Geodnet Network Project

2021.09

[Abstract]

Location-aware IOT device or mobile device plays a vital role in many of its applications, whose market is expected to reach a value of USD 1,386.06 billion by 2026 from USD 761.4 billion in 2020 at a CAGR of 10.53%. Using blockchain technology to secure elements of a location service infrastructure, we can invite a community of business partners to leverage Geodnet as the platform to build out the most extensive RTK network and provide centimeter-accurate location service while enjoying the economy of scale in cost, reliability, and accuracy.

The recent development in AI and navigation technology leads to a new generation of autonomous robots and drones used in retail, security, maintenance, agriculture, and transport & logistics. The scope of autonomous mobility continues to grow with a new type of Transport-as-a-Service offering: commercial robotic taxis, short-haul delivery services, and autonomous food delivery services are already prototyping their services in China, the USA, and even in Europe, attracting increasing attention among experts.

GPS based solution has been widely adopted for the past 30 years. However, accurate centimeter location service is only available to minimal use cases, yet very expensive. With the fast-growing autonomous applications, the demand for Geodnete location service is growing exponentially.

The traditional way to provide accurate location service is to build locating infrastructure at a predictable and planned pace, with a massive cost. It usually will take years or more than a decade to make it usable. Geodnet project utilizes blockchain technology, a community-based economic model, together with the most cost-effective hardware, to build the accurate location service network as quickly as a few months, with cost only one or two orders of magnitude less.

The Geodnet mission is to gather dense real-time geospatial data from the Earth and her Atmosphere using a new class of roof-mounted Space Weather stations. The use of blockchain will promote a robust and resilient network that delivers secure and trusted geospatial data products used in key sectors of the economy including Agriculture, Transportation, and Finance, as well as new emerging applications for Autonomy, AR/VR, and the Metaverse. The best aspect of Geodnet is everyone can affordable and easily mine GEOD token without high-power CPU or GPU intensive equipment.

Keyword Definitions

A. **GNSS** stands for Global Navigation Satellite System and is the standard generic term for satellite navigation systems that provide autonomous geospatial positioning with global coverage. This term includes, e.g., the GPS, GLONASS, Galileo, Beidou, and other regional networks. GNSS is a term used worldwide. The advantage to having access to multiple satellites is accuracy, redundancy, and availability at all times. Though satellite systems don't often fail, GNSS receivers can pick up signals from other systems if one does. Meanwhile, if a line of sight is obstructed, having access to multiple satellites is also beneficial. Common GNSS Systems are GPS, GLONASS, Galileo, Beidou, and other regional systems.

B. **RTK** (Real-Time Kinematic) is a technique used to improve the accuracy of a standalone GNSS receiver. Traditional GNSS receivers, like the one in a smartphone, could only determine the position with 2-4 meters (7-13 feet) accuracy. GNSS receivers measure how long it takes for a signal to travel from a satellite to the receiver. Transmitted signals travel through the ionosphere and atmosphere and are slowed down and perturbed on the way. For example, travel time on a cloudy day and in clear sky conditions would be different. That is why it is difficult for a standalone receiver to Geodnetely determine its position.
However, RTK can give you centimeter accuracy. Since the 1990s, RTK has become a reliable, mainstream technology for surveying and construction.
In a typical RTK setup, two receivers are used. One of them is stationary, and another moves freely. They are called **base station** and **rover**. The base's mission is to stay in one place and send corrections to a moving receiver. Rover uses that data to achieve centimeter Geodnete position. Any number of rovers can connect to one base if their input settings match the base's output.

C. **RTK network.** RTK network is the network that base stations are inter-connected.
RTK network utilizes a large group of strategically spaced reference stations to provide RTK coverage for various users. It can also offer a network RTK correction based on most or all reference stations in the network. RTK Network infrastructure (hardware and software) can be more beneficial than traditional agriculture applications.

D. **Geodnet Network.** Geodnet Network is a type of RTK network utilizing blockchain as the base framework, with a token as an incentive method to build, expand, maintain the network itself. Also, Geodnet Network provides cryptographic guarantees of data transmission, location servicing, and data ownership authenticity. It also offers a rich development environment enabling secure, scalable transactions, smart contracts, etc.

E. **Geodnet Token (GEOD)**: GEOD is the native token of the Geodnet Network. The core utility of GEOD acts as an incentive and utility to secure the network and transactions. Miners(base

station miners and service provider miners) will get GEOD token reward as they provide Geodnet Network's infrastructure. Service providers will also accept GEOD token as the staking power to increase its weight when proposing blocks.

F. **Geodnet Consensus Protocol.** We present a novel consensus protocol construction that creates a robust, high throughput, scalable system by combining POS with BLS-based byzantine fault-tolerant protocol and external resource consumption presented via Proof-of-Accuracy.

G. **Proof-of-Stake.** Proof of Stake (POS), sometimes Delegated Proof of Stake(DPOS), is the consensus protocol that miners can propose and validate block transactions according to how many coins are staked. POS provides faster processing of transactions than POW while consumes significantly less energy than POW. However, POS is also considered less decentralized as cartels can form over time.

H. **Proof-of-Accuracy.** We present a computationally inexpensive Proof-of-Accuracy (POA) that allows Miners to prove they provide accurate RTK location streaming data with their unique geospatial coordinates and RTK hardware. Service providers collect those streaming data information, verifying the data's accuracy relative to their physical position, creating proof of accurate geographic span in a cryptographically secure way.

I. **Miner.** Base station miner acquires the RTCM hardware, set up in the desired location, streaming real-time location data to a service provider, maintaining the system. In return, it will get tokens for baseline data and service stream for honest service provided.

J. **Service Provider**: Service provider miner serves as the backbone of the Geodnet Network. It creates a block proposal and validates each block. It also connects with base stations within its local area. Service provider will also accept user service requests and provide high-quality location service to end-users.

