



CONSTELLATION

Whitepaper v 1.0

A decentralized application integration platform and global mobile payment platform

Contents

Constellation – Whitepaper v 1.0	1
The Dawn of the 4th Industrial Revolution	3
Existing and Emerging Advancements in Cloud Computing	4
How Constellation Is Approaching Blockchain Differently	5
Market Opportunities	7
Introducing The Constellation Ecosystem	11
Pillars of The Constellation Ecosystem	12
The Technology Overview	13
The Constellation Network	13
Nodes In Constellation	15
Reputation System of Constellation	16
Relative Trust Among Nodes	18
The Constellation Data Structure (CDS)	19
The Communication Protocol in Constellation	21
Code Examples	23
Proof-of-Meme: The Consensus in Constellation	26
Developer and Community Portal – Orion	27
Orion Development Roadmap	28
Orion Membership Tiers	29

Bounties	29
Community	29
Developer	30
Forum Badges and Points	30
Constellation Token Model	32
Token Distribution Table	34
Business Development in Constellation	35
Go-To-Market Strategy	35
Constellation's Approach	36
Constellation's Ambassador Program Overview	37
Scalable Protocol Alliance (SPA)	40
Foundation Overview	40
SPA Governance	42
MOBI Consortium Partnership	43
Marketing Plan	45
Brand - Node Growth & Awareness OKRs	45
Developer & Orion Growth OKRs	46
Business Development OKRs	47
Media Strategies & Platforms	47
Community and Marketing Vision	48
Team	49

The Dawn of the 4th Industrial Revolution

The World Economic Forum has identified that we have entered the Fourth Industrial Revolution. This industrial revolution, unlike those that came before, can be characterized as the “fusing of the physical, digital and biological worlds, impacting all disciplines, economies, and industries, and even challenging ideas about what it means to be human.”¹

In Salim Ismail’s book, *Exponential Organizations*, he discusses technologies that are native to this Fourth Industrial Revolution and how organizations can leverage these technologies, as well as the characteristics of successful organizations that have adapted to the changing business ecosystem.

Constellation’s technology will enable the advancement of the digital revolution by creating an ecosystem facilitating decentralized applications throughout a scalable distributed network. Constellation acts as a centerpiece framework that other applications can integrate with, without giving away data security and application dependency. Furthermore, our goal is to leverage existing technologies in distributed computing, big data and machine learning that are widely used among developer communities, and apply them to a decentralized distributed network.

To realize the potential impact of the Fourth Industrial Revolution, rails or pipes will need to be constructed in an entirely new frame of mind. That’s where we come in. At Constellation, we are creating distributing mechanisms between connected devices, software, and digital worlds. These will unlock the ability for engineers to seamlessly create applications that distribute and transact information in a trustless and decentralized way to a global population of smart devices and existing applications.

Disruptive technologies of the Fourth Industrial Revolution will be able to seamlessly interconnect and distribute collected data and transact independently of centralized operations. This will enable cross-collaboration of independent disciplines, technologies, and industries. While Blockchain technology has seen a dramatic rise in popularity and adoption over the past year, there are still some roadblocks that are preventing it from widespread enterprise adoption. In order for enterprise and consumer grade applications to successfully shift a significant portion of their tech stack onto Blockchain technologies, we must rethink the following:

- A new architecture: A Scalable architecture for processing large amounts of data
- A globally distributed network: Initiating global dispersion of network consensus
- Novel Consensus model: Shifting away from plutocratic delegate selection and transaction validation models like Proof-of-Work or Proof-of-Meme.
- Increased Security: Leveraging a combination of improved architecture and novel consensus models to enable trustless and distributed networks to exist without security breaches

¹ Schwab, Klaus. *The Fourth Industrial Revolution*. pg. 83, Portfolio, 2017

- Ease of engineering onboarding: Enabling developer communities to use known programming languages to tap into the benefits of Blockchain technologies and distributed communities

The Fourth Industrial Revolution has ushered in an era where devices, such as sensors across cars, home automation, wearable watches, home appliances, and automobiles, are collecting more data than we can comprehend: “By the year 2020, it is estimated that the average person will generate 1.5gb worth of data per day. The global IoT market is expected to exceed \$1.7T by 2019, more than tripling its size from \$486B seen in 2013”². Additionally, the use of artificial intelligence and applied mathematics requires high computational demands that are forcing us to rethink cloud computing and storage.

Existing and Emerging Advancements in Cloud Computing

Cloud computing has enabled individuals to retrieve data from anywhere in the world. While cloud computing appears remote, it is still highly centralized and dominated by a few of the major tech giants: Amazon, Microsoft, Google. By 2025 there will be approximately 80 billion devices connected to the internet (4,800 devices are being connected every minute).³ The consolidation of cloud computing has enabled low-cost development and data storage, but this has resulted in a significant strain on the network. To handle the data demands of the future, we are looking to the Edge Computing industry. One of Constellation’s primary initiatives is to provide enterprise and consumer grade applications with the ability to gain the security benefits offered by decentralized blockchain solutions by integrating with a broader network — which can assist in auditing, verifying, and transacting with data and other networks beyond conventional cloud storage solutions.

“The global edge computing market is estimated to reach \$6.7B by 2022.”⁴ Edge computing allows for particular data processing to occur at a more local level. This is an effective way to alleviate strain on the network while also create less lag time between passing data to centralized cloud computing.

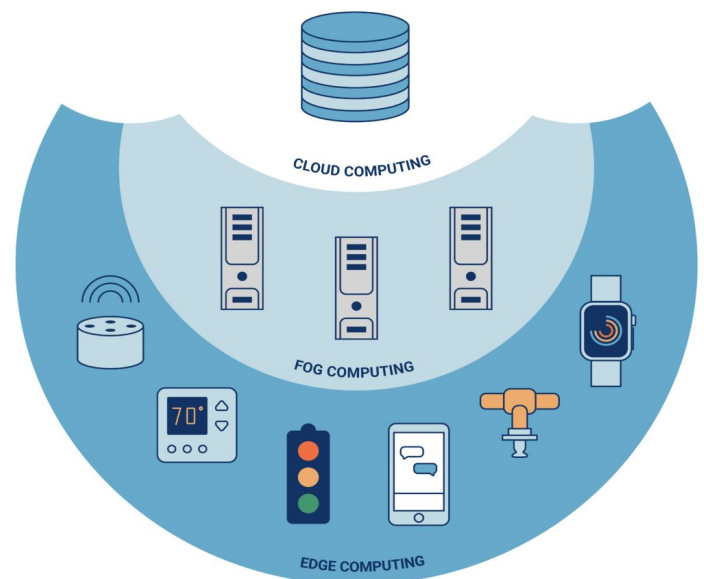


Fig.1 Cloud Fog Edge Infographic, CBinsights

Furthermore, It is described as a “mesh network of microdata centers that process or store critical data locally and push all received data to a central data center or cloud storage repository, in a footprint of

² CBinsights, <https://www.cbinsights.com/research/what-is-edge-computing/>

³ Forbes, Michael Kanellos

<https://www.forbes.com/sites/michaelkanellos/2016/03/03/152000-smart-devices-every-minute-in-2025-idc-outlines-the-future-of-smart-things/#5162dc704b63>

⁴ CBinsights, <https://www.cbinsights.com/research/what-is-edge-computing/>

less than 100 square feet,” according to research firm IDC. By 2020, it is projected that there will be nearly 75 billion connected devices interconnecting, transacting, and storing more data than we ever thought possible. Nearly 5 billion people will be coming online, gaining access to an abundance of information, and will contribute to this collective well of unique identities and stored data. There is a consistent trend towards cheaper computing, where smart devices are now entering the realm of affordability for billions of potential new users. Thus, the leading economic incentive is to seamlessly distribute mobile devices while connecting people and getting them to communicate, transact, and buy through devices. As nearly every significant business will have digitized by this point in time, the marginal cost associated with the production of the device is far exceeded by the opportunity cost for people to connect and transact.

Edge computing comes into play as the “network connections between the edge devices and the cloud.” Fog computing enables cloud computing (processing and storing of data) to occur closer to the point of data collection and interaction. Constellation’s global network of micro-computers, connected through micro-services, will enable existing hardware and software to process data in a tokenized way. Our network works alongside existing cloud computing infrastructure by allowing enterprise organizations the ability to toggle between their existing infrastructure and our network. To clarify, we are not aiming to become a direct competitor to AWS. The goal is to offer something that existing cloud computing infrastructure does not provide — namely, decentralized security through consensus. Through Constellation’s tokenized API’s, machines and devices from other networks (as well as those created within Constellation) will be able to exchange value with one another seamlessly.

One example that leverages edge and fog computing would be how connected automobiles process and use data. A connected car can analyze tire data around a pothole in the road. That data can be sent to *Waze* maps to signify road damage for other automobiles on the road. \$DAG (Constellation’s native token, referred to as \$DAG from now on) could be used to reward the nodes that sent information to *Waze* for contributing data to their application and network. This uses a combination of edge computing (tire sensor processing the pothole), fog computing (analyzing the pothole and providing metrics to the car), and cloud storage (future data is stored for other drives on the road). In Constellation, our network would reward the automobile for sending transactions to another network, while leveraging our network for the bandwidth of the transaction.

How Constellation Is Approaching Blockchain Differently

The World Economic Forum identified Infrastructure and Innovation as their 9th-ranked sustainable development goal, out of seventeen.⁵ Constellation is focused on riding in parallel to the WEF, as they represent global initiatives agreed upon by multiple nations. While infrastructure and innovation can mean a lot of things, we’ve applied both concepts to our protocol in a unique manner — our infrastructure is innovative in that it unlocks the data while providing distribution in an alternative and novel infrastructure framework.

⁵ World Economic Forum, Stephanie Thomson, <https://www.weforum.org/agenda/2015/09/what-are-the-sustainable-development-goals/>

Over the past year and a half, all of the first in class consulting firms have built initiatives for Fortune 1000 companies to apply Blockchain. This resulted in many sandbox test environments with traditional Blockchain technologies that were unable to scale beyond their test environments. Even though Blockchain technology companies are still in their nascent stages, enterprise consulting firms seemed to move the cryptocurrency sales needle too rapidly, causing a demystification and decline in confidence in the technologies.

A couple of reasons why they failed:

- Existing Blockchain technology just doesn't scale
- Benefit analysis was unable to recognize real cost savings or a substantial increase in revenue
- Conclusion: there wasn't a clear economic incentive to move a significant portion of the tech stack onto this new Blockchain technology

As a result, we hit the bottom of the Gartner Hype Cycle. Over the next several years, organizations and technologies like Constellation will bring extensive enterprise and developer adoption to distributed ledger technologies by emphasizing new architectures, alternative consensus models, and addressing the pain points and plights of early-to-market testing. Our go-to-market focus is to partner up with organizations that will have a high use case for edge computing and big data initiatives as the means of exchange in their ecosystem. Furthermore, we look to connect new emerging markets (countries, industries, entertainment) while focusing on being the piping and thus a new distribution model for data.

