

ASTERA

A decentralized and incentivized personal health data platform.

Whitepaper v0.1

April 4, 2018

Background

Data is essential. Regardless of the industry, most companies now collect, process and analyze large volumes of data, and data is becoming the most important and vital aspect in the decision making process. It is now the fourth largest resource on the planet with roughly \$260 billion being spent on every year. By 2022, data is expected to be the world's most valuable resource.

Among the sea of data being collected nowadays, the information that human body produces is being considered more valuable due to the fact that it directly relates to the quality of people's life. By collecting and analyzing one's health data, it is now possible to monitor the health status of a person more accurately and lower the risk for diseases in the future.

However, it is very difficult to collect daily personal health data at a reasonable price.

Most personal health data can only be captured through expensive medical devices at big institutions or hospitals. Health data becomes more valuable once it is collected over the course of time, but majority of people only visits big institutions and hospitals once or twice a year. Data is not only sparsely collected, but also highly fragmented across multiple different places and platforms, making it extremely hard to gather all information of a person into one single standardized database.

There exist devices in the market that enable people to measure health data at home, but these devices are often too expensive to be widely used across the norm. It is also very difficult for people to understand and analyze the true meaning of measured data through these devices at home.

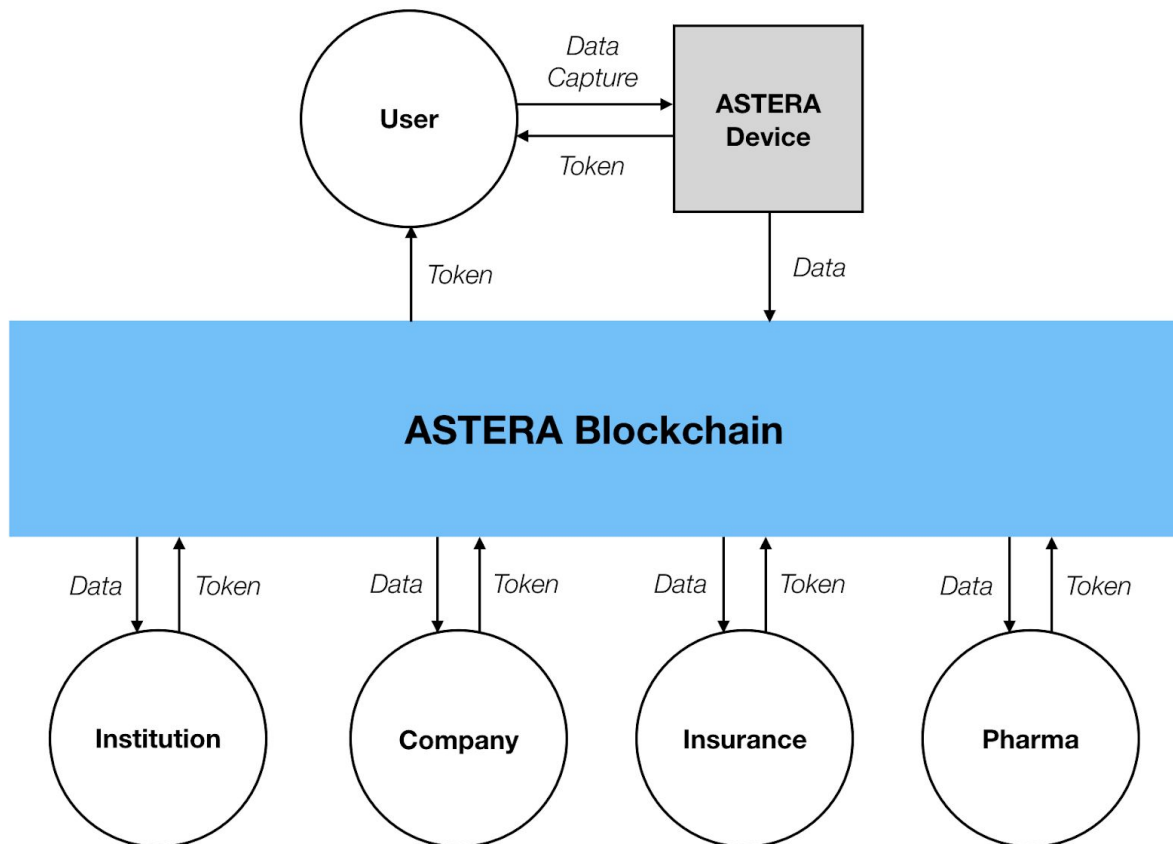
In addition, the current system does not compensate people for generating and providing their health data to others. Companies in need of population health data purchase information from data brokerages and institutions, but users are not included in the data value chain, nor they are financially reimbursed for the data they create.

