ttDATA HEALTH

Whitepaper

APRIL 3, 2021

ttData Health, a blockchain based data analysis platform for personal real-time vital health data platform, prompts its proprietary "ttData Health Personal Index" (tPHI) and supports health digital asset exchange in a privacy protected and secured crypto-economics environment.

EXECUTIVE SUMMARY

As blockchain technologies rapidly evolving, there are still very few dApps that has truly penetrated people ordinary daily life. In 2017, many scenarios and dApps attempted to land, but with the burst of the bubble in 2018, majority of dApps proved to be unacceptable to the public. It is undeniable that some were far-fetched with meaningful attempts though. In general, the market timing is not in favor. Fortunately, after in 2020, the DEFI and especially the recently popular NFT have injected new energy and opportunities into the blockchain scenes.

The pandemic of 2020 had raised the importance of people own health to an unprecedented level. The lifestyles, such as working from home and telemedicine, which could not be promoted before, especially in the United States, are widely accepted by the whole society. Everyone has a better understanding of their own health, especially the importance of data such as physical healthcare and basic physiological indicators. Kroleo LLC has been engaged in the application and development of blockchain since 2017. During the years, we have developed varies dApps on different blockchain technologies. With a deep understanding of the difficulty of blockchain for big data processing, we independently developed the cross-chain ttData platform during 2019-2020. The platform solved an inherent problem of the blockchain that neither information that existing in different single data points, databases and blockchains, can be exchanged, nor the innovation of one chain can be used to share information with another chain. At the same time, the platform also provides a solution for the blockchain's slow speed and poor throughput. Then, we noticed the following technological innovation challenges and the opportunities that follow:

For an example, hypertension is a public health problem that affects millions of people worldwide. Hypertension is an asymptomatic disease that is easy to detect, but if not treated early, can lead to serious or fatal complications. In 2010, a global disease burden study revealed that nine million people died because of hypertension, making this cardiovascular problem the world's leading health risk factor [1]. Worldwide, approximately 40% of adults aged 25 and above had been diagnosed with hypertension; the number of people with the condition rose from 600 million in 1980 to one billion [2]. The prevalence of hypertension is the highest in the African Region, at 46% of adults aged 25 and above, whereas the lowest prevalence at 35% is in the Americas. Overall, high-income countries have a lower prevalence of hypertension, at 35%, compared with other groups at 40% [3]. The incidence of hypertension has doubled in the last five years in all social strata. Between 20 and 40% of the adult population in the Region of the Americas are estimated to suffer from hypertension. At the global level, of the people with hypertension, of the 57% that have been estimated to be aware of their condition, 40.6% receive antihypertensive drug treatment, but only 13.2% attain controlled blood pressure figures. This gap between the number of hypertensive patients, the access to treatment, and the achievement of control is accentuated in middle- and low-income countries, where 80% of the burden attributed to cardiovascular diseases occurs [4].

Industry insiders and market surveys have shown [5] that the detection of continuous enhancement of personal health and monitoring capabilities will be a major public healthcare trend. At the same

time, the value of the vital data will become higher and higher. Big personal health data has always been a target of major data company, a scarce category in related enterprise and government data. Facts have shown that in the 2020 epidemic, no company, institution, or government in the world could provide complete real-time big health data. Due to the difficulty of collecting big health data, even in a country like the United States with the most complete medical records in the world, the most incomplete and most irregular data is the big health data. In addition, the problem of not being able to confirm the privacy, authenticity and reliability of the data is a road blocker.

Health is the greatest capital and most precious wealth in life. Personal health data becoming personal assets is inevitable in future. It builds the foundation of health artificial intelligence. In line with the purpose of establishing a brand-new personal health asset and serving the general health of people, we put forward the slogan, "Are you healthier today?" to seek a breakthrough for purpose of adopting a win-win cooperation model, gathering personal basic physiological data reasonably and legally, and packaging these data into digital assets. Medical data is strictly controlled by countries all over the world. However, personal vital data such as basic vital signs, emotions, and sports are collected by home healthcare equipment and devices, including wearable medical equipment now, and we expect there will be more in the future. We have proposed a "ttData Health Personal Index" (tPHI) of individuals, using comprehensive means, relying on ttData's blockchain data platform to collect these data in real time; applying for artificial intelligence to generate assessments including health indexes and other related KPIs, RYG (red means exceeding the standard, yellow means warning, and green means good). Meanwhile, we have designed various rewards to individuals according to the tPHI.