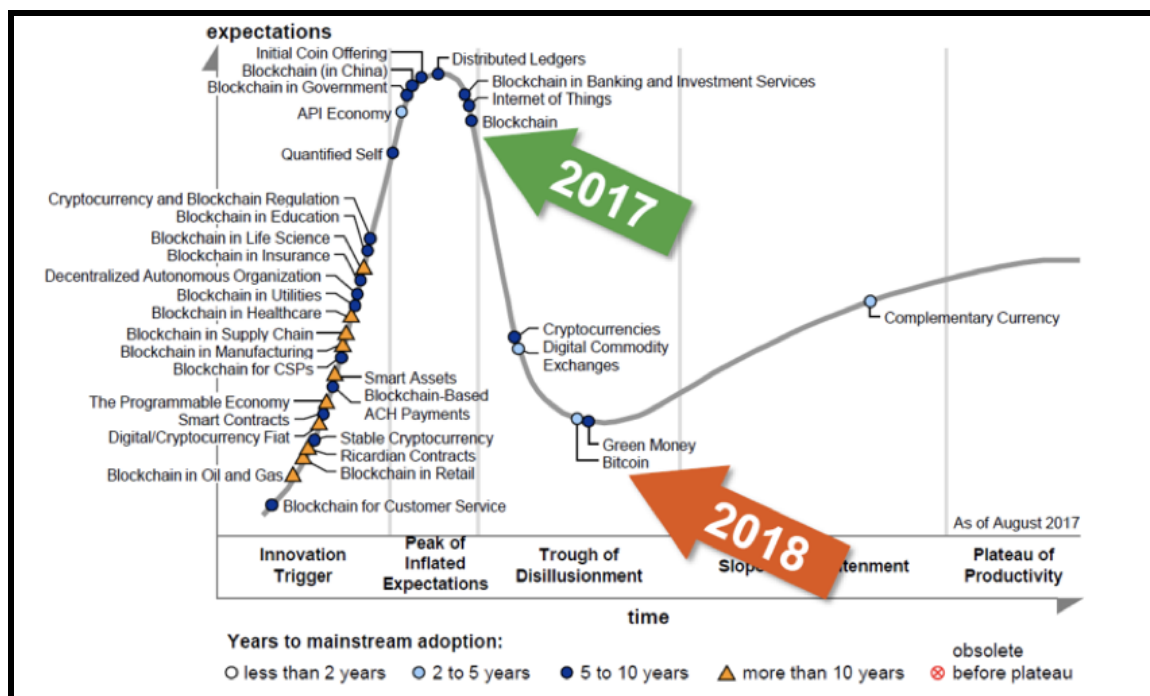


Fig. 2 Crypto Gartner Hype Cycle via Karmashares.com

Constellation's goal will be to form high touch partnerships that will cause exponential adoption of our network (one to many approach), while we empower a DIY (do-it-yourself) developer environment to build specific Blockchain use cases.

Constellation Value proposition:

- Faster Processing – As nodes join our network, the quicker the network becomes. Additionally, as we score and identify different nodes, we will be able to send a fewer amount of data to centralized servers.
- Cost-effective network for processing local data.
- Scalability – as more sensors and devices come online exponentially, traffic through existing infrastructures will become heavy.
- Improved Security – with less of an emphasis on centralized cloud services, it mitigates us against a single point of vulnerability. Additionally, Constellation will enable organizations to decide what data is stored on their para-chain and available to the network. This will further allow networks to toggle between off-chain and on-chain data.
- Ease of Adoption – Developers need a low learning curve to quickly onboard and leverage distributed ledger technologies. We focus on Java (9 million developers), which is taught in nearly every school in the world, and Scala.

Market Opportunities

While on the surface, IoT seems to be the strongest position for Constellation's network because the value propositions are most congruent, we envision an ecosystem that fundamentally redefines what it means to *transact*. If we look at Amazon as a company that enables transactions across multiple industries (retail, produce, entertainment), Constellation sees that the next frontier of transactions will be driven by the value derived from data — be it information, solar energy, non-fungible assets, fungible assets, or alternative currencies. Therefore, we are not limited to the IoT space and are more focused on exchanging and weighing value between ecosystems at large.

Financial institutions are primarily equipped to use Blockchain solutions and have successfully deployed many test environments across a myriad of use cases. These use cases have failed to surmount to meaningful go-to-market strategies and have been exhausted. Furthermore, while Constellation can provide meaningful scale to existing sandboxed use cases, we see an opportunity to rethink connected ecosystems and how emerging markets transact — imagine a smart farm calculating the number of calories in its produce, transferring its solar energy on the grid into a currency, and then providing peer-to-peer sharing of value in their ecosystem and adjoining ecosystems.

As a result of this perspective, we primarily see opportunities in these verticals to be the earliest drivers of Constellation's network and for Blockchain technology at large. While edge computing is sizeable at a \$6.7B market, we expect to see 19.92% CAGR in IoT market growth leading to an estimated 80B in

connected devices by 2025.⁶ There will be an exponential demand to manage large data sets in a cost-effective and decentralized manner, especially in regards to scaling the use of artificial intelligence applied to distributed computations. The following industries and verticals will see an exponential increase of big data demands as more and more sensors come online and we rethink how to share and use data across various systems.

Through the use of para-chains in a DAG architecture, we will be equipped to create connected ecosystems that enable seamless connectivity while allowing transactions between different data structures and economies. To put it simply, a para-chain is a simpler form of Blockchain, which attaches to the security provided by a global protocol rather than producing its own. This is also where we get the notion of Constellation's value being "consensus as a service." While many Blockchain companies are focused on Blockchain solutions for various industries, Constellation's para-chain ecosystem and tokenized API's will provide the ability for Blockchain technologies and existing and outdated computing infrastructures to transact independently. Furthermore, through our reputation based delegate selection and consensus model, more companies and developers will opt to work with Constellation because it is a model built on a sound foundation of math and programmatic decision making, making hacking of the network much more difficult than other consensus models.

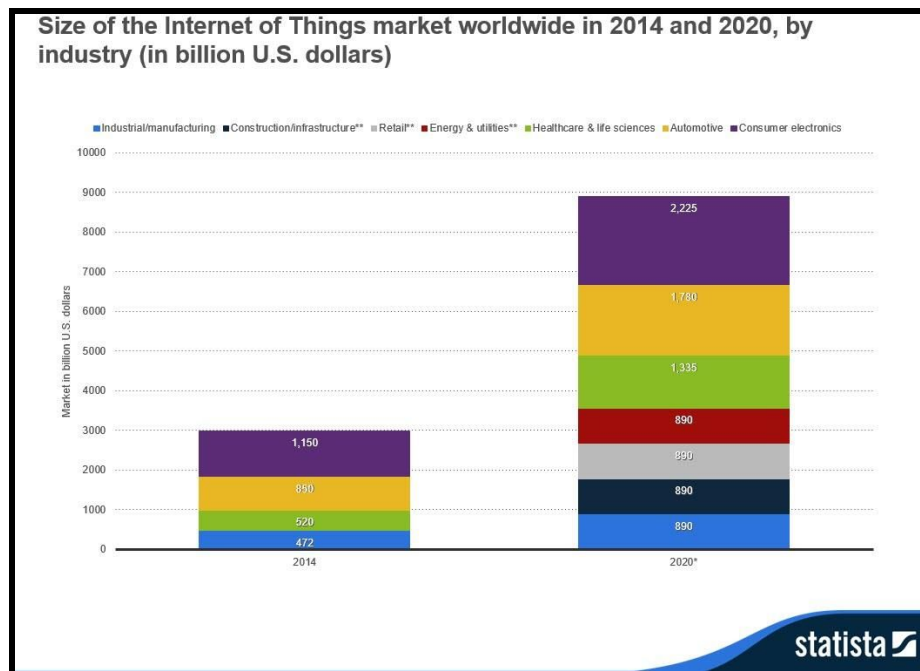


Fig. 3 via Forbes

⁶ Forbes, Louis Columbus, <https://www.forbes.com/sites/louiscolombus/2017/12/10/2017-roundup-of-internet-of-things-forecasts/#6fd920b31480>

Transportation⁷ – \$1.7T IoT Market. While self-driving cars will ultimately require the greatest use of distributed networks and machine learning, we don't need to look too far into the future, as the automotive industry is already quite dependent on IoT. From health checks on automobiles to adaptive cruise control, or analyzing recalls and other data pushes that lead to predictive, rather than reactive, outcomes, IoT has made its presence known in the industry. These are a handful current use cases that the automotive industry is focused on, but Constellation can help provide a rollout strategy for deeper AI and machine learning around existing data and shared data resources.

Healthcare - \$1.335T by 2020 in global IoT Spending. “The average hospital bed has upwards of 20 connected devices, generating a considerable amount of data. Instead of sending confidential data to the cloud where it could be improperly accessed, it would happen closer to the edge.” (CBS Insights 2018). In addition to the amount of data being processed within hospitals, wearables have come to the forefront of the general consumer market. To truly see the benefits of all the data being generated across wearables and connected devices, Constellation will be equipped to unlock the real benefits of patient monitoring to preventative medicine (currently siloed in data collection points) by enabling ways to transact certain data on-chain while maintaining data privacy off-chain. Furthermore, Constellation will offer network redundancy to mitigate against potential centralized network outages, creating more confidence in the healthcare industry to shift more of their data into digital means of distribution.

Manufacturing - \$890B by 2020. “In Dongguan City, China-based phone part maker Changying Precision Technology Company has created an unmanned factory. Where it once required 650 people to operate the factory, it now only needs 60 people.”⁸ This level of automation is what we are seeing out of the 4th Industrial Revolution. While robotics are leading the charge of these substantial cost savings, Blockchain technologies that analyze and interpret data in realtime will be needed to unlock the potential efficiencies of these manufacturing plants further. Scalable Blockchain architectures, like DAG and Constellation, alongside reputation based delegate selection, will enable factories to better mitigate against robot malfunctions and faulty productions. Sensors are being added to every point of the manufacturing supply chain today, aiding technicians by reducing their call to action and allowing them to fix assembly lines with less lag time. Ultimately, these sensors will provide technicians with the exact location of a problem or disruption, reducing their investigation time.

Energy, Utilities, Agriculture and Smart Farms - \$890B by 2020. This number might be much greater anticipated because the cost of solar energy has dropped significantly compared to other sources of energy. As a result, there is a tremendous opportunity to provide the appropriate pipes to redistribute this low-cost energy to other consumers in remote locations. When it comes to Smart Farms, understanding how to create a highly functional farm using IoT (sensors, water management, solar energy, and farm yields) in remote areas of the planet while also optimizing existing infrastructure will be vital for feeding our expanding population. Already, emerging smart farms have shown results from automated farm management. These results aren't limited to just improved crop yields, as the use of data and projections have caused an increase in micro-financing. Constellation will not only enable these

⁷ *Digitalist, Moncumbu Raju,*
<https://www.digitalistmag.com/iot/2018/04/06/why-automotive-companies-need-to-capitalize-on-iot-in-manufacturing-06042451>

⁸ *CBInsights,* <https://www.cbinsights.com/research/future-factory-manufacturing-tech-trends/>

new infrastructures to better analyze data on the edge (especially in remote areas), but also enable new micro-economies created around smart farms to seamlessly transact indexed crops between people, machines, and other businesses.

Consumer and Entertainment - \$2.25T by 2020. Direct to consumer is an immense opportunity. CryptoKitties was the first true debut of a solid direct-to-consumer play where individuals could buy and sell digital images to one another for cryptocurrency. It is no secret that CryptoKitties caused a massive logjam in the Ethereum network. While the Ethereum Foundation is attempting to build a fix to scalability in Plasma, it may not be enough, as their synchronous architecture will not be able to meet existing consumer application traffic and demands entirely. The recent interest in non-fungible tokens and assets (unique tokens/assets vs. commoditized tokens) presents some interesting use cases for our established digital world we live in. Hello Kitty, based out of London, was the first brand to incorporate filters in SnapChat's application. Within a day, they saw hundreds of millions of impressions on their skins. While this doesn't present an obvious distributed ledger use case, it does show the emergence of digital branding and the consumer's appetite. Additionally, traditional investors and venture capitalists will need to see more direct to consumer initiatives before they invest in the market. Constellation's technology will supply the correct framework to build real-world direct to consumer applications that provide the tools used in centralized big data and machine learning environments.