The aforementioned problem exists mainly due to the lack of a marketplace that directly connects data consumers with suppliers. It is really difficult for data consumers to obtain specific population health data they want, so they turn to data brokerage for such information. On the other hand, data suppliers have difficulty measuring, collecting, and claiming ownership over their own health data.

Astera seeks to solve these problems via decentralized and incentivized personal health data platform.

ASTERA Explained

Astera is a blockchain that enables people to store and manage their own health data, while providing a method for institutions and companies to easily find and purchase data they seek for. By securely saving, managing, and analyzing users' health data on the blockchain, Astera aims to create a data market that directly connects data consumers (institutions, companies) to data suppliers (users).



Why Blockchain?

Astera platform was built with blockchain technology for three reasons:

1. Blockchain can provide direct transfer and access to health data upon multi-signature approvals between users and institutions. This eliminates the need for brokerage in between users and institutions, and thus provides commission free transactions between the two parties.
2. Blockchain grants health researchers access to certain personal health information, and enables the use of micropayments for automatically transferring compensation to users for participation. In the event of conducting studies that involve a large amount of people's data, the method of

compensation could be complicated. This can be solved using smart contracts and payments by token on blockchain.

3. Blockchain can track users' health related actions and data through Astera devices, and automatically generate rewards in token based on specific milestones.

Astera B (Astera Body Checker)

Astera B is a health tracking IoT device that captures 8 fundamental health data values of a human body, a device which also acts as a mining tool. With Astera B, users can easily measure and store their health data at home on daily basis in return for Aster tokens, which compensate and incentivize users to track record of their data.



Details on the 8 fundamental health data values captured by Astera B are as follows:

- 1) Body Temperature - Standard temperature for normal and healthy body is 36.5 degrees celsius. Even though body temperature can vary due to external environmental factors, the amount of body temperature change can be used as a basic indicator of the physical condition.
- 2) Weight - Body weight is the most basic data of a human body that can also be used to create other data such as obesity index and body composition index. Based on the results of the derived data, it is possible to determine the risk for weight related diseases such as obesity and diabetes.

3) Heart Rate - The number of beats per minute in the resting state of the body can also indicate numerous condition of the body. Measured heart rate constantly falling outside the normal BPM range could possibly indicate thyroid dysfunction, anemia, hypoxia, or arrhythmia.

4) Blood Pressure - Blood pressure is the pressure of circulating blood on the walls of blood vessels. Hypertension, also known as high blood pressure, increases the risk of heart disease, such as stroke, myocardial infarction and heart failure. Hypotension, also known as low blood pressure, increases the risk of chronic anemia and dizziness.

5) Body Mass Index (BMI) - BMI is used as an index of human obesity. High BMI indicates high risk of adult diseases such as diabetes and hyperlipidemia due to obesity. Since BMI only uses the mass and height of an individual, when measured together with body fat percent and skeletal muscle mass, it can lead to a more accurate assessment of the physical condition.

6) Skeletal Muscle Mass (SMM) - Human body has three major muscle types: cardiac, smooth, and skeletal. Skeletal muscle is the only type of muscle that can actively grow and develop through proper exercise and nutrition.