Through the self-developed ttData blockchain technology platform and NFT asset packaging, while personal privacy and security are ensured and protected, personal data assets are generated. These digital assets become private owned assets by individuals. They can independently share and authorize to share, even exchange these assets. With ttData Health service, people will not only experience a brand-new health level of up spinning and improving their overall health levels, but also enjoy the economic benefits. We expect that through the construction of communities, a healthy virtual economy can be influenced, educated, and established. After the community reaches to a certain scale, it will solve the needs and provides big health data companies and organizations such as big pharms, factories, insurance, scientific research, and related health product companies, and eventually benefit the whole human being.

In general, ttData Health Community is a service platform based on big health data analysis and individual health portraits. We shorten the usual annual check of personal health to daily check. At the same time, we use a virtual economy model to package personal health data. Make it a private digital asset, explore an effective win-win way for the industry, create a new world for the exchange and sharing of personal health assets, mobilize the power of the community, and ultimately serve the public.

ttData Health Platform

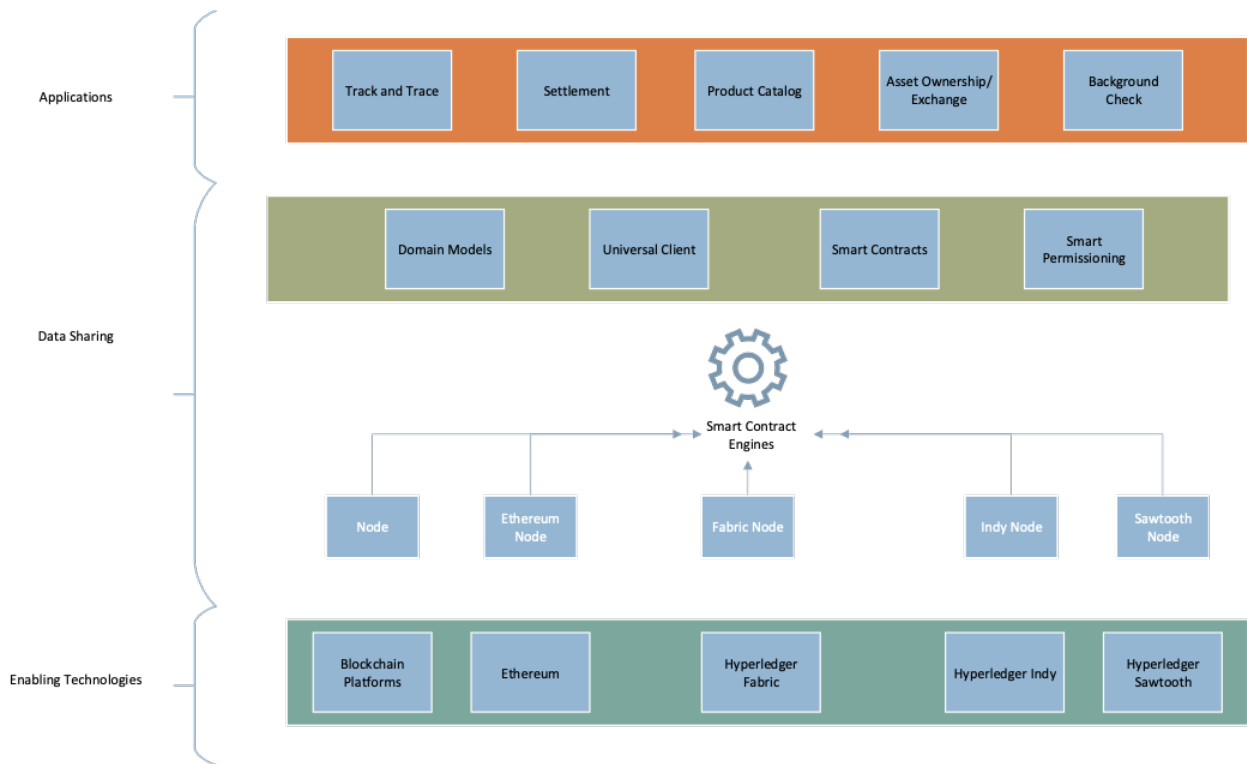ttData Health is built based on ttData blockchain platform,