I. Introduction

Centimeter Precision location and nano-second accurate timing service have always been the dream of humankind. In today's ubiquitous AI applications, more services will rely on high-Precision location and timing service. It has promising prospects in the fields of autonomous driving, geodetic surveying, map producing, autonomous construction, unmanned aerial vehicle (UAV) logistics, unmanned farm, virtual reality, augmented reality, and deformation monitoring.

The RTK networks extend the use of RTK to a larger area containing a network of reference stations. Operational reliability and accuracy depend on the density and capabilities of the reference-station network. As network and coverage grow, the accuracy increases, the value of the network also increases.

Most recently, climate change draws more and more attention all over the world. Space Weather is caused by continuous and natural changes in our Sun. As the Sun radiates energy, a Solar Wind hits

the Earth carrying along with it a Magnetic Field that interacts directly with the Earth's atmosphere. While Solar and Space Weather sounds abstract, it has a host of practical impacts both positive and negative. Real-time Space Weather data can help us monitor air-quality, sea-levels, predict earthquakes, and power a host of IT services from nano-second timing to millimeter accurate position measurements.

Existing RTK Clusters/Networks are built and managed predominantly by commercial entities. RTK Clusters in the US exist primarily within the agriculture industry. Subscription fee is the typical model to access RTK Cluster/network. Fees to access a Cluster/Network in the US are on the order of $100/month to $500/month per receiver.

However, establishing a reliable RTK network is not easy. It is typically being funded, built, and managed by government entities. The progress of the current RTK network is plodding. It suffers from three parts: high initial deployment cost including hardware, human resource, land use, etc.; Building the network is a time-consuming work and maintenance cost skyrockets.

The Geodnet Network solution provides another way to attack these problems, armed with the latest technology advancement. We can solve these problems by combining blockchain technology and RTK. Specifically, Geodnet Network is built upon a miners network, incentivized by a token system on top of a blockchain. In this way, initial deployment costs can be minimized. Instead, miners purchase RTCM devices as a mining rig; deploy with their existing resources(land, network, electricity, etc.); maintain the system in a sound state. In return, miners will get tokens as a reward to keep the Geodnet network working.

Furthermore, the Geodnet Network has a far more extensible and more profound impact than the existing RTK network. Geodnet Network RTK service can be used in many application scenarios far beyond the agriculture industry.

Any user who wants to use the RTK service will need to pay the benefit in terms of a token. Blockchain can enable quick and frictionless payment to multiple parties with smart contracts. This also creates a continuous income stream into the Geodnet network, driving the Geodnet network's value up.

For traditional users who are not familiar with the token system and would instead use the conventional way for payment(credit card, fiat system), we also provide an abstract layer on top of the token system such that those users can use the location service with traditional payment methods, without exposure for crypto payment technology.

Additionally, space Weather changes rapidly and over short distances less than 10km. To date observation of Space Weather has been expensive and limited to specialized networks known as "CORS" networks (Continuously Operated References Stations) which are regionally operated. Geodnet uses new receiver technology and the power of blockchain to build a new global cyber-infrastructure that provides a dense set of measurements at radically lower cost.

Compared to other RTK service on non-blockchain based solutions, the Geodnet network has many advantages:

i. Cost-effective service. As a community-based solution, Geodnet eliminates a lot of overhead that the traditional approach will incur.
ii. Flexible service solution. Pay-per-use, subscription, mutual sharing, etc., service solutions could be used for all kinds of applications.
iii. As a communication network itself, the Geodnet network can also be a valuable user base for many applications.

II. Geodnet design principles

1. Why another blockchain?

   The cryptocurrency world has been very active for the past several years. Bitcoin is the first blockchain that implements Proof-of-Work (Nakamoto Consensus POW) consensus protocol. In the POW protocol, each peer node competes to find a nonce value as proof to validate itself as the next valid block generator. POW blockchain utilizes this mechanism to determine which node has the right to seal a block.

   Most POW blockchain systems only offer probabilistic finality. Probabilistic finality refers to the fact that theoretically, some nodes with overwhelmingly high computation power can build an alternative branch and eventually replace the original one. Also, POW consumes a lot of energy to perform the brutal force search for a valid nonce.

   Proof-of-Stake (POS) is a consensus protocol that uses stake as the criteria to vote on new block generation. Unlike POW, POS is a closed system, which means tokens are created without any external entropy. Thus, the POS system will likely suffer from centralization in initial token distribution and reward system. Another drawback of POS consensus protocol is that the POS system itself can be easily cloned, equivalent to an unlimited token supply.

   We take an approach that merges the desired features of POW and POS. We believe external resource consumption (External Entropy) is critical to the system's security and decentralization. However, instead of using the unbounded energy consumption as in Bitcoin or most other POW protocols, we use geospatial information as the unique and unforgeable resource to be part of the consensus process. Geodnet Consensus Protocol uses both geospatial data input and staked token to determine the block generation efficiently.

   In our setup, our consensus protocol is the POA + POS. In POS part, validators(Service Provider miner) need to stake tokens to participate in system consensus. In POA (Proof of Accuracy) part, each validator will also associate with several base station miners. These base station miners form a unique yet verifiable geospatial span. Each validator provides the geospatial span proof with staked power to perform block proposal and generation. An additional advanced algorithm such as the BLS algorithm will be used to optimize the network efficiency. The protocol will also improve economic security by punishing any misbehaving validators.

   In this way, Geodnet Network will be the first and unique network that utilized limited Earth surface as the resource, which provides enormous value for the network. Additional services

such as location, high-def map, autonomous navigation are just natural derivatives of this network.