7) Body Fat Percent (BFP) - BFP is total mass of fat divided by total body mass times 100. It is the only body measurement which directly calculates a person's relative body composition without regard to height and weight.

8) ECG (Electrocardiogram) - ECG is a method of measuring normal/abnormal rhythm of cardiac activity by recording the electrical activity of the heart within a period of time. ECG is used to detect potential myocardial infarction.

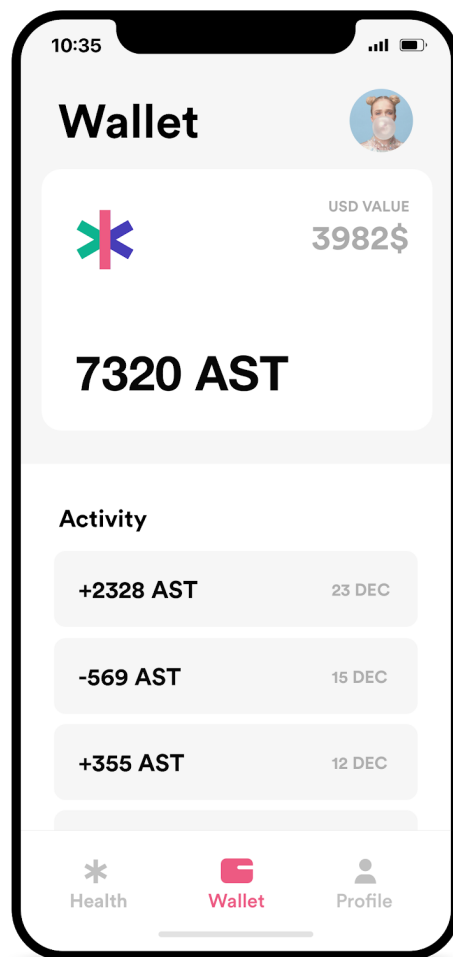
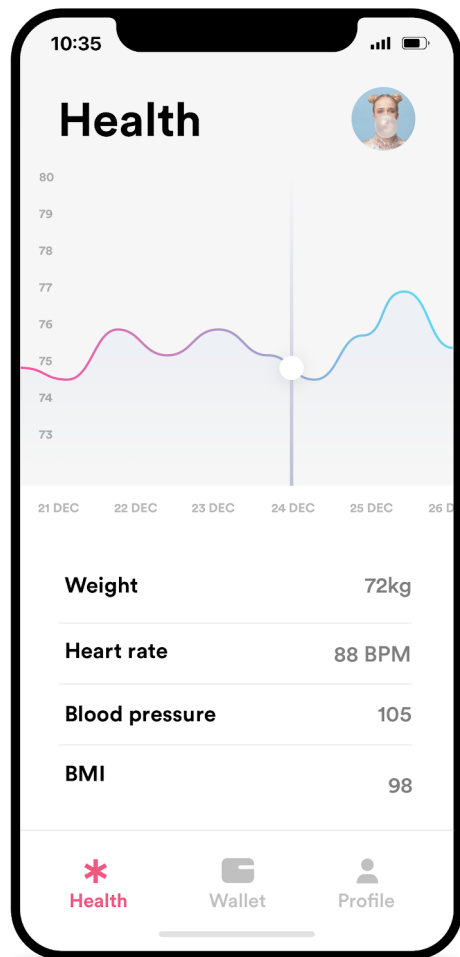
Incentivizing Data Collection

Astera B also acts as a mining device and as a node of the Astera network. Every time a user captures his or her health data on Astera B, the Astera blockchain issues Aster tokens as compensation for producing and storing data. Also, for the amount of time Astera B is turned on and connected to the internet, user receives Aster token as a reward.

Aster token will be used for data transactions between data consumers(institutions, companies) and data suppliers(users).

ASTERA Mobile App

All data captured by Aster B is analyzed and displayed on user's mobile app. Through mobile app, users can view their recorded health data over time, manage tokens, and conduct data transaction with data consumers.



