automated services to use the platform. The BotCoin token's utility grants access to the platform and allows for the deployment of bots and programmable interactions between them. A user may make their bots available to a separate set of end users (such as participants in a chat room), but the user is responsible for any fees in BotCoin charged. Users of the BotChain platform will be required to pay fees for services provided by the BotChain platform.

The BotCoin token allows for users to pay for the services of bots instantly over a blockchain network, and incentivizes developers to accept (and develop more applications for) BotCoin as more and more agents are deployed on the network.

## **Roadmap**

### *April 2018 - Test network launch*

The test network will be launched on the Kovan Test Network of Ethereum. It focuses on provisioning features that lay the foundation in building a truly decentralized and distributed system including:

- BotChain Registry : Approved list of Bot Developers & Products
- Add Developer, Services, Bots, and Bot Instances
- Bot Services, Bot Query, and Bot Identity

### *May 2018 - Main network launch*

- Service discovery
- Refined Search
- Audit Service (beta)

### *November 2018 - Identity and audit services*

- Audit Service
- Identity Service

*April 2019 - Skills Marketplace (beta)*

- Marketplace Payments
- Audit Payment channels

*November 2019 - Bot2Bot communication protocol*

- Payment
- Negotiation
- Scripting

## **Team**

For two years, The Talla team has built intelligent, AI-driven bots for enterprises before deciding to develop BotChain. Talla is based in Boston, Massachusetts and has raised over \$12 million dollars in venture capital, making it one of the most well-funded startups focused on building A.I. autonomous agents for enterprises. The leadership team represents decades of experience in software development, artificial intelligence, startups, and innovation.

**Rob May** is the CEO and Co-founder of Talla. He is the author of Inside AI, the most popular AI newsletter online, and an active angel investor in the AI space. Previously, Rob was the CEO and Co-founder of Backupify (acquired by Datto in 2014). Before that, he held engineering, business development, and management positions at various startups. Rob has a B.S. in Electrical Engineering and an MBA from the University of Kentucky.

**Byron Galbraith** is the Chief Data Scientist and Co-Founder of Talla. Byron has a PhD in Cognitive and Neural Systems from Boston University and a MS in Bioinformatics from Marquette University. His research expertise includes brain-computer interfaces, neuromorphic robotics, and high-performance computing. Byron has held software engineering positions at companies ranging from a multi-national insurance enterprise to a boutique web development consultancy.

**Jon Klein** is Chief Architect at Talla. Previously he was Director of Engineering at Drync, and prior to that, led the Ad Products team at Tapjoy. Jon has worked extensively with research on evolutionary computation and multi-agent systems, and has an M.Sc. in Complex Adaptive Systems from Chalmers University.

**Catharina Lavers Mallet** is the COO of Talla. Previously, she served as the London Studio General Manager at King Digital Entertainment (developer of Candy Crush, and now part of Activision Blizzard) and held leadership roles at Playfish (acquired by Electronic Arts) and

Algorithmics (acquired by Fitch Ratings), among others. She has an MBA from MIT Sloan and a BA cum laude from Harvard.

**Will Murphy** is the VP of Blockchain and Co-Founder of Talla, where he was the founding VP of Product. Previously, he was a Principal and corporate entrepreneur within FedEx Innovation, where he led new emerging tech venture development initiatives involving technologies like IoT, big data, AI, blockchain, cleantech, and drones. Will has a B.S. in Economics from Christian Brothers University and a M.S. in Information Systems from the University of Memphis.

**Matt Conway** is the Blockchain Architect for the Talla BotChain. Previously, he was the founding CTO at Backupify involved in all aspects of its creation and lifecycle. Matt has a B.S. in Computer Science from MIT, originally hails from Kingston, Jamaica, and in his spare time enjoys FPV Racing Drones.

**Anthony Habayeb** is the strategic operator heading Talla's Partnerships. Most recently, Anthony lead strategy and development for Propel Marketing, now Thrivehive, during its growth from 50M. He previously held partnership and revenue leadership roles at Monster and Yahoo! after starting his career as a strategy consultant with Accenture.

**Henry Wagner** is a blockchain engineer who previously served as a Sr Software Engineer at Akamai Technologies, where he configured management systems and development of enterprise on-ramp technologies. He has a BA from Auburn University and pursued graduate studies in Distributed Systems at the University of Connecticut.

**Brooke Torres** is BotChain's Director of Marketing. She joined Talla Inc. in 2015 after advising early stage companies on customer acquisition and go-to-market strategy in the London consumer products market. Before that, she lead social media at The Muse. She holds a BA from Smith College.

**Dr. Roman Yampolskiy** is an AI safety expert, Associate Professor and Director of the Cyber Security Lab at University of Louisville, and author of "Artificial Superintelligence" and nearly 100 publications. Dr. Yampolskiy maintains a database of documented AI failures that will help understand the ways BotChain can help identify, catalogue, audit, and eventually prevent many such failures.

## Summary

As companies scale in size, they become more difficult to manage, navigate, and restructure themselves to more rigid forms of organization. By engaging reliable software agents to do the tedious work of often less reliable human agents, large scale enterprises can preserve the flexibility and orientation of small companies, while maintaining the same level of efficiency.

As more businesses adopt bots into company systems and processes, with the additional intention to utilize them as employee replacements, new challenges will arise. Programmed by humans, bots possess inherent risks of error and malfunction, which need to be effectively mitigated and managed. BotChain will be the pioneer in the field of enterprise bot management, bringing transparency, security, fraud prevention, and interoperability to the marketplace.

## **Acknowledgements**

Thanks to our advisors: Michael Maloney, CEO at VestChain, the VestChain team, and Ambisafe. Thanks to Jon Klein and Daniel Shank for providing ideas and technical feedback. And, thanks to the entire Talla team for your feedback and support.