2. Our Mission

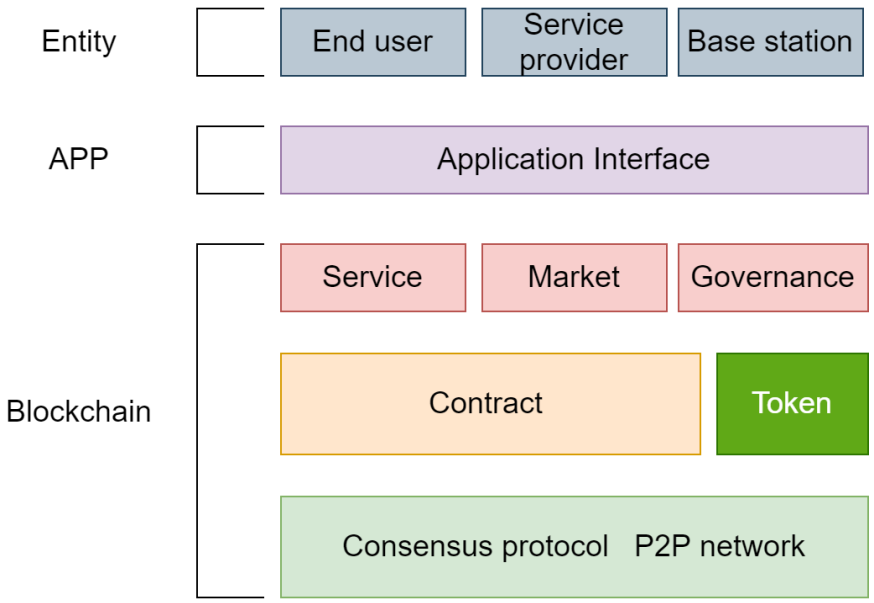
Geodnet is to redesign and implement the location service network from a new set of tools. The purpose of Geodnet is following:

1) Revolutionize blockchain protocol by introducing external scarce geo-location resources as the system underlying value base.
2) Build and operate a native blockchain system for Geodnet Network to meet the requirement of decentralized global services.
3) Create the most extensive RTK network coverage in the whole world.
4) Introduce a decentralized service model to allow localization service for a wide range of applications, enhancing service quality.
5) Create a token system that supports RTK based mining and service mining to encourage Geodnet Network's growth and incentivize all parties.
6) Implement a service market to connect a vast amount of users and RTK service, enabling low-cost and highly reliable location service for emerging new applications.

As the base of the project, Geodnet token system is also carefully redesigned to fit the need to expand RTK service requirements.

3. Geodnet architecture

Below are the building blocks of Geodnet architecture. Blockchain is the supporting layer, with the smart contract and token enabled. On top of that, the service module, market module, and governance module are defined as smart contracts in the blockchain. These modules can be executed and monitored in a decentralized way.



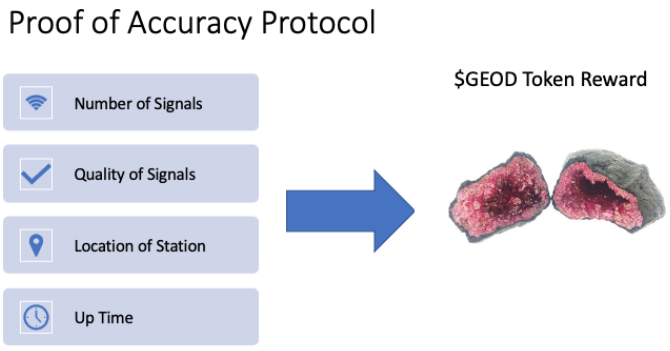
Application interface on top of the blockchain will be provided for actual applications such as drone auto-pilot, autonomous driving, etc. Entities such as user, service provider, and base station interact with the application interface to perform blockchain operations.

4. Consensus protocol

Geodnet employs a blockchain secured by a Proof-of-Stake and Proof-of-Accuracy (POA) hybrid as the consensus model.

Proof-of-Stake(POS) is a consensus protocol widely used in recent blockchain projects. In our setup, service provider miners (validator, v-node) need to stake tokens to participate in system consensus. Each node will have its chance to produce blocks based on the BLS algorithm weighted by the staked token. We use the BLS algorithm for fast and reliable BFT-like (Byzantine Fault Tolerant) consensus. Multiple parties use threshold signature to reach an agreement on a blockchain proposal. The staking will also improve economic security by punishing any misbehaving validators. Anyone who owns a Geodnet token can bond (or delegate) their coins and become a validator, making the validator set open and permissionless.

Similar to POW, Proof of Accuracy requires external resource consumption to add entropy to the system. This external resource is in the form of physical geospatial coordinates. It is unique, computationally inexpensive, yet fully decentralized available to a large group of people. With very affordable RTK hardware, each base station miner can provide accurate RTK location streaming data with their unique geospatial coordinates. Service provider miners collect those streaming data, verifying the data's accuracy relative to their physical position, creating proof of accurate geographic span in a cryptographically secure way.



POS and POA's combination is to create a fast, scalable, and secure blockchain for various applications on top of it.