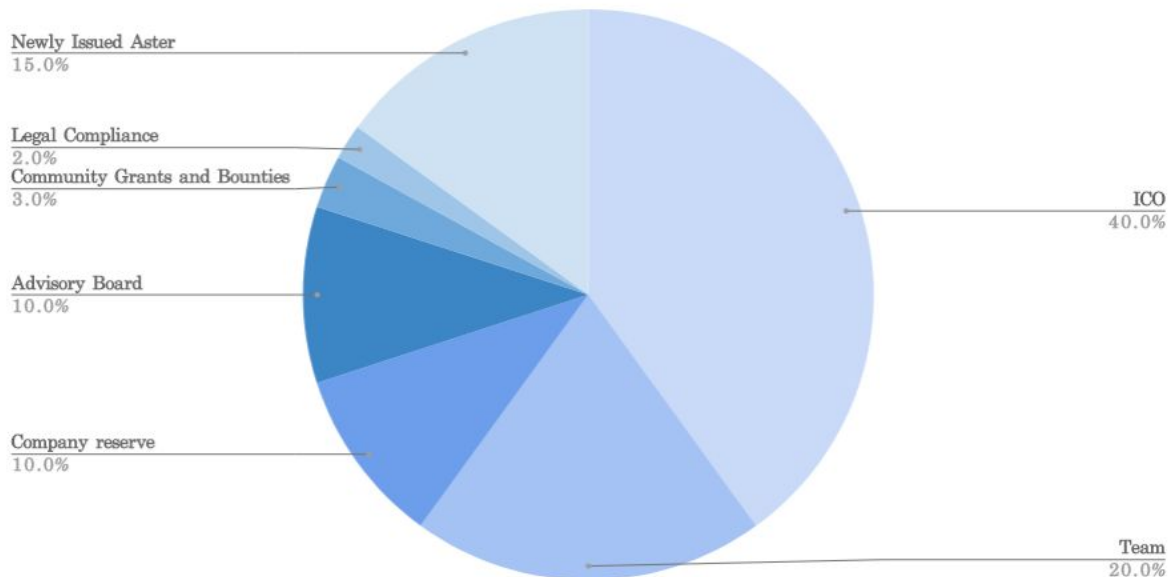
ASTER Token Explained

Astera blockchain issues Aster tokens (AST) for all transactions occurring on the blockchain. AST will be mainly used in three ways: 1) for data transactions between data consumers(institutions, companies) and data suppliers(users), 2) for compensating users in exchange for providing nodes and collecting data, 3) for purchasing Astera devices and paying for Astera affiliated services.