The real impact of Blockchain technologies will be to enable businesses, developers, and the global population outside of the small (yet growing) crypto community to participate in the advancements of distributed ledger technologies. This includes: alternative governance structures, creating new revenue streams by enabling more "miners" and participation in the supply side of distributed networks, cost savings by entities for leveraging distributed networks, utilizing existing computing tools and applying those to distributed networks, and rethinking new modalities of transactions by enabling applications to transact through micro-services on these new networks. Over the next several years, we at Constellation will continue to explore every vertical and the potential use cases for scalable distributed ledger technology. Our goal will be to accentuate some of the core features of the Blockchain and crypto community and amplify community, transparency, and open source and apply those to existing industries and organizations. Through the Orion portal, developers will be encouraged to build applications that work for shifting business ecosystem seen in the 4th Industrial Revolution. By presenting the opportunity for developers to build para-chains which connect to Constellation's ecosystem, we will reimagine a connected ecosystem of transactions.

The Constellation team's mission is to grow and develop a community that can become a part of a vision for a new world. We aim to empower global leaders, ambassadors, and align with critical protocols to create best in practices to make it safe and secure for mainstream adoption of DLT. Finally, we challenge the greater population to rethink emerging economies and traditional aspects of transactions to one that is self-regulating and built on the foundational desire to unlock and distribute the abundance of digital information seen in this 4th Industrial Revolution.

Introducing The Constellation Ecosystem

Constellation is positioning itself to be the world's first Decentralized Application Integration platform. The Constellation network is open and available to anyone globally and offers validator rewards to anyone who provides resources and bandwidth to the network. The network will consist of hundreds of thousands of nodes located globally — from smartphones, IoT devices, recycled computers, and laptops, to enterprise servers that validate transactions with unused and redundant resources — all incentivized to work together in an integrated constellation of devices. Ultimately, this will provide an inclusive, resilient, and secure platform for end users and application developers to transact and build on.

The Constellation network aggregates the resources and bandwidth of many internet connected devices, routing transactions efficiently using its partitioned DAG (directed acyclic graph). It proposes message-based transactions among nodes through a novel probabilistic gossip protocol. Each transaction is not sent to all nodes in every round but instead flown intelligently through the network such that the state of the network remains stable at any given time. Each node collects data from different parts of the network and combines them and signs, then gossiping it to its neighbors.

The most pressing need for current decentralization platforms is to make it scalable. Constellation takes a unique approach to solve this problem — an autonomous reputation based Proof-of-Meme. The potential conflict in the data structure is resolved by the reputation of the signatory nodes. The network uses an autonomous Machine Learning algorithm to determine the reputation of each node. The reputation of a node is not determined by the computation or financial strength of the nodes, but rather the participation and inclination of the node towards the constellation. Constellation aims to be the first platform in the world to design a consensus mechanism that is not computationally heavy (Proof-of-Work), plutocratic (Proof-of-Stake) or monopolistic (Delegated-Proof-of-Stake) in nature.

Constellation's DAG is built using the principles of functional programming and uses Scala and Java at its core. This means that application developers will feel right at home, as they'll be able to immediately use much of the existing code in their technology stack within Constellation. Only by importing a node (Constellation library) into their application, their application can start to integrate with a completely distributed network and become partially decentralized in its architecture. In addition, there are some nine-million Java developers globally that will be able to begin developing applications on Constellation easily. For mass adoption of decentralized networks, it is vital that the underlying code-base be accessible to a vast pool of developers.

Constellation is built to be language-agnostic, allowing developers to create their application logic without relying on any specific language or platform-specific idiosyncrasies. The applications can utilize the Constellation network through an accessible API, provided in multiple popular languages starting with Java, Scala and followed by Python. Thus, one can build not only a complete decentralized application with Constellation, but also a traditional centralized application using components from Constellation's application and API library for data integrity, redundancy, and cloud computing services. Developers can build their own Blockchain and provide cross-chain atomic swap, providing liquidity among Blockchains.

Sooner than we may comprehend, the future of the decentralized economy will be an entangled internet of Blockchains and applications, connected to each other. The economic value will be tokenized in different contexts and will flow seamlessly through different decentralized applications. Constellation, along with its novel approach towards building a scalable application integration platform, will lead the way to become the protocol-of-protocols in the decentralization space.

Pillars of The Constellation Ecosystem

The Constellation ecosystem consists of four key components.

The Constellation Protocol

Each node in Constellation adheres to a set of rules that governs the network. While the protocol can be implemented in different ways, the core interface/RPC remains the crux of the protocol.

The Constellation Framework

The first implementation of the Constellation protocol, as in our Github (cite), is the Constellation framework. In coming months, developers will be able to simply *import* this codebase directly into their applications to integrate Constellation. Since we chose Scala to develop our protocol, we can integrate into all JVM languages natively at the first pass. We also plan to bring out frameworks in different implementations, the foremost in consideration being Python.

The Constellation Ecosystem

Developers can build applications importing the Constellation framework, but not necessarily on the Constellation distributed ledger. Constellation proposes an ecosystem of applications, called para-protocols that are connected through the Constellation ledger in the center. The idea is to allow developers to program the actual use of a para-protocol into the protocol's validation logic itself, meaning that the para-protocol is the decentralized application.

\$DAG: The Liquidity Agent of Constellation

All para-protocols define some *utility* based upon their use cases. They can often be backed by real-life assets such as sensor data or renewable energy. The core protocol of these applications being the Constellation framework, their utilities can also be seamlessly transferred across applications through the native token of Constellation: \$DAG. The network effect of a growing ecosystem embodies the value of \$DAG, enriched by the values of all applications and their use cases combined.

The Technology Overview

The goal of Constellation is to create a decentralized application integration platform facilitating the next generation of applications. In this chapter, we will dive deep into the technology behind Constellation. We start with a detailed description of the network of nodes that constitutes the collective infrastructure of the platform. In order to facilitate mass adoption of decentralized applications, the platform is designed to be *horizontally scalable*. We then propose a novel reputation system for the nodes, weaved by an automated machine learning algorithm baked into the protocol. The reputation of a node will be used to establish consensus within the network, as well as to provide a genuinely democratic governing mechanism.

Constellation uses Directed Acyclic Graph as its core data structure, instead of the path-like Blockchain structure that the first- generation decentralization projects (e.g., Bitcoin and Ethereum) are following. Unlike some newer projects such as IOTA, Nano, and BlockDAG, Constellation does not merely extend chain-like structure to a graph-like structure consisting of linked blocks. The transactions and observations across the network are stored in multiple data structures. The granular data structure in Constellation is abstracted as *edges* — similar to GraphX from Apache Spark, the foundation of many scalable applications. As a matter of fact, we take pride in standing on the shoulders of giants, taking a cue from battle-tested projects on scalability in the wild.

Mimicking biological systems in nature, Constellation proposes *Epidemic Diffusion Mechanism (EDM)* — a novel probabilistic communication protocol among the nodes. Through nodes gossiping among its neighbors, critical information about the state of the network spreads rapidly. The gossiped information also provides a node with the perception of the network structure and the reputation system within. We then discuss *Proof-of-Meme (PoM)* — an autonomously scalable distributed consensus protocol. The protocol is governed by two objectives: optimally shuffling data over the network and maintaining a stable state for the computation cost.

The Constellation Network

The Constellation network consists of an interconnected set of nodes that exist in a hierarchical clustering-like topology. A node is defined as an entity with computational power and storage that executes a particular action determined by the network. The exact specification of the node — be it a smartphone or a high-performing server — is not crucial. The storage capacity or bandwidth of a node can also be drastically different — there is a role for everybody in Constellation, as inclusivity is a core value of our network.

Each node starts off by owning some number of Constellation's native \$DAG tokens, the internal unit of value fueling the network. This incentivizes sustained use and provides a borderless economic transaction layer on the network. However, we would like to clarify that the trustworthiness of a node is not proportional to the number of tokens it owns, thus differentiating it from a Proof-of-Stake style network model. Network activity and use are quantified by the volume of transactions of these tokens among and between the nodes. A transaction is, in reality, a *message-based* transaction, which is a

generalization of a token-based transaction. For simplicity's sake, until we further elaborate on message-based transactions, let us assume that transactions are solely based on \$DAG tokens.

Any node can send \$DAG to any other nodes on the Constellation network in a feeless, fast, and secure way. A transaction is *valid* if the sender has sufficient tokens to execute the transaction and the network has determined that no double spend has occurred. There is no central authority to verify the validity of transactions in Constellation — it is verified by a local neighborhood of nodes which then routes transactions through the most efficient topology on the network. Thus, no single entity can dictate or censor any transaction, making the network void of a single point of failure. Constellation is public, not permissioned, and completely open-source, allowing nodes from all over the world to join the network. This makes Constellation a truly distributed platform where an extensive and diverse network of nodes share computation, bandwidth, and storage infrastructure across the globe.

The previous generation of Blockchain platforms, such as Bitcoin and Ethereum, also aimed to create such a network. With varying degree of success, these platforms failed to attain a stage of mass adoption, primarily because verifying transactions on these networks is a prolonged and inefficient process. In addition to this, the economic incentives to join such networks are biased towards nodes with immense computational power or vast financial bonds. These factors have inevitably paved the way for further centralization of power within these networks, verticalizing mining and centralizing large bondholders as a plutocracy.

Constellation is a democratic network of nodes which allows nodes of any size to join in. The time to verify a transaction is an order of magnitude faster and is state-of-the-art. More importantly, as more nodes join the network, the faster the verification process becomes—making the network horizontally scalable. Constellation aims to be an integration platform for decentralized applications. The Constellation network will provide a robust API for any application that may want to make use of the network of nodes for decentralized data integrity and computational tasks. The applications can be arbitrary Blockchain applications or even centralized applications with a limited requirement for decentralization. Constellation's protocol will be language-agnostic; however, our framework itself (which is the actual code used by a developer) will initially be available to only a subset of languages starting with Java, Scala and then Python. This will allow existing application ecosystems to participate in the decentralization revolution without being tied to the particular traits of scripting languages built from scratch.

Nodes In Constellation

A node in the Constellation network can be any computational entity. It can be ubiquitous: a smartphone, an idle IoT device, or a full-fledged server. The protocol is built with exposure to popular application development paradigms, allowing a plethora of devices to be spawned as Constellation nodes. A node has three configurable dimensions — the computational power, the storage capacity, and the reputation of a node. The computational power and storage capacity can be configured by the node itself, thus allowing the end participant to choose their commitment to the network. The reputation of the node, however, is a network-imposed score and is beyond the arbitrary control of a node. It is decided by the history, commitment and honest behavior of the node towards the network.

Any device can run a small piece of application and be part of the large constellation, as per their level of commitment. The network is open and dynamically fault-tolerant, thus allowing any nodes to join with measures to prevent any moderate-sized attack on the network.



Figure 4: Nodes in Constellation can be devices of any nature

Reputation System of Constellation

Scalable distributed systems are not new — Spark and Hadoop are two of the most widely used systems in large distributed data applications. Handling millions of transactions a day, they auto-scale with ease across many servers to create highly flexible and elastic computing clusters. Millions of users throughout the world use hundreds of applications every day, and these apps operate across distributed data centers globally.

The challenge, however, is to create a scalable *decentralized* application platform that is essentially trustless in its operation and functionality. In typical distributed systems, all nodes are controlled by the parent company and trivially trusted by all the participants of the platform. In a decentralized platform, the origin of the nodes is not controlled by any single entity; thus we cannot necessarily impose a pre-defined trust on them to prevent malicious behavior on the network.

This raises a more fundamental question: why is the trust of a node relevant to the network? It is well-known from distributed computing that separate parts of the network often have different sets of data due to concurrency and latency. The network needs to eventually reach a *consensus* about the state of the network — thereby formalizing the true state of transactions and data flowing in the network. However, in an open network, a node may propagate falsified data and try to establish a wrong state of the network aligned with their incentive (financial or otherwise). In that case, deciding between two sets of conflicting data is not easy without taking into account the reputation of the nodes behind them.