5. Token economics

Token will play an essential role inside the Geodnet platform. The native token in the Geodnet platform is called GEOD. GEOD's primary functions are in staking, payment method for all

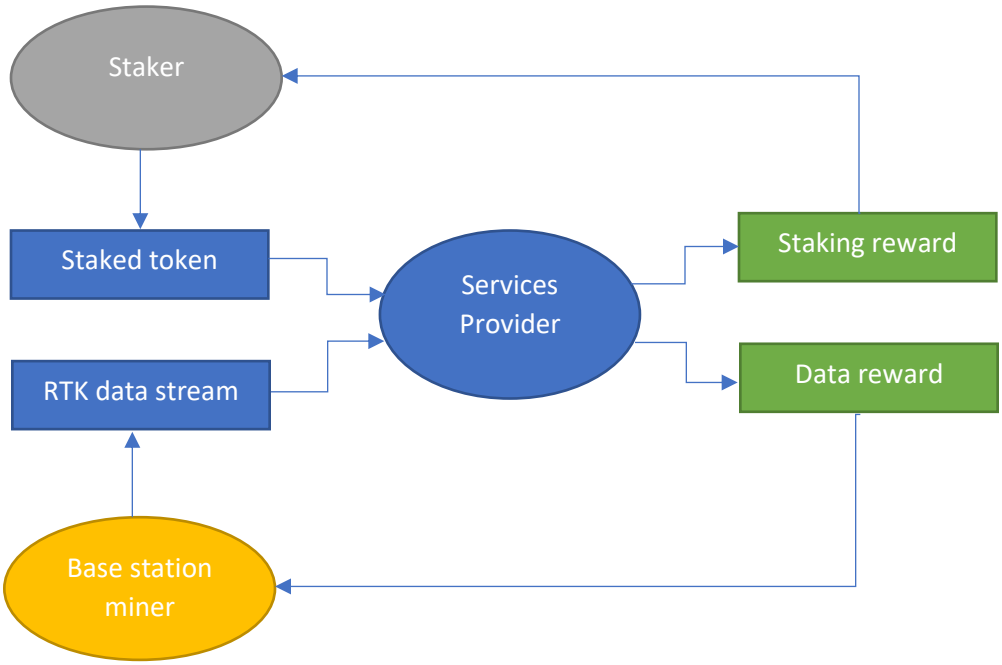
applications or services in the Geodnet platform. GEOD tokens will also be used to pay transaction fees and the reward for miners and validators.

Additionally, to facilitate the service based on Geodnet, a new type of token (Data Credit) is created. User can utilize the service with a Data Credit which is a fixed price of $0.0001. A data credit corresponds to one second of real-time service from the Weather Network. The Data Credit can be directly purchased or exchanged from $GEOD tokens at the oracle price.

Reward Types

Reward Users of GEOD stake tokens to subsidize operating and capital expenditures. A reward can happen in two ways.

A. Stakers can stake tokens to active Service Provider Miner. Each staked token will be rewarded proportionally according to the set inflation ratio.
B. Base Station Miner can uniquely bind to a Service Provider Miner. Once bound, Base Station Miner will stream accuracy RTK data to Service Provider Miner. Service Provider Miner will validate the data and use the combined geospatial RTK coverage map inside the block proposal for additional token reward, besides the staked token reward. In return, Service Provider Miner will distribute mining rewards back to Base Station Miners.



Additionally, Service Provider can provide accurate location service to end customer such as surveyor, autonomous vehicle, drone, etc. Service Providers can market their service to an intended user group and create a service payment plan. Service Provider's revenue can be split among Base Station Miner in a preset distribution contract, in the form of a smart contract in Geodnet Network, or even an off-chain contract.

Limits on Number of Validators

At the Geodnet Network's initial stage, the number of validators will be limited to a certain number (e.g., 64). The number of validators will increase gradually as the Geodnet Network coverage increases. The selection of validators will be based on the balanced consideration of staked token and RTK map coverage area associated with that validator.

Reward System

A Service Provider Miner commits to provide services for at least time t and intends to earn service income r based on staked token T. The inflation ratio is set as $\lambda = 50\%$, which means the annual return of staked tokens is R= $\lambda * T$. Additionally, the reward half every two years.

Base Station Miner is rewarded by the accurate RTK data stream it provides. Base Station Miner and Service Provider Miner can mutually agree on the split ratio between them. The typical Base Station Miner separation is recommended to be 10 miles. An area of a 10-mile radius is called an RTK map unit coverage. System wise, each RTK map unit coverage is rewarded at a rate:

$$m = k * S * \frac{1}{10{,}000}$$

S is the initial total token supply. K is the multiplier constant, typically 1~4. It balances the weight of mining and staking. K is higher to encourage deployment of Base Station Miners.

For example, if one Service Provider Miner has 10 Base Station Miner associated with it, it also stakes 10,000,000 GEOD tokens, given total initial supply is 1B. The total annual reward is :

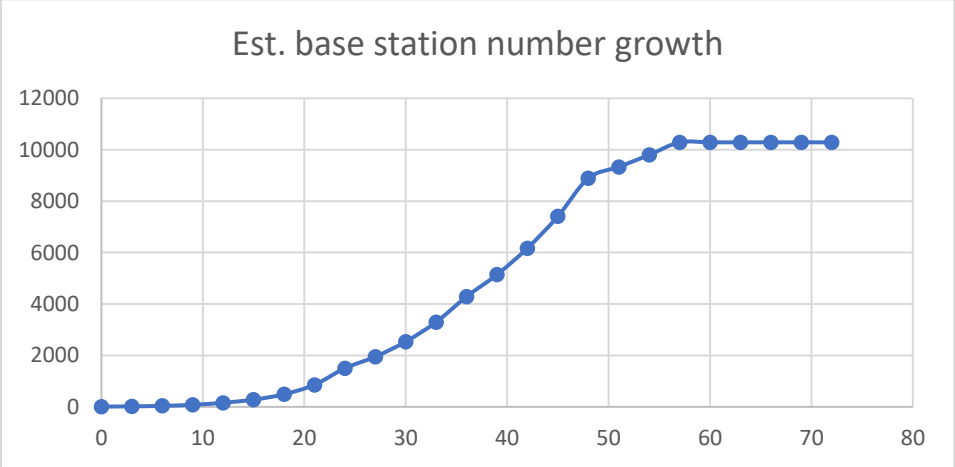
$$R_{staking} = 10{,}000{,}000 * \lambda \ = \ 5{,}000{,}000$$
$$R_{mining} = 1{,}000{,}000{,}000/10{,}000 \ * \ 10 * 1 \ = \ 1{,}000{,}000, \quad for\ k = 1$$
$$R_{total} \ = \ R_{staking} + R_{mining} = 6{,}000{,}000$$

Similarly, the mining reward decays at a rate of halving every two years.