Initial Token Distribution

Total supply of AST : 300,000,000 AST

Astera Token Supply



Initial Coin Offering: 40%

Team: 20%

Company Reserve: 10%

Advisory Board: 10%

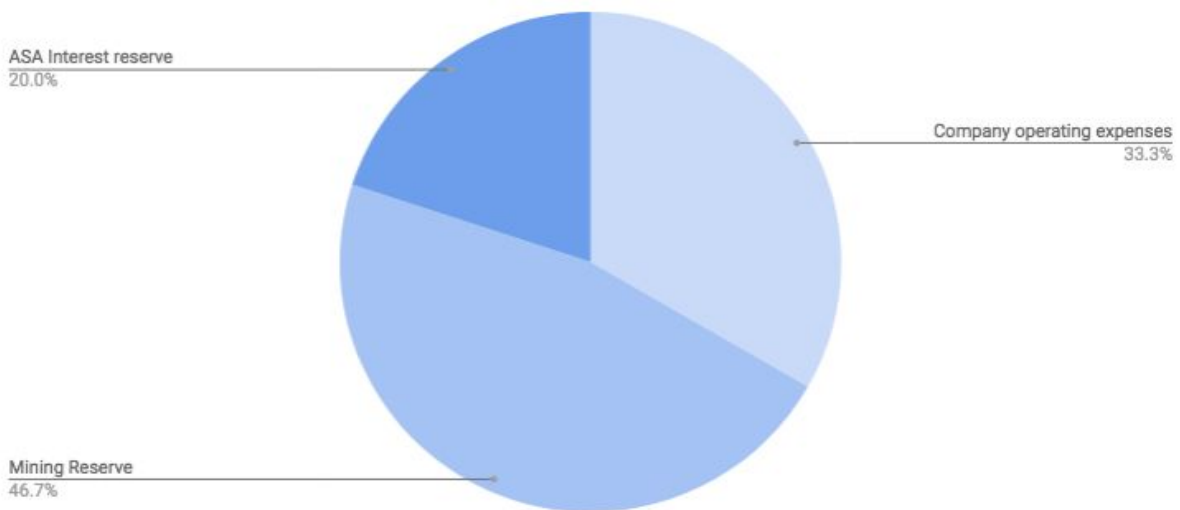
Community Grants and Bounties: 3%

Legal Compliance: 2%

Additional AST Issuance

Astera blockchain issues 15% of new AST every year to be used for company's operating expenses, savings wallet interest reserve, and mining reserve. Details of the newly issued AST are as follows:

Astera



Company Operating Expenses: 5% (33.3% of **Newly Issued AST**)

Mining Reserve*: 7% (46.7% of **Newly Issued AST**)

Astera Interest reserve: 3% (20% of **Newly Issued AST**)

**The volume of yearly issuing AST for Mining Reserve decreases over time by 0.75% per year for 20 years. After 20 years when the newly issuing AST for Mining Reserve becomes 1%, it no longer decreases.*

Aster Savings Wallet

Astera platform has a plan in bringing interest to long term investors. Speculators choose to invest in cryptocurrency based on short term performances, and this often influences the market price of tokens. In order to prevent unnecessary price fluctuation in the market, Astera provides interest for all AST deposited in savings wallet and encourages long term investment.

All users will be given with an option to transfer their AST to the savings wallet at anytime. AST deposited in savings wallet will not be transferable for 12 weeks, but is subject to receiving interest. 20% of newly issued AST per year will be rewarded to users with AST in savings wallet, number being proportional to the amount of AST they keep in savings wallet.

In addition, to encourage collecting data more regularly, the number of AST mined from Astera B each day becomes bigger with more AST deposited in savings wallet. Again, the number of bonus AST being rewarded depends on the amount of AST kept in savings wallet.

Savings Wallet Interest Rate

Interest Reserve = Total Issued AST * 0.15[Newly Issued AST] * 0.2[20% of Newly Issued AST]

Daily Interest pool = Interest Reserve / 365

Daily Interest = (User's AST in Savings Wallet / Total AST in Savings Wallet) * Daily Interest pool

Capped Daily Interest = Min(0.05*User's AST in Savings Wallet, Daily Interest)

If (Daily Interest - 0.05*User's AST in Savings Wallet > 0),
then incinerate [Daily Interest - 0.05*User's AST in Savings Wallet]

- Daily Interest cannot exceed 5% of User's AST in Savings Wallet
- Exceeded amount will be incinerated.

Example

If the total number of AST stored in the savings wallet is 600,000,000 AST, and user A has 100,000 AST in his or her savings wallet, the daily and annual interest rates are as follows:

Interest Reserve = 3,000,000,000 * 0.15 * 0.2 = 90,000,000 AST.

Daily Interest pool = 90,000,000/365 (days in a year) = 246,575.34 AST

Daily Interest = (100,000 / 600,000,000) * 246,575.34 = 41.1 AST

Capped Daily Interest = Min(100,000 * 0.05 = 5,000, Daily Interest) = 41.1 AST

Daily Interest Rate = 41.1 / 100,000 = 0.0411%

Expected Annual Compounding Interest Rate = (1.000411)^365 = 16.18%

**Note that depending on the total number of AST stored in the savings wallet, daily interest rate changes.*

AST Mining Bonus Calculation

To encourage capturing data regularly, the number of AST mined from Astera B becomes bigger with more AST saved in savings wallet.