Bitcoin and similar networks use proof-of-work, where the computational power of a node is aligned with its honest behavior. In other words, the reputation of a node is tied to the node's computational clout. Thus, nodes are incentivized not to act maliciously, since that will require them to do a significant amount of computation without any monetary benefit. While revolutionary, this is an artificial gamification of a consensus mechanism that does not scale. This has also given rise to the centralization of the network gathered by vertical compute power with specialized hardware such as ASICs. The Bitcoin network has even historically come dangerously close to a permanent failure with a possibility of a 51% attack.

In some of the recently proposed proof-of-bond style protocols — proof-of-stake being the most familiar example — the reputation of a node is tied to the node's financial clout. This arguably will give rise to unprecedented plutocracy and centralization among the powerful nodes. Finally, some decentralized protocols have purposefully sacrificed their degree of decentralization for the sake of scalability. The most popular form of such protocols includes electing a small number of nodes as leaders, which can then have a disproportionate amount of reputation and power over the rest of the network. This is arguably not a desirable approach to true decentralization at all.

Reputation of Nodes

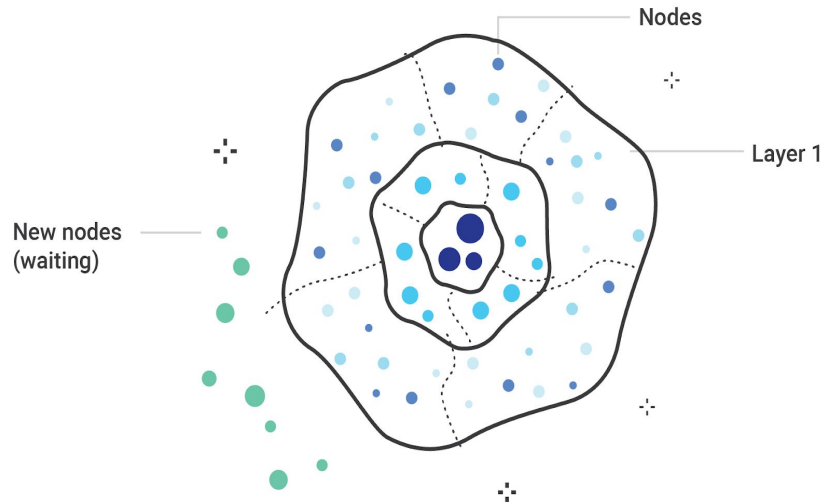


Figure 5: Visualizing network of nodes by layers of their reputation. Nodes with lower reputation flock further from the center.

In Constellation, the reputation of a node is carefully calibrated by the community. The reputation assignment system is an autonomous machine learning algorithm that takes into account the behavior of the node to the network and incentivizes the nodes, to be honest. The reputation of a node is independent of its computational or financial power — thus giving the nodes no special status, fairly democratizing the network.

The Constellation network can be seen as concentric layers of reputation (see Figure 5 above), such that nodes with lower reputation gather around the outermost edges, as seen the visualization below. The reputation of a node depends on a myriad of features, including their availability, loyalty to the network integrity, and history with the network when adding to the data structure in Constellation. They are carefully designed not to be tied to wealth or computational power — making Constellation unique in relation to existing approaches, such as Proof-of-Bond or Proof-of-Work. There is no pre-imposed trust on any node; thus Constellation does not depend on any small subset of nodes to maintain the integrity of the network. A higher reputation does not bestow any blind authority on to any node. In other words, nodes are only financially incentivized to gain higher reputation, not to gain any special status in the network. In addition, reputation is equivalent to \$DAG and can be spent like \$DAG to increase an account's throughput requirements. However, we democratize the protocol by preventing \$DAG ownership to affect consensus unfairly.

The deterministic trust score of a node is calculated primarily based on its participation in the network. The participation of a node is based on regular activities of a node that directly benefits the network. It often involves receiving observations from other nodes, combining the incoming observations, then signing and passing it off to other neighboring nodes. In general, nodes which participate more frequently will receive higher scores. An evolving machine learning algorithm probabilistically determines the reputation of a score, thus thwarting any attempt to game the reputation score system. The system also takes a global ban list to keep the clear adversaries away. Any node with full knowledge of the network structure can calculate and verify the scores for any other node. Trust is normalized so that no node can ever dominate the scoring calculations by contributing disproportionately more than

other nodes, despite having more significant resources. Nodes are penalized in various degrees for malicious behavior, overwhelming participation, and failure to comply with basic network activities.

Relative Trust Among Nodes

In any distributed network, the reputation of a node is always subjective to multiple dimensions and can never be truly global. Let us examine the classic case of ranking web pages by a search engine. The reputation of a web page is not only a global score but also dependent on multiple metrics, like the geographic location of the user, the search term, and its context. The localized trust among the web pages — often characterized as hyperlinks — is crucial when determining the quality and relevance of a web page to a users search. We have taken a similar approach by adding an additional layer of trust among the nodes of the Constellation network.

Nodes can declare trust to other nodes. This is similar to voting mechanisms like liquid democracy, whereby trust is bestowed on an individual by another to cast a vote. Thus, there exists not only a global score of the reputation of a node, but also a relative score when seen from the point of view of different nodes. This allows for a trust flow within the network, analogous to how page authority flows through web pages in a PageRank algorithm.

To further illustrate this concept, let us examine the graphic at Figure 6: imagine that nodes n_1 and n_2 are in layer 0, which includes nodes between reputation score 0 and 30. Similarly, node n_3 and n_4 are in layer 1 (reputation score 30 – 50). Let us assume that node n_2 publicly declares full trust to node n_3 , and incidentally n_1 trusts n_2 . When required, node n_1 trusts node n_3 more than any arbitrary node n_4 even though they both have a global reputation of 50, since there is no public trust flow from n_1 to n_4 . We note that the reputation score and scaling mechanism in this example are for illustration purposes only.

A node may also impose a secret trust on nodes based on off- chain information (geography, real-world trust etc..) and use that to calculate trustworthiness among nodes. For example, in Figure 3, n_1 can choose not to broadcast its trust on n_2 publicly, nonetheless, it can use that information to decide the relative reputation of n_3 .

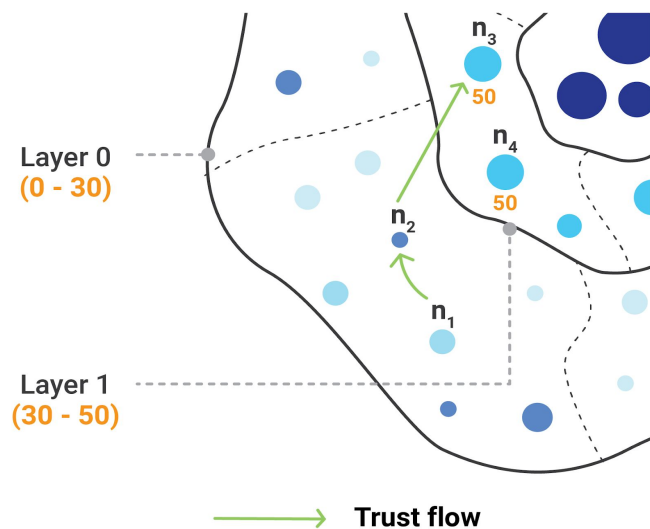


Figure 6: How trust flow determines relative reputation scores.

In a nutshell, the reputation of a node depends not only on a set of globally available parameters, but it is also relative to the node that is calculating the reputation. This is critical for handling specific types of network attacks, as a purely deterministic reputation model can be more easily attacked by throwing a considerable amount of computation at the network. Since a node broadcasts only to part of the

network, it is essential to establish a well-balanced network topology such that the data flow in the network is evenly distributed. A node receives bundles of data, which includes signed data from various other nodes. Unwrapping the bundle and seeing the timestamp and ordering structure of the signatures, the node will be able to construct a view of the network from their own perspective.

The Constellation Data Structure (CDS)

The Constellation network consists of nodes of various computational and storage capabilities, stemmed from various geographic locations. In this section, we propose the Constellation Data Structure (CDS), a novel distributed data structure that holds the integrity of this network. CDS is a scalable, cryptographically secure, and modular structure that can be accessed and validated by the smallest of the nodes. At its heart, the data structure consists of a number of Directed Acyclic Graphs (DAGs) holding information stemming from network activity. The two most important building blocks of CDS are *message-based transactions* and *observation bundles*.

Message-based Transactions (MBTs) in Constellation

In general, message-based transactions (MBTs) from one node to another will include a message and an acceptance condition on the message. The message may typically include a computational command, while the acceptance condition will be defined by the outcome of the computation. A more straightforward example of an MBT is a token-based transaction. In a token-based transaction, the message is merely the number of tokens to be transferred from one node to another, whereas the acceptance condition is that the sender has a sufficient balance to send the transaction. The schema of generic MBTs is under active development and will be released along with future iterations of the Constellation test network. Until explicitly stated otherwise in this document, we assume token-based transactions whenever we mention transactions.

Tokens in the Constellation network is abbreviated as \$DAG, a tribute to Directed Acyclic Graphs, the core data structure in our system. All transactions and tokens in Constellation are held by addresses or accounts, which are a hash of a public key that takes the form of a base58 string. An example of a Constellation address is DAG5ZTe31ysjikEgREqnf9CQR2KVYv3pfxV5NQZY. The address is divided into three parts: the prefix being 0xDAG, the parity check bit, and the tail. In this example, 5 is the parity direct sum bit and ZTe31ysjikEgREqnf9CQR2KVYv3pfxV5NQZY is the tail. We can verify the integrity of the address by adding all digits in the tail as a direct sum and comparing with the parity check bit. In the example, $3+1+9+2+3+5 = 23$; $2 + 3 = 5$, which can also be represented as $23 \text{ divmod } 9 = 5$.

An individual node signs transactions using a node key, which can also be used as a transaction address. Nodes can maintain as many addresses as desired, in order to allow the highest security possible by supporting one-time-use addresses (similar to in Bitcoin) or rely on a single account key. Unlike other platforms, Constellation makes no distinction between UTXO (Unspent Transaction Output -- which encourages a unique 'account' per output address) or account format, allowing the user to determine which use case is most appropriate for them. For each transaction, the public address key is exposed to enable validations and the corresponding private key signs the transaction data before broadcasting. Transactions do not require any state information, and so can be generated completely offline with no

knowledge of the network. Once submitted to the network, the ordering and validity of a transaction are calculated and the network state is updated correspondingly. No nonce or other hashes are required for approval of a transaction, although nodes can choose to embed additional validation information in MBTs for prioritizing transactions.

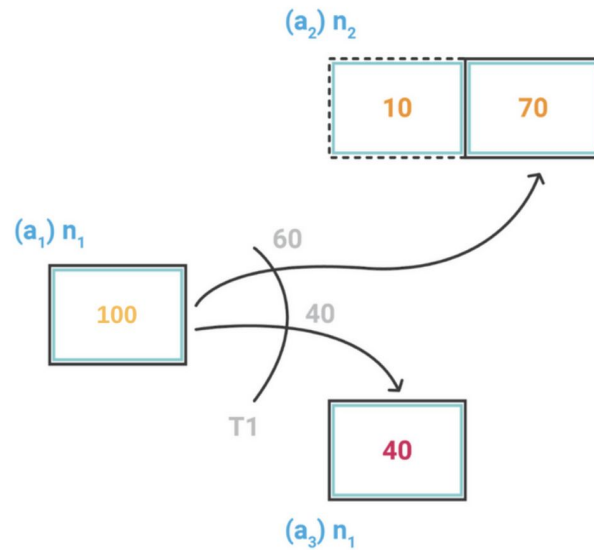


Figure 7

A transaction, in its bare minimum form, is defined as the transfer of a token balance from one address to another that is confirmed by consensus and does not constitute a double spend. However, in general, a transaction consists of an input address, a set of output addresses with their corresponding amount and a remainder address in the case of a UTXO-style transaction. The input represents the address sending the transaction, and the output represents the set of addresses receiving the corresponding amounts or amount. The remainder address is a new or originating address with the remainder of the funds from the input address sent to this address as a balance. As seen in the above example in Figure 7, the address a_1 , holding 100 \$DAG, sends a transaction with 60 \$DAG to address a_2 and puts the remainder 40 \$DAG in a_3 . The node n_1 , controlling a_1 , trivially retains the control of a_3 . The dotted box in a_2 represents the previous state of a_2 holding 10 \$DAG.