Expected number of Base Station Miners

Our mission is to create worldwide coverage of the RTK network. The minimal number of Base Station Miners is about 10,000. To ensure robust service with enough system redundancy, the ideal number of base station miners could be 3x. Base Station Miners' density may vary from area to area, as the demand for RTK service may change dramatically.

The estimated Base Station Miner growth over months after Geodnet Network launch:



Token supply and unlock schedule

Geodnet Network will define its initial pre-mined token in its genesis file. The initial token distribution will be divided into multiple parts. For example, if total initial token supply (S) is 1Billion, the distribution table is below.

Initial total supply	1,000,000,000	100%
Investor	350,000,000	35%
Foundation	200,000,000	20%
Team & advisor	250,000,000	25%
Ecosystem	150,000,000	15%
Public sale	20,000,000	2%
Vender & marketing	30,000,000	3%

All initial tokens will have their lock schedule. All unlock starts from the launch of mainnet:

Unlock % at month	3	6	12	24	36	42	100%
Investor	0	0	15	15	5	0	35%
Foundation	5	5	5	2	2	1	20%
Team & advisor	0	0	10	5	5	5	25%
Ecosystem	1	1	4	4	3	2	15%
Public sale	1	1	0	0	0	0	2%
Vender & marketing	1	0.5	0.5	0.5	0.3	0.2	3%

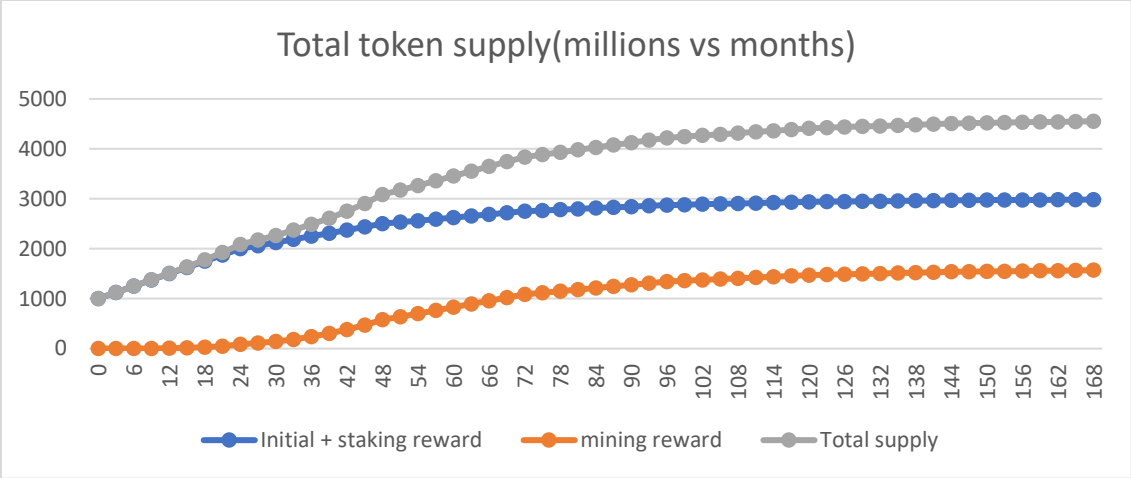
The total token supply growth rate halves every two years. The dependence of the token supply over time t could be written as:

$$\boldsymbol{M(t)} = \boldsymbol{M_0} + \int_0^t \boldsymbol{I_0} * \boldsymbol{exp}[-\boldsymbol{ln2} * (\boldsymbol{t/T})]\, \boldsymbol{dt} + \int_0^t (\boldsymbol{m(t)} + \boldsymbol{\Delta(t)})\, \boldsymbol{dt}$$

M_0 is the initial token supply. The first integral part is the staking reward in terms of time t. The second integral part is the mining reward. The miner number will change over time, as displayed in the previous graph. $\boldsymbol{m(t)}$ is the current Base Station number, and $\boldsymbol{\Delta(t)}$ is the expected miner growth.

The total token supply can be calculated by adding the staking reward and the estimated mining reward, given the expected miner number over the months. The total token supply will be around 4.50B in about 14 years. The token supply will increase very slightly afterward.

The change of total token supply in terms of months is shown in below graph:

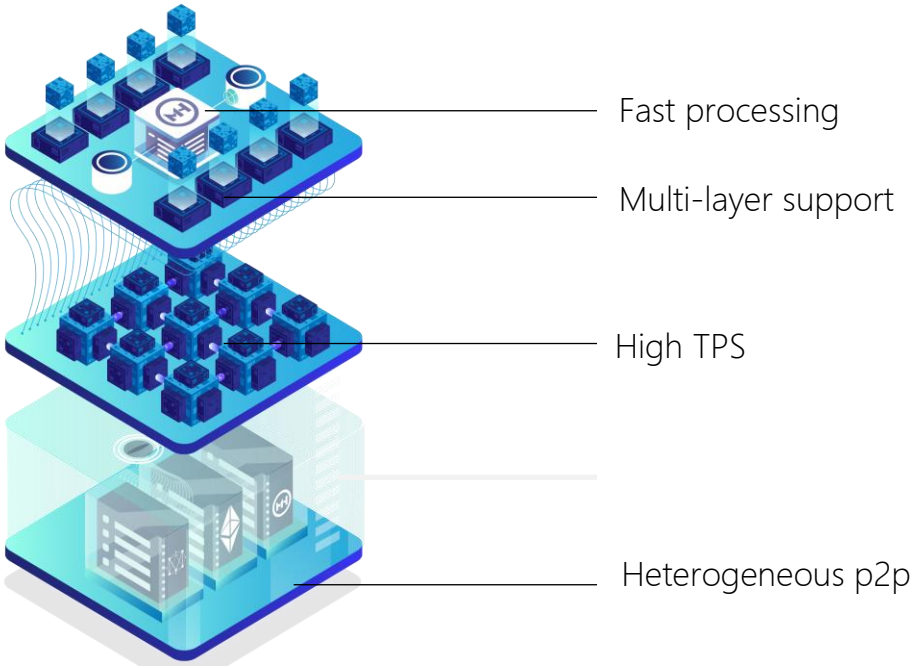


Total token supply vs. months

III. Geodnet Implementation details

1. Geodnet Blockchain setup

Geodnet network is built as an independent public blockchain. However, the Geodnet blockchain will also peg into another public chain for added security. A good candidate is a public blockchain with smart contract support. Before the Geodnet blockchain is ready and running, the Geodnet token is created as an ERC20 smart contract inside the target blockchain. Geodnet blockchain will be a public chain solution with multi-layer architecture focusing on real applications.



Before the Geodnet blockchain is running, smart contracts are also deployed in the target blockchain to facilitate various applications in the Geodnet network, including token minting, data validation, payment system, reputation system, etc.

Geodnet will operate on its independent blockchain system. Geodnet blockchain will utilize customized consensus protocol to provide fast processing power and support a large number of consensus nodes. It will also adopt the two-layer architecture to enable scalability.

2. Geodnet Ecosystem

Geodnet ecosystem consists of three roles, miners, end-users, and the Foundation. The miners include both base station miners and service provider miners. The end-user is the ultimate custom of the Geodnet network and pays for the service it uses. The Foundation is the initiator of this project and piloting the creation, bootup, and Geodnet network coordination. It also employs and incentives the dev team for the technology stack development. Foundation is also responsible for the promotion and management of the Geodnet network. The ownership of the Geodnet network belongs to the community.

- Base station miner

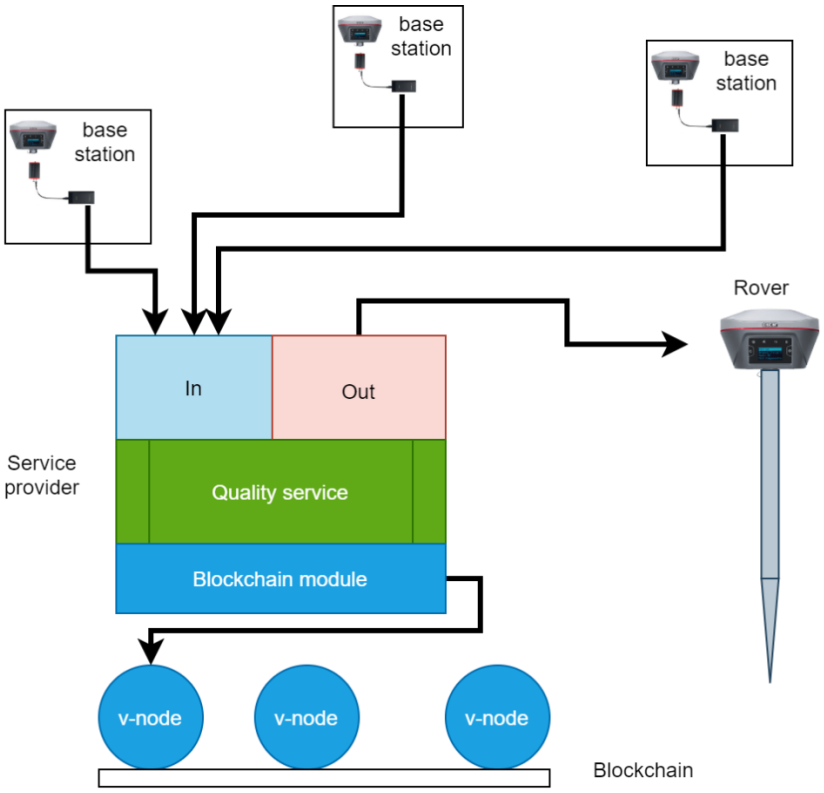
  The base station miner can acquire the RTCM hardware, set it up in the desired location, stream real-time data to a service provider, and maintain the system. In return, it will get tokens for baseline data and service stream for honest service provided.

  Base station miner does not provide service data stream directly to end-user because base station miner typically does not have service quality setup and network bandwidth to provide reliable service.

- Service provider miner

  The service provider miner has two roles. The first role is to serve as the validator of the Geodnet blockchain. Each validator will propose and validate blocks based on Geodnet Consensus Protocol. The service provider will also get associated base station miners' streaming data, validate data stream and create a location accuracy map. This map information will be encapsulated into the proposed block for additional token rewards. Upon successfully creating a new block, the service provider will distribute the proportional reward to each associated base station.

  The second role is to provide quality of service to the end-user. The service provider needs to set up a high-performance server that can handle a high volume of service requests. A typical service provider will be a server accessible by multiple base stations and many end-users. It continuously accepts continuous data streams from base stations. When an end-user requests an RTK service, it will check the best data stream from active base station lists. It will send the data stream from the best match base station to the end-user. It will also actively monitor the data stream quality and can proactively switch to another base station if the original base station is not at the best spot. The service provider will allocate the service revenue to its participation base stations. The above logic is controlled by smart contracts to allow fair distribution.



The above graph illustrates a service provider working with three base station miners and a rover user. The service provider is also the consensus node of the underlining blockchain system.