Mining Bonus = (User's AST in Savings Wallet / Total AST in Savings Wallet) * 1000

Example

If the total number of AST stored in the savings wallet is 600,000,000 AST, and user A has 100,000 AST in his or her savings wallet, and total of 10,000 people mine on the same day, the daily mining bonus of user A is as follows:

Daily Mining Bonus Multiplier = $(100,000 / 600,000,000) * 1,000 = 16.66\%$

User A can earn 16.66% more AST from mining.

$1.1666x[\text{user A}] + 9,999x[\text{miners}] = 575,342.47 \text{ AST}[\text{daily mining pool}]$

Each miners earn 57.533 AST, whereas user A earns 67.08 AST per day.

**Note that depending on the total number of AST stored in the savings wallet, daily mining bonus changes.*

Continuation Combo Bonus

Continuous measurement of health data rewards in a mining bonus. The mining bonus scheme is as follows:

The bonus multiplier is maintained if and only if user captures data for more than 4 days in a week. The multiplier is reset to 1 when the above condition is not met.

Week 1 : Data recorded for more than 4 days in a week → Lv.1: Multiplier 1.1x

Week 2 : Data recorded for more than 4 days in a week → Lv.2: Multiplier 1.2x

Week 3 : Data recorded for more than 4 days in a week → Lv.3: Multiplier 1.3x

After Week 3, the multiplier remains at 1.3x. If the condition of capturing data for more than 4 days in a week is not met, then the multiplier is reset to 1.

Example

If the total number of AST stored in the savings wallet is 60,000,000 AST, and user A has 10,000 AST in his or her savings wallet, total of 10,000 people mine on the same day, and user A has been capturing data for more than 3 weeks straight, the continuation combo bonus is as follows:

Mining Bonus Multiplier = 16.6%

Lv.3 Multiplier = 1.3x

Total Bonus Multiplier = $1.166 * 1.3 = 51.658\%$

$1.5166x[\text{user A}] + 9,999x[\text{miners}] = 172,602 \text{ AST} [\text{daily mining pool}]$

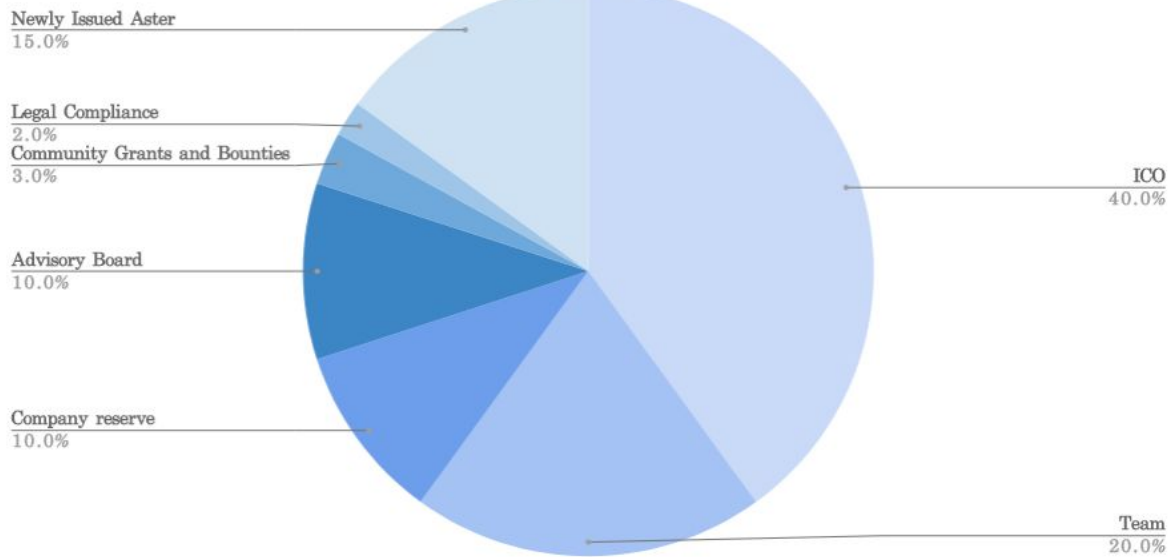
Each miners earn 57.5313 AST, whereas user A earns 87.252 AST per day.