Transaction Dependency DAG (TD-DAG)

In its bare minimum form, the transactions in the CDS can be connected as a transaction dependency Directed Acyclic Graph (TD-DAG) — a graph with addresses as nodes and transactions as the edges. We show an example of a part of a TD-DAG in Figure 7. The transaction data dependencies are only calculated and used to exploit data locality optimizations. The fundamental TD-DAG structure is concerned only with capturing transactions and is used to determine data dependencies. This data structure acts as the cornerstone of the CDS, allowing fast verification process of transactions. This serves as a thin wrapper around a transaction, which can be performed independently of the signer of the transaction. This wrapper then gets signed by further witnesses until it passes a minimum threshold required for entry into a checkpoint block. A checkpoint block may consist of only a single transaction, but in practice, for performance purposes, it is better for it to consist of many. It has a partitioning

function as well which is dynamically determined based on a window view into the surface history of the ancestors over which it is defined which is described in further detail in the technical whitepaper.

Observation Bundles

Transactions among nodes are bundled together in Observation Bundles, defined recursively as a bundle of bundles. The atomic bundle being the transaction. Each bundle is signed with timestamps by a node with their key, thus notarizing the proof of witness. Such bundles form edges in Constellation, similar to GraphX, the graph building API from Apache Spark. Edges can be derived or cryptographically signed, with details coming in later versions of the whitepaper.

Edge Formation in Constellation - Observation Dependency DAG (OD-DAG)

There are 2 types of edge combiner operations, adding a checkpoint child to two parent tips, or adding a verification child to two parent tips. The primary hard rule for edge formation is that no links between a new child can contain 2 ancestry trees with duplicate transactions or cycles. This means traversing all ancestors to find all transactions from both branches yields zero overlap and no cyclic references.

Beyond that, tips are prioritized based on reputation scoring criteria and information about the active tip surface. Checkpoint blocks are 'encouraged' when there are too many validation tips of high depth (i.e., many validations in a row with few checkpoint blocks) and vice versa. There are metrics to determine for a given tip what the relative ratio of validation edges to checkpoint edges are, this is defined as the 'depth ratio' of a given edge. Edges prefer to be formed between tips with a high reputation score which has a high distance from one another - where distance is defined by ancestry overlap (this prevents the DAG from becoming excessively 'wide'). 'Dead edges' may form, which represent either attacks on the network, or poor connectivity/node failures. Nodes refuse to select them from the tip surface, and they get dropped.

Facilitator selection with a fallback allowing excess node participation in the event of node failure is used to prevent individual nodes from over participating in edge construction or edge batch signing. Tips are deterministically selected in favor of those with proper facilitators so that the fallback mechanism cannot be used as an attack vector. Facilitator selection is made per tip by looking at a window backward in the tip ancestry and selecting from the set of all signers who participated in that ancestry. The child may use facilitators from either parent branch.

The Communication Protocol in Constellation

Nodes in Constellation connect to a number of other nodes called its peers. Understandably, it is not efficient for a node to connect to all other nodes. Hence the number of peers it is connected to is reasonably small relative to the total number of nodes. We propose a novel protocol that governs the way nodes communicate with each other. The communication protocol is not only for data to travel across the network, but also for nodes to realize and understand the reputation and distance of other nodes.

Epidemic Diffusion Mechanism (EDM)

Mimicking biological systems, the data is constellation flows through a gossip protocol called Epidemic Diffusion Mechanism. Typically, a node gets observation bundles from its peers. The EDM has two key steps: *unwrapping* the bundle and detecting the positions of the signatory nodes, and *bundling*, efficiently combining the incoming bundles into an optimized bundle before gossiping over to the peers. By way of unwrapping more bundles, a node can map out more nodes other than its peers, and their relative distance. A formal definition of the distance and elaboration of the mechanism will be added to the whitepaper in the upcoming version.

Code Examples

Edge Schema

```
/**
 * Our basic set of allowed edge hash types
 */
object EdgeHashType extends Enumeration {
  type EdgeHashType = Value
  val AddressHash,
  CheckpointDataHash, CheckpointHash,
  TransactionDataHash, TransactionHash,
  ValidationHash = Value
}

/**
 * Wrapper for encapsulating a typed hash reference
 * @param hash : String of hashed value
 * @param hashType : Strictly typed from set of allowed edge formats
 */
case class TypedEdgeHash(hash: String, hashType: EdgeHashType)

/**
 * Basic edge format for linking two hashes with an optional piece of data attached. Similar to GraphX format.
 * Left is topologically ordered before right
 * @param left : First parent reference in order
 * @param right : Second parent reference
 * @param data : Optional hash reference to attached information
 */
case class ObservationEdge(
  left: TypedEdgeHash,
  right: TypedEdgeHash,
  data: Option[TypedEdgeHash] = None
) extends ProductHash

/**
 * Encapsulation for all witness information about a given observation edge.
 * @param signatureBatch : Collection of validation signatures about the edge.
 */
case class SignedObservationEdge(signatureBatch: SignatureBatch) extends ProductHash

/**
 * Holder for ledger update information about a transaction
 * @param amount : Quantity to be transferred
 * @param salt : Ensure hash uniqueness
 */
case class TransactionEdgeData(amount: Long, salt: Long = Random.nextLong()) extends ProductHash

/**
 * Collection of references to transaction hashes
 * @param hashes : TX edge hashes
 */
case class CheckpointEdgeData(hashes: Seq[String]) extends ProductHash
```

Signature Schema

```
case class HashSignature(
    signature: String,
    b58EncodedPublicKey: String
) {
  def publicKey: PublicKey = EncodedPublicKey(b58EncodedPublicKey).toPublicKey
  def valid(hash: String): Boolean =
    verifySignature(hash.getBytes(), fromBase64(signature))(publicKey)
}

case class SignatureBatch(
    hash: String,
    signatures: Set[HashSignature]
) {
  def valid: Boolean = {
    signatures.forall(_.valid(hash))
  }
  def plus(other: SignatureBatch): SignatureBatch = {
    this.copy(
      signatures = signatures ++ other.signatures
    )
  }
  def plus(other: KeyPair): SignatureBatch = {
    this.copy(
      signatures = signatures + hashSign(hash, other)
    )
  }
}
```

Transaction Building

```
/**
 * Transaction builder (for local use)
 * @param src : Source address
 * @param dst : Destination address
 * @param amount : Quantity
 * @param keyPair : Signing pair matching source
 * @param normalized : Whether quantity is normalized by NormalizationFactor (1e-8)
 * @return : Resolved transaction in edge format
 */
def createTransactionSafeBatchOE(
    src: String,
    dst: String,
    amount: Long,
    keyPair: KeyPair,
    normalized: Boolean = true
): ResolvedTX = {
  val amountToUse = if (normalized) amount * Schema.NormalizationFactor else amount
  val txData = TransactionEdgeData(amountToUse)
  val dataHash = Some(TypedEdgeHash(txData.hash, EdgeHashType.TransactionDataHash))
  val oe = ObservationEdge(
    TypedEdgeHash(src, EdgeHashType.AddressHash),
    TypedEdgeHash(dst, EdgeHashType.AddressHash),
    data = dataHash
  )
  val soe = signedObservationEdge(oe)(keyPair)
  ResolvedTX(ResolvedEdgeData(oe, soe, ResolvedObservationEdge(Address(src), Address(dst), Some(txData))))
}
```


Genesis Flow

```
/**
 * Build genesis tips and example distribution among initial nodes
 * @param ids: Initial node public keys
 * @return : Resolved edges for state update
 */
def createGenesisAndInitialDistributionOE(ids: Set[Id]): GenesisObservation = {

  val debtAddress = makeKeyPair().address.address

  val redTXGenesisResolved = createTransactionSafeBatchOE(debtAddress, selfAddressStr, 4e9.toLong, keyPair)

  val genTXHash = redTXGenesisResolved.edge.signedObservationEdge.signatureBatch.hash

  val cb = CheckpointEdgeData(Seq(genTXHash))

  val oe = ObservationEdge(
    TypedEdgeHash(CoinBaseHash, EdgeHashType.ValidationHash),
    TypedEdgeHash(genTXHash, EdgeHashType.TransactionHash),
    data = Some(TypedEdgeHash(cb.hash, EdgeHashType.CheckpointDataHash))
  )

  val soe = signedObservationEdge(oe)

  val roe = ResolvedObservationEdge(
    null.asInstanceOf[SignedObservationEdge],
    null.asInstanceOf[SignedObservationEdge],
    Some(cb)
  )

  val redGenesis = ResolvedEdgeData(oe, soe, roe)

  val genesisCB0 = ResolvedCB0Observation(Seq(redTXGenesisResolved), ResolvedCB(redGenesis))

  val distr = ids.toSeq.map{ id =>
    createTransactionSafeBatchOE(selfAddressStr, id.address.address, 1e6.toLong, keyPair)
  }

  val distrCB = CheckpointEdgeData(distr.map{_.edge.signedObservationEdge.signatureBatch.hash})

  val distrOE = ObservationEdge(
    TypedEdgeHash(genTXHash, EdgeHashType.TransactionHash),
    TypedEdgeHash(soe.signatureBatch.hash, EdgeHashType.CheckpointHash),
    data = Some(TypedEdgeHash(distrCB.hash, EdgeHashType.CheckpointDataHash))
  )

  val distrSOE = signedObservationEdge(distrOE)

  val distrROE = ResolvedObservationEdge(soe, soe, Some(distrCB))

  val distrRED = ResolvedEdgeData(distrOE, distrSOE, distrROE)

  val distrCB0 = ResolvedCB0Observation(distr, ResolvedCB(distrRED))

  GenesisObservation(genesisCB0, distrCB0)
}
```

Proof-of-Meme: The Consensus in Constellation

*Why Meme?*⁹

We've created the "Proof-of-Meme"* term to describe Constellation's delegate selection model, as the other terms didn't succinctly describe our own. Our model performs consensus and validates transactions based on an 'actors' past behavior on the network, leading to a fairer, more democratic economic society that can thrive within it. To explain what led to our decision to use the "Proof-of-Meme" term, let's explore its origins:

In his book *The Selfish Gene*, Richard Dawkins coined the phrase "Meme" and "Memplex" to describe when specific behaviors in society are beneficial for an individual, since they increase the likelihood of that individual spreading their genes, and thereby surviving. Fundamentally, this is the process of natural selection, and the same logic can be applied to the realm of ideas and inventions. Ideas are distributed into an inherently competitive landscape — some survive and spread, while others die out and wither. Just like in ecology, Constellation uses entropy as it's underlying measure. Dawkins concluded that in many areas into which a 'thing' spreads there is a natural selection process. He concluded that there was such a selection process and, to emphasize the parallel to natural selection, he coined the term "meme" which is derived from the ancient Greek root, *mimeme*, meaning imitated thing. Dawkins has also referred to memes as "mind viruses." The point he is trying to make is that memes, just like viruses, are indifferent to the welfare of their hosts and the only thing that counts, from their perspective, is that they persist and survive.

For a meme to survive and spread in a competitive environment, it must have attributes which give it advantages over other memes. In our case, this competitive environment is the reputation of a node on the Constellation network. This becomes the process whereby a delegate is rewarded for validating true facts, and providing bandwidth and throughput on the Constellation network. Therefore, behavior that threatens the security of the network will not be rewarded and a node's "Meme Score" will be penalized, thereby having a host of repercussions for its participation and ability to thrive and participate on Constellation.