- End-user

  The end-user is the customer who will use the RTK service to perform all kinds of tasks. It usually will include a rover and need RTK reference data to achieve the desired accuracy.

- Foundation

  Geodnet foundation is the operating entity that will design the ideas, enhance the business model, initialize the network, provide help for hardware install, connect all parties to move the project forward. More importantly, the Foundation will manage the token system, including creating and holding pre-mined tokens, deciding the protocol for token minting and distribution, employing teams to perform necessary tasks, and balancing and incentivizing all participating parties.

- Dev team

  Dev team is essential to the project. It will implement the software stack and release blockchain node distributions. It will also be responsible for any technical challenges during the entire process of the Geodnet blockchain.

- Community

  The community combines all related parties in the ecosystem. Unlike centralized parties such as companies, the community is a decentralized system without a center. Everyone participants in the system and also gets rewarded accordingly.

3. Geodnet service model

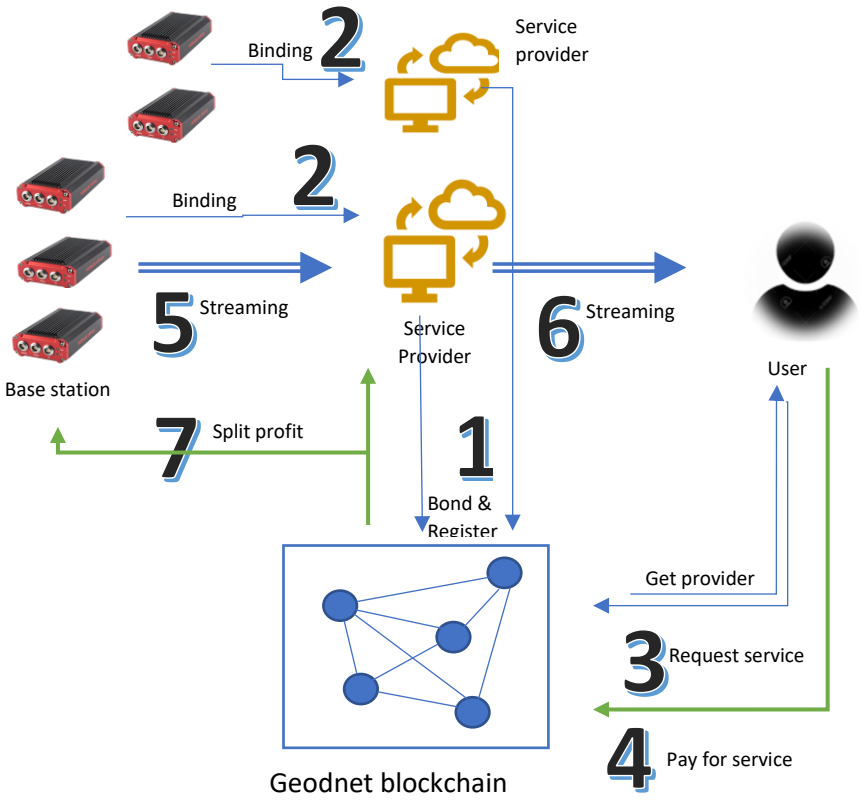
In the Geodnet network, there could be many service providers in the system. Each service provider will register into the blockchain system as a consensus node. Service provider nodes are geographically distributed to maximize the coverage of the Geodnet network. Each base station will register with at least one service provider to get it listed in that service provider.

When the end-user is trying to acquire RTK service, it will query a list of service providers. Based on its needs, it will pick the right service provider for its application.

The user will then pay its service with tokens. There are multiple ways to pay, such as pay per use, subscription, etc.

After that, service smart contracts in the blockchain enable service processing in service providers and related base station miners. They will update their state in the smart contract to ensure their service is recorded correctly and paid accordingly. The service smart contract acts as a trusted decentralized dispatcher to guarantee each party will get paid by preset rules.

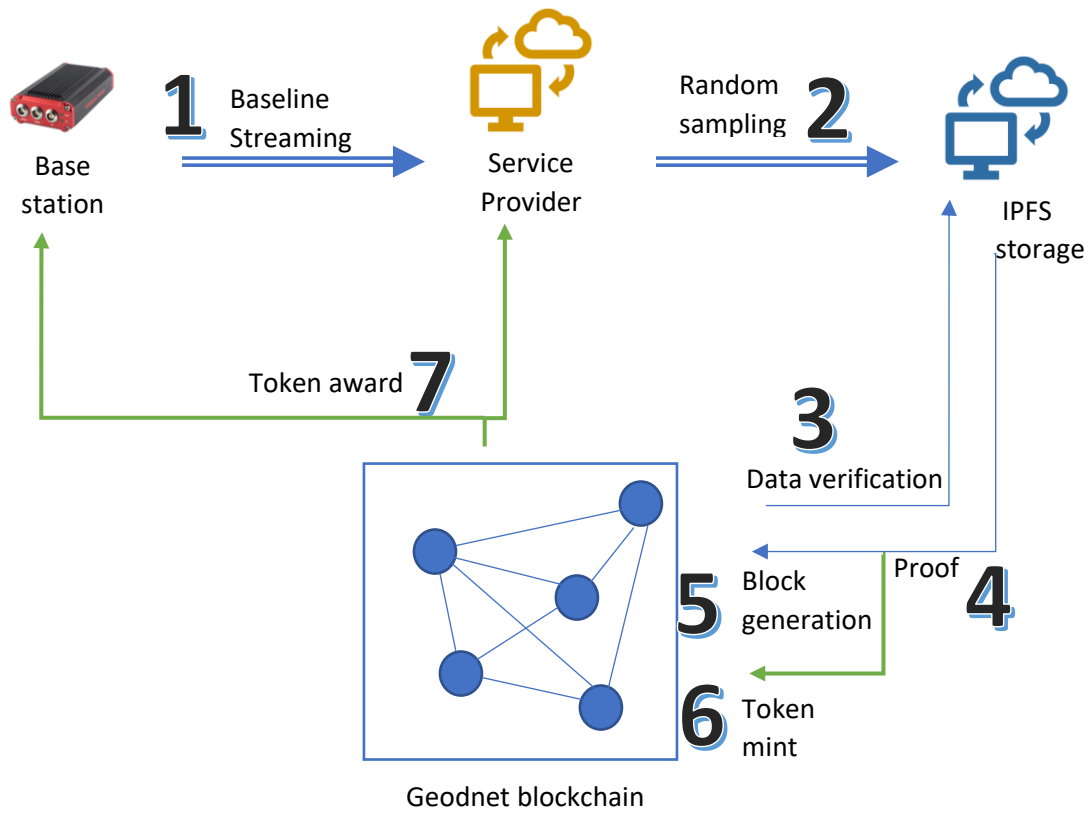
Then base stations will start data streaming to the service provider. The service provider will follow its QoS rule to properly restream a single source or combined source to the end-user.