Fig 1. ttData cross-chain platform with multiple layers

The ttData Platform is dedicated to the development of open application protocol stack, as follows:

Blockchain Protocol Layer

At present, various blockchain systems such as public blockchains and consortium blockchains have their certain innovations, developers, and users. The ttData Platform will develop the common kit application protocols utilizing each chain's specific innovations to incubate common business applications - starting with decentralized identity (DID) from Hyperledger Indy. Initial blockchains supported by the ttData Platform will initially include Hyperledger Indy and Ethereum with future support for additional blockchains. Ethereum's support is also of importance to ttData due to the popularity and frequency of projects that run on EVM.

The reason why Hyperledger Indy is the priority for ttData is due to its tools, libraries, and reusable components for providing digital identities rooted on blockchains or other distributed ledgers that are interoperable across administrative domains, applications, and any other silo. Indy is interoperable with other blockchains or can be used standalone powering the decentralization of identity - which is synergistic with the goals of the ttData Platform.

The design direction of ttData Platform is as follows:

- Enhance capabilities such as authorization management, security control, privacy protection, supervision/regulation, etc. for business needs
- Meet the high throughput and high-performance requirements
- Compatible with Hyperledger Indy and make full use of its digital identities
- Compatible with EVM and make full use of Ethereum's ecological resources
- Solve the problem of cross-chain asset transfer

Data Sharing Layer

Based on in-depth research and understanding of regulatory standards, ttData Platform will design a proprietary underlying consensus protocol for our application protocols, combined with Smart Contract Engine support for scalability and cross-chain interoperability, providing security, compliance, reliability, and high performance for the open public blockchain and consortium blockchain solution.

The ttData Platform's blockchain layered structure:

1. Network layer: responsible for broadcasting transactions and information related to consensus
2. Consensus layer: enables nodes to reach consensus on the current state of the system
3. Application layer: responsible for updating the status of various transactions (i.e. processing transactions)

Smart Contract Engines

At present, various blockchain systems have their own different smart contract systems. This situation brings inconvenience to the development of smart contracts for users. The smart contract engine of the ttData platform will provide users with a universal smart contract platform so that users can apply the same smart contract to different blockchain systems. To be Provided

Application Protocol Stack

For different types of applications, the ttData Platform's application protocol stack is responsible for formulating specific network communication standards, realizing the encapsulation of business functions in corresponding scenarios, facing upper-layer applications, and exposing friendly object-oriented functional interfaces. Based on this technical architecture, in terms of business functions, developers of upper-level application services only need to interface-oriented programming and focus on implementing business logic, without having to consider complex business rules, mathematical models, regulatory requirements, and underlying technology of blockchain.

There are many kinds of business services and the rules are complex. Through the abstraction of various business processes and business logics, ttData Platform has designed two basic modules in the application protocol stack, which includes basic components and expansion components.

1. Basic components: Standardized and modular features, including domain models, universal clients, smart contracts, smart permissions, data catalogs, etc.
2. Extended components: Provide interfaces to support internal and external functions calling such as big data, Internet of Things (IoT) and Artificial Intelligence (AI).

Domain Models

A good domain model is not necessarily an exact copy from the real world, but it must model the problem domain with the required accuracy whilst adhering to the standards proposed. For TtData, our primary goal for providing support to domain models is to make these benefits available to all people - thereby building trust on a global scale. Certain standards we will provide support for in the beginning are: W3C standard for Decentralized Identity (DID), Blockchain in Transport Alliance (BITA), Global Standards (GS1) and Open data initiative.