It's important to note that a meme may improve its prospects for survival if it becomes part of what Dawkins termed a "memplex." This is a situation where several compatible memes join together in a manner that is mutually supportive and may be seen as a roughly analogous situation to genes working in concert with other genes in the genome. We can conclude that our network is comparable to both a constellation and a memplex, as both are scale-free networks.

It is for this reason that we call our reputation-based consensus model, Proof-of-Meme.

⁹ As the application of our consensus model widens in scope, expect to see a broader name reflected in future iterations of this paper.

Developer and Community Portal – Orion

The primary function and value of the Orion Portal is to serve as a foundational source of information for all things Constellation Labs. Whether its support, marketing material, bounty campaigns, or developer documentation, it will all be living within Orion. We wanted to create a platform where the Constellation team can interact and share with developers and community members alike, while also giving our users a chance to be rewarded for their time and expertise.

Orion will become the gateway and membership portal to the Constellation ecosystem. By staking \$DAG tokens, token holders will be able to gain membership access to the portal on two levels, Community (250 \$DAG) and Developer (1000 \$DAG). There is also a free membership tier, where no \$DAG staking is required. Within the portal, token holders will be able to work on GitHub issues, offer marketing services, as well as provide community support in return for tokens.

The vision of Orion is to enable Constellation to scale in a truly decentralized fashion. The Constellation Core team will curate the network while allowing the community to help shape, build, and grow the ecosystem. Depending on the membership level, there will be additional services such as a support desk for users and developers, as well as access to developer tools. Membership access token for the Orion user portal that will offer the following resources:

1. Developer documentation and Wiki
2. Developer support desk (tiered support based on membership level)
3. Developer tools (when test-net is launched)
4. Developer bounties for building features and application modules or full native applications.

Over time, the Orion portal will become the Constellation Application Marketplace where Developers will be able to monetize applications and services that they build on Constellation. For more information check out [our blog on Orion](#), or feel free to sign up and [explore the platform itself](#).

Orion Development Roadmap

What to expect in the upcoming sprints:

Orion V2




- Enhanced end-user experience for various flows
 - MetaMask
 - Airdrop support
 - Onboarding
 - Concierge
- Forum and leaderboard enhancements
 - Badge creation
 - Styling & Design
- Email redesign
- Bounty Rewards
 - Bounty rewards are leveraged to increase community engagement and onboarding.
There are various types of rewards that will be targeted to different communities:
- Home portal updates
- Inviting friends enhancements

Constellation Ambassador Program

- Version 1
 - Registration flow
 - Lead capture
 - Hubspot integration
- Version 2
 - Customer journey pre-vetting phase
 - Support of certification process
 - Ambassador agreement delivered
 - Kit sent, incentivization provided
 - Activity integrated into Orion

Orion Membership Tiers

There will be a limited number of guild tiers that are available for purchase on first come first served basis. However, access to the portal will not be restricted. They are outlined as follows:

 Free 0 DAG	 Community 250 DAG	 Developer 1,000 DAG
Free members can use the community forum, developer docs, open jobs, and Discord. Earn rewards by inviting friends.	Community members earn rewards by contributing to support, marketing and documentation.	Developers earn rewards by contributing to documentation, building application, and contributing to core development.
Key features	Key features	Key features
Community Discord access	Incentivized community job board	App developer marketplace
View community job board	Core team discord access	Incentivized developer job board
View developer documentation	Early access to core releases	Core dev-team Discord access
Community Support	Video Tutorials	Video Tutorials
	Incentivized community support	Priority chat support

Bounties

With the advent of Blockchain and cryptocurrencies, novel ways of leveraging reward mechanisms have come about through the use of bounties. Constellation implements several types of bounty rewards systems to build and stabilize the core protocol, while simultaneously growing the community. Bounties will be posted in Orion from the Core Constellation team and be available to both Community and Developer tiers. Some examples of bounties that will be available for each tier are as follows (*note that rewards here are for illustrative purposes only and will be subject to change when living in the portal*):

Community

Social media users can receive \$DAG by helping to promote the project through BitcoinTalk, Reddit, Twitter, and other social media platforms. Marketing bounties also include rewards for creating content relevant to Constellation such as Youtube videos, articles, reviews, etc. Payment in cryptocurrency provides the added potential for the coin's value to increase as more people join and use the service.

1. Write a Steemit post about the technical architecture of Constellation - 1000 \$DAG reward.
2. Produce a YouTube video about Constellation or conduct an interview with the Constellation team - 2000 \$DAG reward.

Developer

Rewards are offered to developers in both fiat and digital currencies to solve technical problems. Largely, bug bounty hunters find security “loopholes” in software code to prevent hacking. The Constellation Bounty Program will play an important role in the development of a more secure Constellation Codebase. Some examples of a Developer bounty are as follows:

1. Build a native Android \$DAG wallet - 50,000 \$DAG reward.
2. Run a testnet node for 3-months and provide 90% uptime - 15,000 \$DAG reward.

These rewards will first be paid out of the Constellation community allocation of tokens, which totals 80M tokens. Once these have all been issued, the Constellation Foundation will repurchase or ‘buy-back’ tokens to pay out community bounties from the open market.

Forum Badges and Points

Users will earn rewards on Orion for completing a number of activities within the portal by contributing to the Constellation forum, where a user will earn points that get converted to \$DAG on a cycle governed by our own smart contract. The table below outlines the points that a user will earn based on given actions.

Badge Name	Description	Amount of Points
Autobiographer	Users complete their profile	20
First Flag	First time a user flags a post	20
First Link	First time you add a link to another topic	5
First Mention	First time you do @ another user	5
First Quote	First time you quote another post	5
First Reply By Email	First time you reply to a post via email	5
First Share	First time you share a topic	5
New User of the Month	2 new users each month - overall contribution by likes, posts	100
Admired	5 likes on 300 different posts	100

Crazy in love	Use all 50 daily likes for 20 days	20
Devotee	Visit 365 days in a row	200
Empathetic	500 liked posts, give 1000 likes in return	250
Great Share	Link that was clicked 1000 by outside	150
Aficionado	Visiting 100 days in a row	50
Anniversary	1 year anniversary	50
Gives Back	100 liked posts and 100 in return	50
Good Share	300 outside visitors from sharing an external link	75
Appreciated	1 like on 20 different posts	20
Enthusiast	Visiting 10 consecutive days	10
Promoter	Invites an outside friend who joins	50
Thank you	20 liked posts and 10 in return	5
Welcome	First like on a post	25
Famous Link	1000 clicks to a link	50
Great Reply	Reply gets 50 likes	20
Great Topic	Topics get 50 likes	20
Good reply	25 likes	10
Good Topic	25 likes	10
Leader	Trust level 4	250
Basic	Upgrade account to level 1	10
Regular	Trust Level 3	100
Member	Trust Level 2	50

Constellation Token Model

Definitions

Token Vesting

“Vesting” is used to describe the mechanism by which performance-based rights to tokens are earned. This is the same mechanism by which traditional companies issue stock. If an employee or founder leaves Constellation, they lose the right to any “unvested” tokens. These tokens are returned back to The Constellation Foundation’s treasury. Vesting commences on the employee or founder’s first day at Constellation.

Token Lockup

“Lockup” means ownership has transferred to the person or entity, but the tokens are locked and cannot be transferred until a predetermined date has passed. Lockups apply to both vested and unvested tokens. This is done both by smart contract and escrow as part of The Constellation Foundation’s treasury function. All lockup periods begin on June 1, 2018.

Cliff

“Cliff” is the date or anniversary on which tokens first “vest.” For example, if a Founder has a four-year vesting schedule with a 12-month cliff, this means that 12 months after starting work for the Foundation, the founder “vests” 25% of their token allocation. After this cliff, tokens move to pro-rata vesting which runs on a calendar month basis. This means that in the aforementioned Founder case, 1/48th of tokens granted would vest monthly after the 12-month cliff until all tokens are fully vested on the four year anniversary of the Founder’s start date.

Founders

Founding core team members of The Constellation Foundation Company Limited who have been working on the project since March 2018.

Partners & Advisors

“Partners and Advisors” are a collection of Angel Investors, Institutional Funds, supporters, and individuals that have been associated with Constellation from day 1. Without these individuals, Constellation would not exist. It would likely still be a project confined to Brendan and Wyatt’s homes, not the world-changing organization that is now set up to become. All Partners & Advisors’ token allocations are heavily locked up, with 100% of such tokens subject to a two-year lock up with a six-month cliff.

Foundation Tokens

The Foundation's tokens are held in an audited treasury that is managed by our ownerless structure under strict governance and custody conditions. These tokens are available for issuance to the employees, consultants, and advisors of The Constellation Foundation, in each case with a vesting schedule commensurate with the token allocation. For example, token grants to employees will be subject to a four-year vesting schedule with a 12-month cliff. Additionally, tokens held in treasury are available to further the mission of The Constellation Foundation.

Community Tokens

These tokens are used to incentivize community participation in the Constellation ecosystem through Airdrops, Developer Initiatives, and Academic Grants that will be available through our community portal.

Validator Rewards

These tokens are issued to validators on the Constellation mainnet when it is launched in 2019. They are released over 10-years to validators on the Constellation mainnet.

Private Sale

The Constellation private sale was open to Accredited Investors, Funds, and Institutional Investors in January 2018. A hard cap of \$33.7M was reached and a total of 730,124,835 tokens were sold, of which **566,163,826** are liquid at the TGE or ~ **14%** of the total supply. Discounted tokens are locked for 6 months from the date of the Token Generation Event.

Token Distribution Table

Token Distribution	%	Total	Vesting	Lockup
Founders	20.00%	800,000,000	4 years, 25% vests 12 months from the start date, remaining 75% released in equal monthly installments thereafter.	4 years, 5% released at TGE, 20% released on 12/1/18, remaining 75% released in equal monthly installments thereafter.
Partners & Advisors	13.43%	537,065,000	-	2 years, 25% released on 12/1/18, remaining 75% released in equal monthly installments thereafter. **
Foundation Tokens	26.32%	1,052,810,165	Tokens issued to employees are subject to 4-year vesting schedule with cliff.	-
Community Tokens	2.00%	80,000,000	-	-
Validator Rewards	20.00%	800,000,000	-	10-years, minting starts at Mainnet Launch
Private Sale	18.25%	730,124,835	-	All tokens issued at a discount will be locked up until 12/1/18. For example, a purchaser with 15% discount will have 15% of tokens subject to lock up.
Total	100.00%	4,000,000,000	-	

Business Development in Constellation

Go-To-Market Strategy

Constellation is flushing out a multitude of use cases where we can help translate the value captured by new technologies observed in the 4th Industrial Revolution while providing the underlying framework to deliver data and value. While our north star metric as a company is to drive “net new node growth,” we first must build out go-to-market stages to educate the market, align ourselves with key partners, and create an understanding of the needs and wants from a community and enterprise perspective.

Our go-to-market strategy is as follows:

V1

- Develop community interest across Reddit, Discord, Facebook, Telegram and other social channels.
- Create and distribute a token (\$DAG) to show community confidence and seed the network with value.
- Develop the Orion Portal to encourage more in-depth conversations, source developer and community interest in building our open-source technology, and provide bounties to incentivize growth of our network and community.

V2

- Onboard the Constellation developer community to participate in running nodes across our network.
- Leverage our community support and network to build an Ambassador program which focuses on activating vertical specialists to represent Constellation and our use cases for specific verticals.
- Participate in existing global consortiums to build trust, awareness, partnerships, and thought leadership across various verticals and enterprise organization.
- Create our own consortium called Scalable Protocol Alliance (SPA) that will collaborate with protocols that are addressing scalability and applications that are building on protocols that will require scalability.
- Develop direct relationships with organizations that are building connected ecosystems and applications that will develop on top of Constellation.
- Appeal to the 9 million developers within the Java community to start testing our technology.