4. Baseline mining

If there is no end-user, which is when the network is in its early stage or the base station is located in a less popular area, it will receive no service request. However, the system needs to encourage the base station to continuously service the network even if there is an active end-user.

The idea is to provide a baseline income for the base station when it provides the verifiable data streaming. It is called **data-driven mining**.



As a base station, the miner will continue to stream its data to the service provider. The service provider then randomly samples all its base station miners' data stream, generates a collection of data samples together with Merkle-proof. The sampled data and Merkle-proof will be saved into decentralized storage. The storage is accessible to all service providers (also blockchain consensus node). The consensus protocol will determine who will generate block at a particular time point. The chosen node will perform data verification while generating the next block. Specifically, the node will randomly pick some data set view from storage and verify if all the base station miner's data will result in an accurate stationary state for all miners. Once verified,

a proof will be generated. A certain amount of tokens will be mined and allocated to base station miners and service providers.

If some base station provided insufficient data/fake data, it would be easily spotted. The proof is also included in the block. Other consensus nodes can easily verify it as well. The service provider connected with the misbehavior base station will not be rewarded. As a result, the service provider and base station can work together to figure the problem.

5. Hardware

As the significant driving force of the Geodnet network, Terus-GNSS company is the provider of state-of-art hardware for RTK mining devices.

Not only the quality of devices matches comparable device from big names such as Trimble, but the price of these devices is also only 1/5 to 1/10 of its counterparts. The attractive price will promote the quick deployment of the Geodnet network with a significantly lower cost.

6. Blockchain integration and requirements

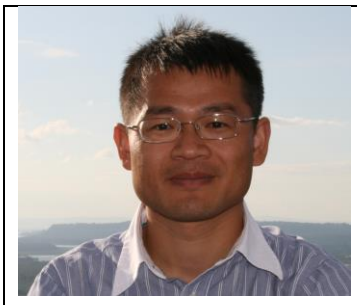
Geodnet blockchain has a two-layer architecture. Here is the specification:

- High performance, TPS > 1000tps
- Fast processing, block generation time < 8s
- Consensus protocol with finality
- Support consensus node ~1000 nodes
- Support Turing complete smart contract

IV. Team & Company

Geodnet Network will be initialized and operated by GEODAO, a silicon valley company with a global view. GEODAO has gathered a team with a diverse yet complementary skillset within RTK and hardware, manufacturing, distributed systems, peer-to-peer, and blockchain technologies.

Core members

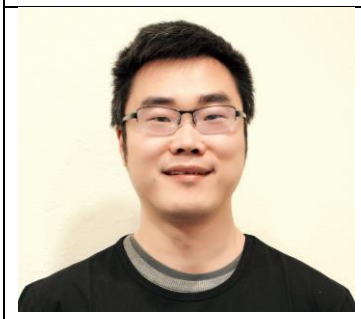


Yudan Yi

As one of the top expert in his area, Yudan served as Senior Director with Aceinna. Prior to that, he was Research Scientist with Qianxun SI. He was Senior Research Scientist with Topcon Positioning Systems before that. Yudan He received Ph.D from Ohio State University and MS from Tongji University.

Mike A. Horton

As a successful entrepreneur, Horton co-founded Crossbow Technology in 1995 and served as CEO until it was sold to Moog Inc. in 2011. Afterward, Mike co-founded several adventures, including Yabberz to promote enjoyable civic discussion on news topics, AtMaps to develop indoor mapping and location solutions, HYFIX.AI for Geodnete positioning algorithms for IoT Devices, etc. He earned a BS/MS in Electric Engineering from UC Berkeley.



Yifan Wang

Yifan is a proven technology leader with over 15 years of experience in Silicon Valley. He has served as Principal Architecture for MOAC Blockchain Tech Inc since 2019. Before that, he is an early member of Yelp's engineering team and worked on various infrastructure projects. He received MS from both the University of Chicago and the Technische Universität München.

CHARLES K. NG

Charles has more than 30 years of experience in advanced economic research and consulting, statistical modeling, and forecasting in relation to multi-disciplines. He served as Principal Economist for Economic Regulation Group of the UK Civil Aviation Authority to advise the UK Government and Airport Regulator on issues relating to infrastructure and environmental impact assessment. He earned his Ph.D. in Applied Economics from the University of Minnesota.

V. CONCLUSION

This paper explains the Geodnet Consensus Protocol and mining economics of the Geodnet Network. We present the ideas and implementation of Geodnet Network for Precision service network. Integrated with GEOD token, this network is believed to grow with exponential speed and provides the first global service for many applications like autonomous vehicles, drones, Precision agriculture and etc.

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