W3C Decentralized Identity (DID)

Once a user has a main net account for a public blockchain, many decentralized applications can be used. However, for many business application scenarios, identity certification is mandated in accordance with relevant legal requirements, especially in anti-money laundering and counter-terrorism financing. In the traditional scheme, when we conduct a KYC, we provide identity information to the platform; however, there is a risk of disclosure of the identity information during this process. The ttData Platform will incorporate Decentralized Identifier (DID) in conjunction with biometrics and cryptography algorithms to ensure user identity data privacy and security. The ttData Platform's authentication protocol will follow the W3C standard and will also seek to work with projects such as Hyperledger Indy, MicrosoftDID, Sovrin, and uPort.

Blockchain in Transport Alliance (BITA)

The Blockchain in Transport Alliance (BiTA) focuses on the transportation and logistics sectors. By complying to BiTA, ttData adheres to a set of open blockchain standards so companies within their respective industries can develop blockchain-related applications. To monitor the real-time movement of a shipment through blockchain, it is critical to define a whole array of components within supply chain entities, while also initiating stable relationships between different parties. Defining the core set of entities and creating contracts that they will work on, is instrumental in helping businesses manage operations in a more streamlined and efficient way.

Global Standards (GS1)

GS1 standards create a common foundation for businesses by uniquely identifying, accurately capturing, and automatically sharing vital information about products, locations, assets and more. Businesses can also combine different GS1 standards to streamline business processes such as traceability.

Open Data Initiative

The Open Data Initiative provides a platform for a single, comprehensive view of the data from the ttData Platform, bringing together and enriching the data from all lines of business, across all systems and blockchains to deliver real-time intelligence back into your applications and services on the platform.

Universal Client

ttData is a Platform as a Service (PaaS) model that will provide a universal client to deliver easy-to-use digital workflows that create intended end-user experiences and unlocks productivity for employees and the enterprise alike. We simplify the complexity of work on a single, enterprise cloud platform.

Smart Contract

The ttData Platform's blockchain will integrate the Ethernet module into its system to be compatible with public blockchains or consortium blockchains which support solidity, such as Ethereum, ETC and RSK. With the update of the EVM and the advancement of the smart contract programming language, ttData Platform's blockchain will always track industry progress and integrate forward-thinking technology into the system. ttData also proposes a secure oracle network that is fully decentralized by being based on blockchain technology, allowing connectivity between smart contracts and external (or off-chain) resources.

Oracles

For implementing business logic on the blockchain, the judgment of the contract state inevitably requires the use of information in the out-of-chain system. This combination of out-of-chain data and on-chain smart contracts requires a trustworthy channel for data access on & off the chain, which is the oracle. For the oracle, the most important thing is to ensure that the oracle is trustworthy and does not tamper with the data. The oracle usually has two modes: the centralized oracle and the decentralized oracle. ttData proposes a coexistence mechanism of centralized and decentralized oracle, that is, introducing multiple data sources service nodes through certain reward and punishment mechanism, encouraging data source nodes to provide effective data on-chain services.

Smart Permissions

ttData aims to provide Smart permission functions (SPFs) which are business logic implemented in a programming language, stored in a distributed ledger's global state, and executed within a smart contract during transaction execution.

In some respects, Smart Permission Functions are similar to smart contracts; in that, both can be stored on the chain, retrieved from global state as needed, and executed during transaction execution. However, the purposes are distinct. Smart contracts implement business logic to update global state, while Smart Permission Functions implement business logic to return a Boolean result which answers a specific permission question. This allows shared/agreed-upon contract logic which governs the mechanics of a transaction to be gated by a domain or organization-specific set of permissions. A typical usage of this is an organizational Smart Permission Function called from within a smart contract.