Constellation's Approach

Constellation's core advantage will rely on creating a two-sided marketplace. Namely, the players in our market will consist of:

Supply

Consumers looking to earn tokens and income by participating in our delegate selection; Devices and machines that can seamlessly transact with one another.

- A) 5 Billion connected retail consumers that have access to the internet, mobile devices, and computers (smartphone, iPad, personal computers)
- B) 75 Billion Connected Devices by 2022 (servers, cars, sensors)
- C) Existing and outdated computing infrastructure that can support Constellation's node libraries

Demand

SMEs, developers, and entrepreneurs that are looking to build new initiatives with distributed ledger technology, decentralized architecture, and democratized validation of transactions and can seamlessly tap into our supply.

- A) Application developers that need to leverage low-cost and secure distributed computing
- B) Application developers that will leverage a powerful independent mesh network of devices and validators
- C) Enterprise applications that can leverage distributed microservice technology in a high throughput capacity
- D) Constellation's in-house and community developed applications that leverage incentives and a global network

The three core pillars and features of Constellation's technology include reputation-based delegate selection, graph-based architecture, and cross-chain liquidity — democratically enabling high transaction throughput. These features will uniquely position us to provide scalability for SMEs as they look to further shift substantial portions of their technological stack onto Blockchain technology and tap into distributed ledger technology that is secure, scalable and works with existing developer languages (JVM). Furthermore, while Constellation focuses on seeding our network in a one-to-many approach by working with SMEs, we will leverage the Orion community portal to incentivize and encourage the development of applications that will connect with Constellation's network.

Our business development program will develop critical partnerships across developer ecosystems to drive awareness and development on Constellation. Our goal is to use the Ambassador program to crowdsource use cases, develop warm relationships with prospective partners, and create a low-cost, scalable network that represents Constellation on the ground. You can see our Business Development Focus Areas outlined in Figure 8 on the following page.

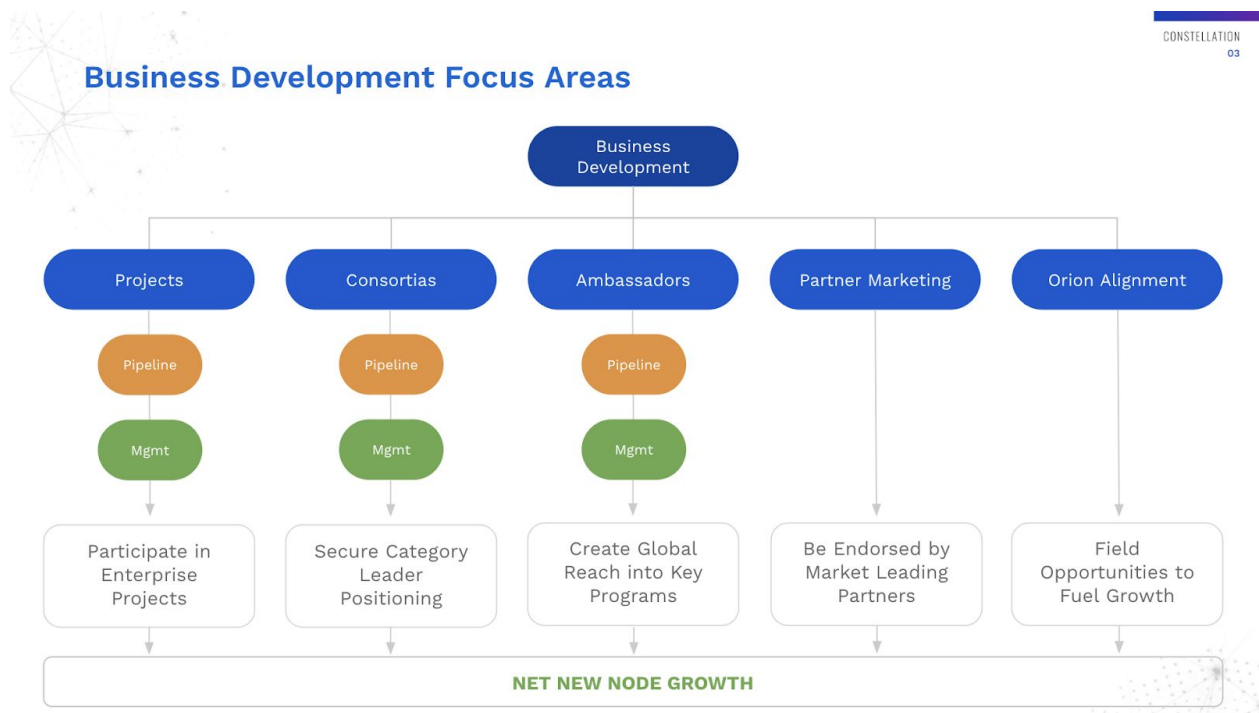


Fig. 8 Business Development Focus Areas

Constellation’s Ambassador Program Overview

While the market interest is high, a clear understanding of the technology and real-world use-case definitions are sparse and often misleading. Many industries will look to their advisors and core collectives to guide them through this new paradigm.

Constellation has created the *Constellation Ambassador Program* to capture the expertise of industry experts and build a bridge between the industry and the new technological advancements in Blockchain. By scaling the ambassador network globally, Constellation will be able to extend its reach into core industries to inspire the minds of those looking to assimilate scalable edge computing into their solution workflows. Our goal is to position, promote and strengthen the Constellation solution with flagship partners in diverse industry sectors that will accelerate positive net new node growth.

An *Ambassador* is a specialist who is passionate about the Blockchain space, the Constellation approach and the possibilities within. We aim to select intelligent individuals who are inspired to participate in our community, at industry events, and help interested members get involved in the project.

Phase one of the ambassador program is focused on an announcement of the program itself with an overview on the Constellation website. This will include an intake form, so leads can be collected from those that are interested and score them for a follow-up.

Phase two of the program employs a certification process that empowers the Ambassador with educational materials and the know-how to promote the Constellation solution and align it to real-world use cases within a targeted industry. The output will position Constellation as a trustworthy and stable partner that's in it for the long term to solve the world's most significant limitations in scaling distributed ledger technologies.

Program Objectives

- Establish world-class positioning and representation through strategic partners in regions and industries aligned with our core vision of enterprise scale.
- Grow and strengthen the value of the Constellation token by building confidence in the market through the quality and focus of our partnership projects.
- Nurture a partner program that rewards those involved in scaling Constellation's impact on the market.

Initial Key Metrics

- Partnerships secured in focused, key markets
- Strategic Ambassadors acquired in desired industries
- Growth and impact of the Ambassador Community
- Commitments from enterprise entities to use Constellation within real-world use cases
- Acceptance and acceleration of involvement in industry groups - I.e., Consortia, Governments, Coalitions, Education, etc.
- Ambassador participation within the Orion Community aligned to developer and project growth initiatives

About the Ambassador Program

The Constellation Ambassador Network is a global network of Blockchain and crypto enthusiasts who are focused on creating strong word-of-mouth networks and growing local communities for Blockchain projects that align with our core vision.

A Constellation Ambassador is someone that is passionate about the Blockchain space and the Constellation approach. We want individuals interested in participating in speaking engagements and helping new community members to get involved in the project.

Our Ambassadors program employs a certification process that enables the Ambassador with educational material and the know how to promote the Constellation vision within their target industry.

Vision

We aim to scale a distributed Ambassador program, enabling Constellation to build touch-points across various industries, verticals, and markets that are complementary to our technology and vision. The Ambassador program will broaden Constellation's reach while allowing us to uncover global use cases in which our technology can be applied. We want to enable our Ambassadors to play a critical part in the Blockchain ecosystem that will, in turn, strengthen our position as a foundational and scalable protocol in the market.

Target Audience

The roles and responsibilities of a Constellation Ambassador may include, but are not limited to:

- Articulate a clear understanding of the existing state of technology, while articulating a vision for the future
- Be a representative of Constellation's brand and maintain an established knowledge base of our core technology and various applications
- Establish initial introductions and seed early conversations with key target leads aligned with your industry
- Position yourself on behalf of Constellation as a thought leader within your industry's community
- Take initiatives to improve our program and brings immense value to our active projects
- Answer questions on Orion, Telegram, Reddit, Twitter, Quora, Git, Stack Overflow, at events, etc.
- Attend and support local Constellation events and other Blockchain community events (travel may apply)
- Help connect interested users with the right folks within the community and with Constellation team
- Identify industry use-cases that are in alignment with the Constellation solution
- Produce industry-specific, market-facing materials
- Attend periodic Constellation Ambassador webinars and be open to presenting
- Be open to presenting to Meetup Organizers, Content Creators, Social Communities, Bloggers and Developers (speaking may apply)

Incentives

Ambassadors may receive the following rewards as part of the program for their efforts. Depending on momentum, strategic Ambassadors may be given more responsibility with access to more incentives.

- Official Constellation Ambassador Certification
- Direct connection to the Constellation team
- Comprehensive online documentation and training on how to participate in community tasks, airdrops
- Support and resources from the Constellation team to organize your own local events
- Constellation Ambassador Badge for LinkedIn, Social, Etc.
- 500 initial points in the Orion community
- Social media mentions
- Constellation SWAG
- Potential travel expenditures
- Blockchain industry experience and new skills

Collaborative Unification of Protocols and Applications

Simultaneously, we will be developing a consortium with several high profile protocol technologies that will create best practices in the industry. Additionally, we will aim to form a mindshare across other companies to help combat skepticism of Blockchain technologies, help reinforce knowledge and awareness of this emerging technology, and further strengthen cross-collaboration of marketing and development resources.

Scalable Protocol Alliance (SPA)

Foundation Overview

Constellation is partnering with key players in the Blockchain industry that share a core focus on solving new modalities of censuses, edge computing, and enterprise scale. By forming this consortium, we will bring together leading solutions that are dedicated to providing consumer and enterprise adoptions at scale.

By working together, this group will combat skepticism and share knowledge and resources to solve enterprise scalability. Though this effort, we will collectively create a new standardized approach to ensure the viability of real-world uses cases and the requirements needed to bring these solutions to real market adoption.

SPA Target Members

- Protocols and infrastructure layer developments that address scalability and broader SME and consumer adoption
- Companies that are building applications on scalable protocols
- Has established online communities across Telegram, social channels, and email
- Sets examples on best practices across pillars (see below)
- Contributes minimal resources, perspective, and participation
- Believe that cooperation and shared vision is more important than weakening competition. We believe that it is not a winner-takes-all market.
- Enterprises, opinion leaders and reputable developers supporting our cause

SPA Values

- **Mass Adoption:** Combat broader consumer/enterprise skepticism of Blockchain and the cryptocurrency communities
- **Leadership:** Implement and disseminate best practices and standards for distributed ledger technology companies
- **Global:** Establish SPA as a thought leader and trusted entity – “United Nations of the (blockless) Blockchain industry”
- **Transparency:** Provide transparency into organizations and meetings held by SPA to further accentuate Blockchain industry philosophy
- **Mindshare:** Invite participation between “competition” and transparency between organizations to build world-class organizations
- **Education:** Be a source of truth while educating consumers and SME’s on these emerging new technologies and how they impact our lives
- **Thought Leadership:** Explore alternative thinking, treasury management, organizational scaling tactics, market research, and hurdles/barriers
- **Homotopy:** Enjoy economies of scale when it comes to everything from event organization to suppliers hiring, rising from better bargaining power
- **Innovation:** Publish and share novel ideas and breakthrough Blockchain technologies

SPA Pillars

We will aim to create a membership style organization that consists of Blockchain technologies that want to be leaders in the space.