**Continuation combo bonus is multiplied after the mining bonus multiplier.*

ASTER Initial Coin Offering

Total supply of AST : 300,000,000 AST

Astera Token Supply



Initial Coin Offering Details

Private Sale

Contribution	Bonus	Vesting Period	Rate
50 ETH - 100 ETH	40%	2 Month	\$0.015
100 ETH - 300 ETH	45%	3 Month	\$0.01375
300 ETH - 1000 ETH	50%	4 Month	\$0.0125

Presale

Contribution	Bonus	Vesting Period	Rate
0.1 ETH - 20 ETH	20%	1 Month	\$0.02
20 ETH - 50 ETH	25%	1 Month	\$0.01875
50 ETH - 100 ETH	30%	2 Month	\$0.0175
100 ETH - 300 ETH	35%	2 Month	\$0.01625
300 ETH - 1000 ETH	40%	3 Month	\$0.015

Public Sale

Time Frame	Bonus	Vesting Period	Rate
First 24 Hours	15%	None	\$0.02125
Week 1	10%	None	\$0.0225
Week 2	5%	None	\$0.02375
Week 3	2.5%	None	\$0.024375
Week 4	0%	None	\$0.025

Funding Details

Aster Token Public Sale will commence July 1st 2018

- ETH will be accepted for acquiring AST
- Private presale will take place to accredited investors only
- Public Presale and Public Sale will be open to everyone
- Token Sale Soft Cap: \$4,000,000
- Token Sale Hard Cap: \$30,000,000
- Max Coin Distribution: 120,000,000 AST

Funding Breakdown

Funds from our token sale will help the development of Astera. The following is a tentative breakdown of how we are planning to use funds for development.

Core Development (40%)

The largest portion of funds will go to completing the development of the entire Astera system as described in this paper. This includes Astera blockchain, node network, Astera B devices, smart contract systems, smartphone mobile app, etc.

Security (20%)

The next major portion of the funds will be going towards developing extremely tight security for our network.

Operations (20%)

This covers the day to day costs incurred for a functional system. This includes hosting, infrastructure, staffing, outsourcing, management, and other related expenses.

Marketing (20%)

The marketing budget will be used for strategic partnerships and directly marketing to consumers. This will lead to a larger network with more nodes, and more data being stored on Astera blockchain.

ICO & Development Roadmap

Before Token Sale (ETA June 2018)

The goal of this stage is to complete a proof of concept prototype of Astera B ready with smart contract v1.0 developed for the initial coin offering.

Development Goals

- Astera B PoC Prototype
- Smart Contracts v1.0

Phase 1 (ETA September 2018)

The goal of this stage is to launch and showcase the core system architecture of Astera system. We will have a functional Astera B device that can be used for capturing user's health data, smart contracts to issue AST tokens to miners and savings wallet holders. First batch of Astera B is expected to be shipped at this phase.

Development Goals

- Astera B (first batch)
- Astera Mobile App
- Smart Contracts v2.0

Phase 2 (ETA December 2018)

Along with the second batch of Astera B, we will also include Astera K to the line up for more detailed data capture.

Development Goals

- Astera B (second batch)
- Astera K

Customer Needs & Market

Astera enters into two major existing markets: 1) health scale market for data suppliers, and 2) health data market for data consumers.