Data Catalog

ttData's Data Catalog is a fully managed and scalable metadata management service that empowers organizations to quickly discover, manage, and understand all their data in their respective blockchains. We offer a simple and easy-to-use search interface for data discovery, a flexible and powerful cataloging system for capturing both technical and business metadata, and a strong security and compliance foundation with Cloud Data Loss Prevention (DLP) and Cloud Identity and Access Management (IAM) integrations.

The service also automatically ingests technical metadata and allows customers to capture business metadata in schematized format via tags, custom APIs, and the UI, offering a simple and efficient way to catalog their data assets. We are building an ecosystem with strategic partners so customers can discover all their data assets wherever they are. With our Data Catalog, organizations can

promote knowledge sharing and collaboration across the organization, allowing users to generate more value from their data assets.

Extension Kit

AI – ttData plans to introduce artificial intelligence technology, including machine learning, knowledge mapping, natural language processing, computer vision, etc. to empower the industry's participating entities and business segments. The goals is to highlight the important role of AI technology for the industry, such as product innovation, service upgrades and process reengineering.

Big Data – Data is the fuel that runs modern businesses in need for quantitative analysis and machine learning. Based on a distributed architecture, TtData Platform aims to provide a one-stop big data solution for ETL processing and cleaning, data analysis and reporting services, and data visualization.

IoT – Adoption of IoT based technologies are making a big impact on various sectors of our daily lives, including energy, manufacturing, smart transportation and smart cities. With more and more autonomous deployments of potentially large scale IoT systems, ensuring security, availability and confidentiality of the data, the devices and the networks become utmost critical. In order to realize an entirely autonomous IoT network, different sensors and devices in an IoT network need to communicate with each other in a distributed fashion. ttData can support optimal consensus methods designed for IoT such as Tangle, Hyperledger Sawtooth, etc.

ttdataAsset	
API	
Standard API	
Token Type Management API	
Extensible API	
Smart Contract	
Manager	**Protocol**
Token Manager	Standard Protocal
Operator Manager	Token Type Management Protocol
Token Type Manager	Extensible Protocol

Fig 2. ttDataAsset Application View

The NFT of personal health data – ttDataAsset is a non-fungible token compatible with ERC721 [6]. It represents the ownership of electronic assets or physical assets. ERC721 was defined by Ethereum at the end of 2017. The format is currently the most common open-source protocol in electronic assets, which is commonly referred to as the common format of NFT. Fig 2 shows the system

framework of ttData version of assets. The personal health asset on the ttData Health platform is a NFT asset, which can be sold and resold on various NTF platforms at a predetermined price without data conversion. The originality of each data, the authenticity, and reliability of the data can be fully obtained and guaranteed. At the same time, due to its uniqueness, the exchange of property rights is clear, which can cut off the illegal ways of counterfeiting, reselling, and disclosing personal private information.

ttData Health Data

ttData Person Health Index

Positive Health[7] is defined by theoretical framework and empirical work that including 3 major assets. Biological health assets might include, for example, high heart rate variability, high levels of HDL, and cardiorespiratory fitness. Subjective health assets might include positive emotions, life satisfaction, hope, optimism, and a sense of meaning and purpose. Functional health assets might include close friends and family members; a stable marriage; meaningful work; participation in a social community; and the ability to carry out work, family, and social roles.