- **Technology:** Addresses the technical scalability issues of traditional Blockchain technology
- **Governance:** Are implementing exemplary organizational and community governance models
- **Social Impact:** Aim to support and develop use cases that have social impact and awareness
- **Community:** Believe in further developing democratic and passionate communities that want to shape the future
- **Creativity:** Encourage novel thinking and out of the box solutions to traditional problems

SPA Governance

Maintaining consistent communication, leadership, transparency, and in-person participation will be pivotal to creating a successful and influential entity.

Membership - There will be an application process that is reviewed by the organization, and each company must contribute up to 2 people to participate in the organization.

The target titles for those involved include *Founder, Marketing, Business Development, Operations, and Technology*.

Frequency - Members will be expected to participate in annual in-person meetups that will take place in the Spring and Fall in a global setting. These meetups will be two-day collaborative discussions.

Along with this, there will be a monthly hour-long remote check-in meeting to conduct organizational updates and learnings. During these check-ins, we will establish other impromptu opportunities to meet, such as group dinners and get-togethers within the global conference circuit.

Supervisor - To begin with, we will create a committee of three (+) individuals that are interested or involved in the space to help drive accountability, raise compelling topics, and provide perspective:

- Blockchain Specialist/Entrepreneurs (not a blockchain technology or protocol company) - I.e., Blockchain advisor
- UN/ or government officials - I.e., Delegate from the US government or SEC (compliance)
- Academics/Academic Entities
- Marketing/Press
- Enterprise
- Global

SPA Benefits - As a part of the membership and participation, there will be various perks that will drive community growth, technological tools, human resource and hiring, and treasury management and investment opportunities.

- **Content Creation:** Develop joint marketing materials (blogs, videos, announcements)
- **Shared Resources:** Provide access to investors, marketing materials, advisors and influencers, and technology/tools
- **Mindshare:** Share learnings, thoughts, and experiences to better navigate our company roadmaps to success
- **Community Cross-Promotion:** Leverage communities to help drive further reach of marketing materials and company announcements

- **Investment:** Encourage and support one another by leveraging investor contacts while also holding tokens interest in one another's company
- **Events:** Host, support, and sponsor local network events, meet-ups, and opportunities to create additional exposure and marketing content

MOBI Consortium Partnership

In conjunction to building our own channels and funnels for adoption, Constellation will be selectively working with several consortiums that will enable us to expand our network, build trust within established conversations around DLT and enterprise adoption, flush out industry-specific use cases, and allow us to become thought leaders in various industries.

The first consortium we have been accepted into is an exclusive group in the San Francisco Bay Area, called [MOBI](#). MOBI is a nonprofit organization working with forward-thinking companies, governments, and NGOs to make mobility services more efficient, affordable, greener, safer, and less congested by promoting standards and accelerating adoption of Blockchain, distributed ledger, and related technologies.

Furthermore, MOBI is broken down into various committees as a way to develop ideas and sort out needs with agility:

1. Vehicle Identity and History (VID) - Sebastian Henot, Renault
2. Economic and Business Model Committee (ECON) - Chris Ballinger, Toyota
3. Intellectual Property, Licensing, and Rights (IPLR) - Michael Fischer, AIOI
4. Tools and Methods (TOOLS) - Liang Kong, VW

Some of the MOBI partners that we are in direct connection with include the following:



Through active participation on monthly calls, meetups, and annual events, Constellation will be set up for success with exposure to leaders in the space looking for Blockchain solutions.

Consortiums offer an effective way to develop key partnerships, advisors, and learn about existing use cases and needs of industries. Through our Ambassador program, we will create a high touch program that allows us to outsource use cases and exposure into sectors thinking about Blockchain technologies. The genesis of the SPA consortium will enable us to create confidence in the broader market for the use of Blockchain technologies — allowing developers to work with a variety of solutions and access to knowledge while providing cross-collaboration between protocols and applications being built on those protocols. Finally, by participating in exclusive and established consortiums, we will develop deeper industry relationships and improved awareness of Constellation.

Marketing Plan

All marketing efforts ladder up to Constellation's mission statement: Connecting personal value with a global economy (finalized 7/27 workshop)

Under this umbrella mission, there are three campaign strands feeding into the various aspects of Constellation. Each marketing strand supports the other but runs in parallel with separate content, channels, targets, strategies, objectives, budgets and timelines and are weighted differently regarding overall focus:

1. Brand
2. Developer
3. Business development

The Constellation marketing plan is a *plan* and not a bible. The industry moves at an incredible pace. We can make sound decisions, but we can't predict the future of crypto. The marketing plan is a fluid working document which must adapt to industry and product changes.

Brand - Node Growth & Awareness OKRs



Objective: Grow a global network of nodes and increase the value of \$DAG

Target Audience: Broad Investor and Crypto Enthusiasts

Resource Allocation: 60%

Objectives	Indicators	Key Results
Media Impressions	Press Coverage	2x Constellation Coverage per Month
Platforms Growth	Social, Reddit, TG, Discord, site visits etc	30% Growth per quarter
Content Output	Monthly Video & Editorial output	4 Editorial, 1 Video
Conferences/Events	Owned and sponsored speaking engagements	2 Speaking Engagements Per Quarter

The success of Constellation is dependent on the number of nodes supporting the network. In turn, this supports the overall throughput of the network and the ability to build complex applications. This marketing effort will support Constellation's node growth plan, and in turn, generate mass awareness. This campaign will reach beyond core developers in 2019 with the ability to run a simple application on an Android device without the need for a specific developer skill set. This campaign feeds into general awareness that supports staking of the token and trading. As opposed to the *Product* and *Media*

campaigns which focus on specific launches, the Brand campaign is ‘always-on’ and playing into our daily content output.

- Objective: Build a global network of connected devices and support the value of \$DAG
- Target: General crypto enthusiasts and Android users
- Weighting: 60%

Given that this campaign comprises the lion share of the budget and resource weighting, it’s important to note how we intend to differentiate ourselves. Although we have superior tech to our competitors, everyone working in the DAG field is touting fast transactions, no fees, and unlimited throughput — therefore we need to focus on our key differentiators. We have a unique approach to consensus, we utilize existing and proven technology, and we possess a highly accessible and communicative team of experts who have a wide variety of experience outside of crypto. These three factors will underpin what we communicate, and how.

Developer & Orion Growth OKRs



Objective: Build a thriving developer community on and off Orion

Target Audience: Developers, varying personas depending on bounty

Resource Allocation 30%

Objectives	Indicators	Key Results
Orion Membership	Number of members	Contribute to % of Orion Growth
Testnet SignUp	Registers for Testnet Node	Contribute to % of Testnet
Bounty Launches	All bounties applied for within 2 weeks	Support top 3 Bounties per Quarter
Event Series	Regular high touch engagements	Monthly Events from Sept 2018
Apps in Development	Number of Apps in development by Dec	TBA - to expand

Orion is Constellation’s focal point, as all content is federated on Orion. It’s our first touchpoint for developers and where they can pull resources from to start building applications. To create utility on the platform, we need an active and growing developer community on Orion. This campaign splits into sub-campaigns, depending on the persona we are targeting and the bounty that has been listed. E.g., simple QAing of an application will have a different persona than a large application build or code review.

- Objective: Build a thriving and active developer community, and support application development
- Target: Developers, varying personas depending on the project
- Weighting: 30%

Orion is an incredibly powerful marketing tool and a linchpin of the Constellation offering and vision. Although other project/protocols boast a ‘developer portal,’ none are as sophisticated and user-friendly as what is currently live and in production for Orion. For this reason, it takes a sizable portion of the three-year marketing budget.

Business Development OKRs



Objective: Support BD across the Ambassador Program, Exchange Listings & App launches.

Target audience: Varies depending on client and industry

Weighting: 10%

Objectives	Indicators	Key Results
Ambassador Program speaking engagements	Monthly active users	1 Per Quarter
Ambassador Program media mentions	Media Exposure	Tier 1 Media Coverage

There are revenue streams and initiatives within Constellation that aren’t directly related to the protocol. The most prevalent and mentioned in this paper is the Ambassador Program, headed up by Benjamin Diggles. Another example is the support of any exchange listing with announcements and press coverage. These initiatives require different marketing approaches altogether.

- Objective: Building a thriving and active developer community and support application development
- Target: Developers, varying personas depending on the bounty
- Weighting: 10%

Media Strategies & Platforms

Each campaign strand utilizes a different mix of paid, owned and earned media strategies depending on the objective. The below list is not exhaustive, some product campaigns will require outreach on very specific niche media-outlets which can’t be listed in full detail here.

Optimized Website: SEO optimized site which articulates our technology and USP. The site is to be regularly updated depending on the priority initiative and campaign.

Distribution Channels: Telegram, Twitter, Email, Reddit, Facebook, Dischord, Bitcointalk, Medium, YouTube Github, Steemit.

Paid Channels: Depending on the campaign, we will promote links and content. We work with a 3rd-party social agency to monitor and optimize campaigns: Twitter, Facebook, Reddit, search.

Content Creation: Content, whether editorial, video or animation, will be produced in-house or with a 3rd-party partner.

PR and Media Outreach: We work with several PR agencies to promote announcements and at times partner with media outlets across content promotion/creation.

Events: Events feed into all campaign strands, used as platforms to promote the Constellation brand, announce product launches or engage with developer communities. Events include the sponsoring of 3rd-party events and the creation of a Constellation series/roadshows.

Influencer Outreach: Influencer outreach incorporates exposure or content created in partnership with influential crypto leaders, as well as interviews and reviews on video streaming sites.

Community and Marketing Vision

The integrated Marketing and Community Team within Constellation is firmly aligned between product, business development, engineering. Community outreach is critical not only to Constellation but for the future of decentralization. Bridging the gap between mainstream and fringe applications as well as demystifying distributed systems and cryptocurrency to the consumer is a core tenet of establishing Constellation's place among the global community.

As education is critical for the proliferation of products, principles, and for growing open communities, Constellation is driving partnerships with leading developers, research institutions, and academic entities. This will engender the natural and sustained progression of adoption globally without prejudice. Targeting high school, university, and emerging developers will leverage and unlock present and future programmers to be able to build with Constellation without guidance from the core team. This is the vision of the Constellation community. Constellation's community initiatives are focused on enablement. We want to enable developers to build on Constellation with the proper tools, while also empowering them to educate and teach one another. This requires an underlying thread linking together the grassroots organizations focused on developing the Constellation protocol beyond the core developers.

Developer community growth is a core tenet to the sustained longevity of Constellation. As Constellation is a foundational layer of interconnectedness, its infrastructure value is directly proportional to the number of applications built on, or integrated with, Constellation. Because of this, to achieve exponential growth and leverage Constellation as a true demand side economy of scale, the outreach initiatives will be hyper-focused on onboarding developers, entrepreneurs, and enterprises.

Team

[Images & Bios can be found here](#)

Altif Brown - CCO

Wyatt Meldman - Floch - CTO

Ben Jorgensen - COO

Emily Arth - VP of Operations

Mathias Goldmann - VP of Finance

Zac Russell - Head of Marketing

Brion Hickey - VP of Product

Ryle Goehausen - VP of Engineering

Benjamin Diggles - VP of Business Development

Preston Parris - Engineer | Distributed Systems

Tyler Prete - Engineer | Distributed Systems

Dr. Ratul Saha - Statistical Model Checking

Giovanni Valdenegro - Lead Product Designer

Sasha Bajzek - Front End Engineer

James Markotic - Web Developer

Gina Rubino - Marketing Manager

Anthony Scarpulla - Content Manager

Sophie Feinberg - Executive Assistant

Shreyas Narayanan Kutty - Senior Community Manager

Advisors

Sunil Daluvoy - Business Development Advisor

Darius Rugevicius - Advisor

Ryan David Williams - Legal Council

Jake Vartanian - Blockchain Advisor

Tom Graham - Advisor