Health Scale Market (for Data Suppliers)

Weight is one of the most important health concerns people face today. While weight management involves a whole lifestyle of good habits, one integral piece is weighing oneself.

More and more bathroom scales are turning into electronic smart scale that measures weight and other body composition metrics. The major advantage of these scales is that the users don't have to record their weight manually as these scales have the capability to sync with various health apps which enables them to track their weight over time. Smart scales are one of the fastest popularity gaining device in the current sports and health industry. A continuous rise in the demand for body fat analyzers is one of the key factors which is expected to drive the smart scales market. Moreover, a rapid growth in the aging population is likely to lead to augmented sales in the very market. Rising cases of hypertension, diabetes, and cardiovascular disease is fostering the adoption of advanced weight management strategies among consumers as well.

Electronic smart scale normally costs within the range between \$100 to \$200, much more expensive than the traditional analog scale. However, the market size accounts to \$4.3B as of 2017, with the number growing 5% each year to reach \$6.3B by 2025.

There are several big players in the market that creates and sell smart scales. Details of these companies are as follow:

Yunmai

Yunmai is a Chinese company founded in 2015 that manufactures healthcare products including smart scales. Their products are being sold in 7 different countries throughout the world, with over 9 million devices sold as of 2017.

Inbody

Inbody is a Korean company with over 80 patents and certifications related to body composition analysis. They have six subsidiaries overseas, and exports products to more than 60 countries around the world. In 2016 Inbody's annual revenue was around \$80M and they are currently listed on Korean stock exchange, KOSDAQ.

Existing healthcare product manufacturers like Withings and Garmin also partake a big portion in the smart scale market.

Health Data Market (for Data Consumers)

Data accumulated over a long period of time is valuable, because it can be used in many different cases. Insurance providers, research institutions, or other big data firms constantly collect population health data to be used on their business.

Health Analytics (\$9B USD as of 2017)

Health analytics can help aforementioned companies conduct much more effective business in the market. Health plans could invest in more effective outreach and personalized care management solutions. Health systems could make care decision with more certainty. Pharmaceutical companies could deliver life-saving therapeutics with more speed and clarity. Institutions could discover new therapeutic pathways, fueling diagnostic and drug innovation. The health analytics market size is \$9B as of 2017, but this number is growing so fast that it is expected to reach \$30B by 2022.

Astera wants to create and provide a search engine that can be used for finding specific cluster of population by health type. This could be used by numerous type of business firms in healthcare market to dramatically reduce the cost of obtaining health related data.

Population Health Management / Preventative Care (\$42.5B USD by 2021)

Currently, chronic disease affects nearly 3 out of 4 adults, and is responsible for more deaths than infectious disease. The management of these conditions also accounts for more than 85% of health care costs in the United States. Diabetes affect 9.5% of the population, with an additional 32% prediabetic patients, who have significant risk of progressing to diabetes. Employers pay approximately \$10,000 more per year for diabetic patients due to lost productivity and higher medical costs.

Studies show that diabetes prevention programs, DPPs, and behavior-change programs are more effective than pharmaceutical intervention for prediabetics. Weight loss is also a clinically accepted proxy measure for reducing the risk of developing diabetes. As a result, many companies started to work with DPP providers to seek out prediabetic employees and treat them to prevent development into type 2 diabetes.

The ROI for employer is pretty clear. A person with Type 2 Diabetes typically costs at least \$10,000 a year, but just a 5 percent weight loss reduces the risk of getting the disease by 70%. Through preventative care, companies can save much costs coming from employee's potential chronic disease.

Astera wants to partner up with organizations, such as firms, institutions, and clinics, to help them identify which of their employees or patients are at the tipping point stage where they are at risk of diabetes or heart disease. These employees or patients will then go through intensive behavior counseling program that includes capturing everyday health data. Using Astera, organizations will be able to create a comprehensive, meaningful and consolidated records, which can be used to quantifying and acting on clinical risk of their employees or patients, as well as quantifying and predicting financial risk.