The ttData Health Platform starts with collecting basic personal biological data, including blood pressure, heartbeat, body temperature, height, weight, waist circumference, hip circumference, constipation status, glucose, happiness index, urine color, sleep state and exercise index to conduct a basic assessment of personal health, which can be increased in future to align with the Position Health definition. The following figure shows the individual index identification chart.
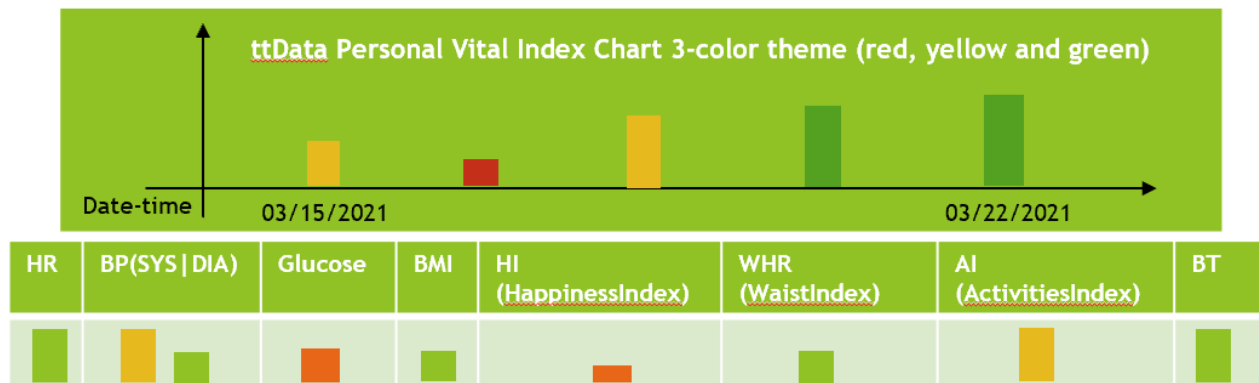

Fig 3. ttData Personal Health Index

	SYSTOLIC BP	DIASTOLIC BP	Heart Rate at Rest	Body Temperature	Weight	Height	BMI	Glucose (Fasting blood sugar test)	Waist-to-Height Ratio	Happiness Index	Activity Index
UNIT	mm Hg	mm Hg	beat	F	lb	cm	kg/m²	mg/dL	Waist and Height in same unit	Scale 0-10: how happy you are	Scale 0-10: how active you are
potential error input	<60 or >200	<40 or >120	<40 or >200	<95 or >105	<60 or >500	<120 or >250	<15 or >50	<50 or >300	<0.2 or >0.8	>10	>10
normal	<120	<80	60-90	97-99	80-200	140-200	18.5-25	70-100	0.4-0.5	7-10	7-10
elevated	120-140	80-90	90-120	100-103	200-300	200-230	25-30	100-125	0.5-0.6	4-6	4-6
abnormal high	>=140	>=90	>=120	>103	>300	>230	>30	>126	>0.6	<=3	<=3

Fig 4. Definition of various indicators

The platform compares various basic data with standards, and identifies red, yellow, and green. At the same time, the platform uses artificial intelligence to classify, compare data, as well as prevent counterfeiting. We proposes the "Tiantian Healthy Personal Index" (tPHI). The following is the calculation formula of this index:

$$tPHI = \sum w(j) \times i(j), \text{ where j is 1 to 12}$$

The formula can get a comprehensive basic health value, which can be used as an indicator to judge the overall physical state of an individual.

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

Fig 5. Definitions of blood pressure readings

Classification	BMI (kg/m^2)	Man	Women	Category
Underweight	<18.5	<0.34	<0.34	Extremely Slim
Normal	18.5–24.9	0.35–0.42	0.35–0.41	Healthy Slim
Overweight	25.00–29.99	0.43–0.52	0.42–0.48	Healthy
Obese I	30.00–34.99	0.53–0.57	0.49–0.53	Overweight
Obese II	35.00–39.99	0.58–0.62	0.54–0.57	Overweight elevated
Obese III	≥40.00	≥0.63	≥0.58	Morbid Obesity

Fig 6. BMI Definitions

Data Privacy, Security and Sharing

Healthcare data is highly private. It involves security measures, requirements and legal regulations. Countries have clear regulations on these data. ttData Health will learn and strictly abide by these regulations. For example, in the United States, we strictly separate personal information and health information. The data storage procedure strictly follows HIPAA requirements, using only HIPAA-certified cloud service providers, such as AWS or AZURE. The access and sharing of personal data is completely authorized or operated by individuals.

ttData Health has solved the challenges of cross-organizational use of medical data. For example, the basic physiological data of elderly parents hope that their children or family doctors can see it. The service layer can be built on the ttData Health platform, connected and shared with these people or service personnel, thereby providing privacy-protected data sharing and analysis. At the same time, AI technology is applied to effectively screen the reliability of data to make platform data more reliable and complete.

ttData Health Platform Introduction

Personal Vital Data

The target data by ttData Health Platform includes blood pressure, heartbeat, body temperature, height, weight, waist circumference, hip circumference, constipation, urine color, sleep status, blood sugar, happiness index, exercise index, etc. Some of them come from personal input, such as height , Waist and hip circumference, some come from home medical equipment, such as Bluetooth thermometers, Bluetooth weight machines, etc., and some data is collected by personal mobile phones in various wearable electronic devices, such as heartbeat, sleep, exercise status, and geographic location.

Platform Framework Introduction

At the first stage, ttData Health is responsible for data collection and sorting by the mobile phone user app, and upload it to the ttData blockchain platform. The blockchain platform is an integrated data chain with a unified data format and smart contract data warehouse. It converts the uploaded data into NFT format, making it a data asset. At the same time, in the background, we establish a health intelligence library with self-learning ability to improve and enhance related artificial intelligence models, and then perform intelligent analysis and related health tips based on user data. This platform has an open-source API interface, which can interface with various smart electronic products and customer application software products. It has laid a solid foundation for further development in the future.
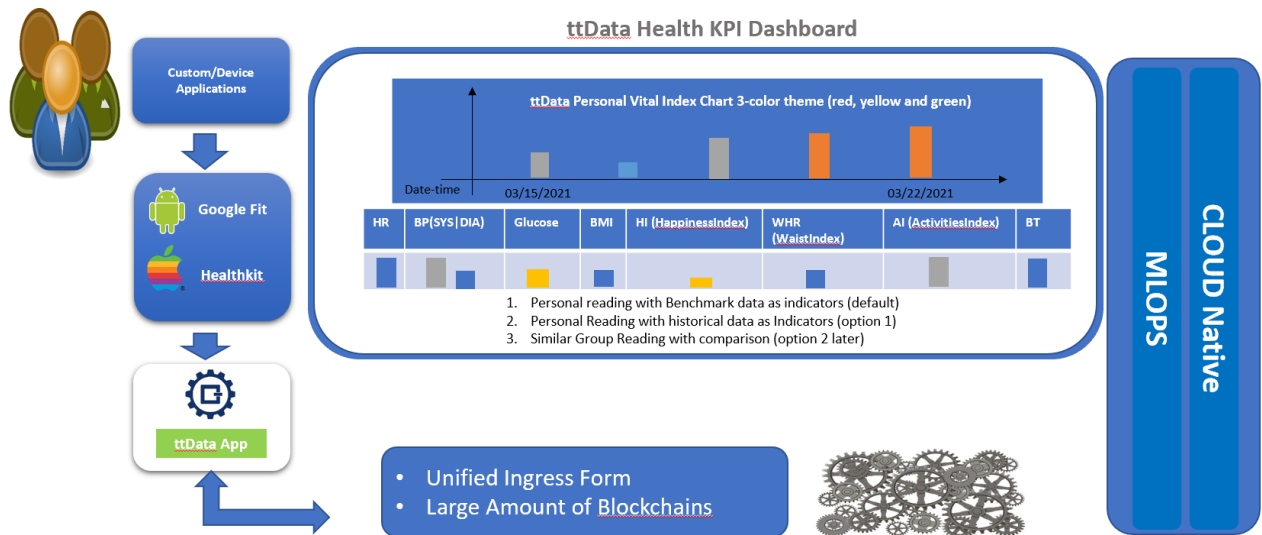

Fig 7. Platform Solution Architect

Crypto Economics and Profit Model

Having better health is priceless. As a community advocate and developer, ttData Health creates a virtual community with primitive power at a lower cost through the virtual economy and achieve rapid user growth. Increase the visibility of the community through low-cost online activities and various health-themed activities with independent and participation in related health services and products. Joint healthcare experts and fitness services; cooperation with various home medical equipment manufacturers to provide targeted services to customers, so that long-term cooperation with customers who are willing to buy big data.

Virtual Economics

ttData Health Community adopts virtual tokens to coordinate the issuance, recycling, and destruction of virtual tokens to ensure the balance between the supply and demand of virtual

tokens. In the issuance, there is a fair reward mechanism to ensure the fairness of the community. In terms of recycling, several recycling paths have been designed. We also have a policy of destroying virtual tokens. As community advocates and developers, we have experience and lessons. In the design of the community, we require centralized management of blockchain nodes. It provides the node owner with the right to supervise, monitor and lead.

Profit Model

ttData Health's profit model is mainly reflected in the enhancement of the value of virtual tokens, the rapid growth of the community and the stability of token prices are the key points. It is the most ideal state that the price of the token is stable and there is growth, in other words, the issued token needs to be consumed. ttData Health consensus is Proof of Stake (POS). We will sell tokens to raise funds to build nodes and communities, and gradually expand the community. There are many potential customers of Big Health Data. We have every reason to find long-term cooperation partners in the following list:

- Large pharmaceutical firms.
- Insurance company-if the person insured is healthier, the profit of their insurance company will be higher.
- Major medical data and instrument companies.
- Clinics and hospitals.
- The human resources department of various large companies-they have such a demand, the healthier the employees, the overall medical insurance can be reduced.
- The government's public health and medical departments.

If the community data is adopted by these institutions, then we will destroy the equivalent virtual token, to achieve the effect of increasing the price of the token and reward the entire community. We also designed such a way to digest within the community:

- Discount on related instruments used for orientation.
- Use discounts on community medical and health services.
- Provide an interest-bearing fund pool so that virtual tokens will not circulate in the market for a certain period of time.
- Of course, some will be cashed out in the market.

ttData Health Consensus

In line with the purpose of serving the community, we designed ttData token to provide effective value media for the virtual operation of the entire community. As an ERC20 virtual token of the community, it is not a function that can replace government currency. It is issued by ttData decentralized data platform. The following are the issuing rules:

1. The platform adopts the Proof of Stake (POS) method to purchase investment, participate in operation and management to obtain the ttData Tokens.

2. The released token can enter the staking pool set by the community as a weight. The Tokens that enter the fund pool will receive a certain interest, and the interest rate (5%+) is determined by the total number of ttData Tokens in the fund pool.

3. Every asset exchange generated in ttData will be rewarded with ttData Token. Please refer to the rules for detailed rewards.

4. ttData requires more than 1.6 million daily health tokens in the fund pool to run. The basic operation node will start at the same time in some regions.

5. The issuance and operation data of ttData can only be seen by the node administrator, and each node is screened by weight. The total number of the most basic nodes is 8, and the first 8 of the weights get the node jurisdiction, but the specific management is performed by ttData.

6. The new node is bid by the owner of the ttData Token according to the weight, and the existing node owner has no right to become the candidate jurisdiction of the second node.

7. The replacement of the existing node jurisdiction is done in the same way as #6.

8. ttData Health's reputation mechanism is independently designated by each operating community. The reputation mechanism of basic operating nodes is judged by smart contracts that participate in the construction of the blockchain and the amount of data transactions is re-weighted every 120 days.

CONCLUSION

Last but not least, the Internet Protocol (IP)[8] was created to connect and allow communication between previously independent and relatively isolated networks. IP solved the issue of network silos by relaying datagrams across network boundaries. Its routing function enables internetworking, and essentially establishes the Internet we know today. ttData draws heavy inspiration from the design and goals of the traditional Internet Protocols with the goal of eventually becoming a key part of the "Blockchain Health Internet of Things". In the field of health, it solves the last mile, that is, human physiological data and the digital world, at the same time, to eliminate the public's concerns about the misuse of personal privacy information, and let everyone safely, legally and autonomously manage and share their own health data.

Money is valuable, but health is priceless. If the ttData Health Community can provide individuals with health knowledge, awareness, and early warning of self-health, we believe that people will join and are willing to promote, to build a very valuable community.

Contact us：
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GitHub: https://github.com/ttdata

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