EpiK Protocol

Building an Everlasting Knowledge Vault
Broaden AI's Horizons

v 2.0

2021.2

Summary

The way of human knowledge inheritance has evolved from word of mouth to inscriptions, then bamboo slips, papers, before finally to the Internet today. However, traditional forms of human knowledge such as text, pictures and videos are difficult to be understood by machines; Google resolved this by introducing knowledge graph (KG) technology, laying the foundation for today's Artificial Intelligence (AI) advancement.

The construction of a qualified KG that can be utilized by AI efficiently is met with multiple challenges: time-consuming to convert all knowledge to appropriate formats, massive labor required to perform tasks and also, the possibility of data manipulation under a centralized control system.

EpiK Protocol envisions building a decentralized KG using blockchain technology to expand the horizons of today's AI technology, tapping on the decentralized storage technology which originated from Filecoin[1],uniquely designed Token Economy[2] which ensures fair incentives, Decentralized Autonomous Organization (DAO[3]) to ensure trusted governance, and Decentralized Financial Technology (DeFi[4]) for reliable financial capabilities. Thus, creating a trusted, multi-party collaboration platform where all trusted contributors are rewarded fairly.

---

[1] Filecoin.io. 2021. Filecoin: A Decentralized Storage Network. [online] Available at: <https://filecoin.io/filecoin.pdf> [Accessed 16 February 2021].

[2] Jei Young Lee, A decentralized token economy: How blockchain and cryptocurrency can revolutionize business, Business Horizons, Volume 62, Issue 6, 2019, Pages 773-784, ISSN 0007-6813, https://doi.org/10.1016/j.bushor.2019.08.003.

[3] En.wikipedia.org. 2021. Decentralized autonomous organization. [online] Available at: <https://en.wikipedia.org/wiki/Decentralized_autonomous_organization> [Accessed 16 February 2021].

[4] En.wikipedia.org. 2021. Decentralized autonomous organization. [online] Available at: <https://en.wikipedia.org/wiki/Decentralized_autonomous_organization> [Accessed 16 February 2021].

Catalog

1 Background

AI in today's context is capable of identifying but imperfect in understanding.

A child is able to recognize a “dog” once they have seen a picture of it. However, AI is reliant on the big data that it is fed with pattern match, before it can identify a “dog” successfully.

The development of AI (as shown in Table 1) is divided into four major stages: computational intelligence, perceptual intelligence, cognitive intelligence and conscious intelligence.

- Computational intelligence allows machines to save and calculate data;
- Perceptual intelligence allows machines to listen and speak, to see and identify;
- Cognitive intelligence allows machines to understand and process information;
- Conscious intelligence allows machines to self-learn and remember.

To date, significant progress has been achieved in AI's perceptual intelligence, allowing face and voice recognition technologies to enter our daily lives via our mobile devices.

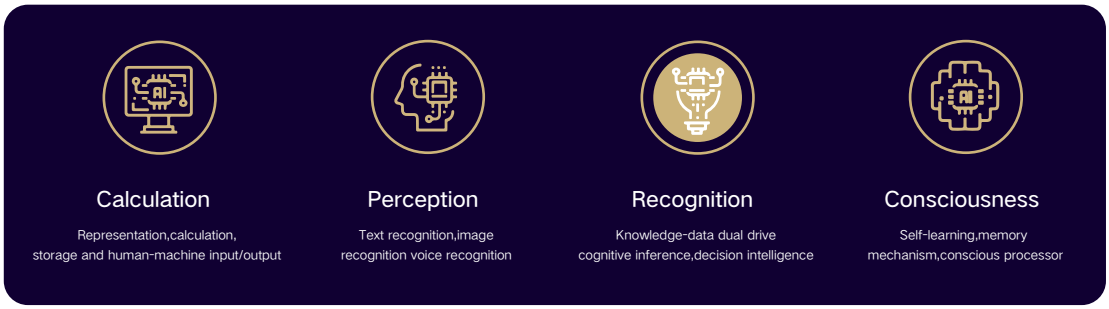

Fig.1 Four Stages of AI Development

The next step is the breakthrough into AI's cognitive intelligence, allowing AI to understand and process information, and having a huge amount of structured knowledge is vital to achieving this.The formation of this structured knowledge differs from how knowledge is inherited traditionally; instead of humans unstandable text, pictures and videos, machines require knowledge to be in well-defined structure.

To achieve this, Google proposed the knowledge graph technology[5J] in 2012, which uses structured entities, concepts, relationships and other elements to represent human knowledge. Doing this allows machines to understand and explain the data.

[5J] Google. 2021. Introducing the Knowledge Graph: things, not strings. [online] Available at: <https://blog.-google/products/search/introducing-knowledge-graph-things-not/> [Accessed 16 February 2021].

Figure 2 is an example of a knowledge graph, documenting the Big Bang to the machine, so that it can understand the semantic information behind the strings.

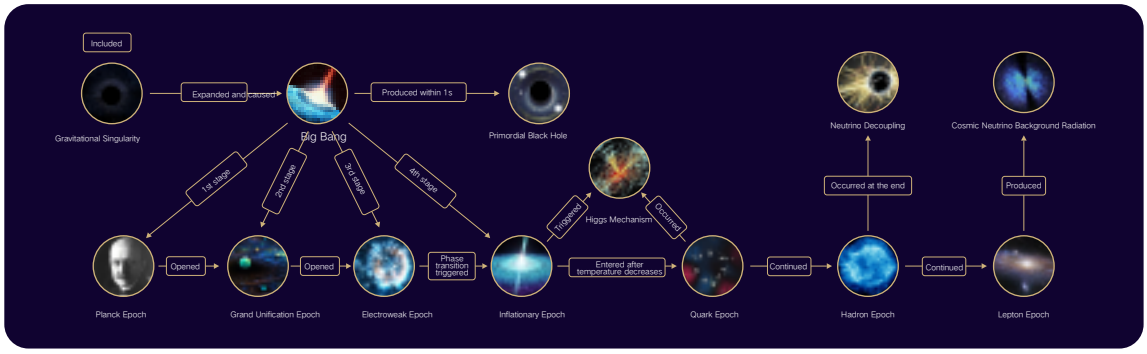

Fig.2 KG of the Big Bang Evolution

A KG is very much similar to the bionic system of the human brain neuron system, where the connection of neurons is like the connection of nodes in the knowledge graph - the denser the connection, the smarter it is.

However, there are many challenges in creating a large-scale high-quality KG:

- Firstly, the documentation of human's knowledge across the vast domains is not a job that can be completed independently by an organization, a company or even a country.
- Secondly, the process of constructing a quality knowledge graph is highly labour intensive and time-consuming - from (a) Knowledge Extraction, (b) Knowledge Fusion, (c) Knowledge Processing to (d) the updating of existing knowledge graphs.
- Lastly, the high cost of constructing a KG acted as a high barrier of entry into this industry. Most companies are unable to construct their own KG for their needs and have to rely on third parties' KG to build cognitive abilities, subjecting themselves to the risk of maliciously tampered data, which will affect their AI at the end of the day.

In a perfect scenario, an immutable, decentralized KG which promotes global collaborative efforts via fair rewards will propel the evolution of AI from perceptual intelligence to cognitive intelligence.

2 EpiK Protocol

EpiK Protocol envisions building a decentralized KG using blockchain technology with trustable storage, incentives, governance and financial capabilities; this creates a trusted, multi-party collaboration platform where all trusted contributors are rewarded fairly while preserving human knowledge at an affordable rate permanently, expanding the horizons of today's AI, and will usher in the era of cognitive intelligence.

2.1 Trusted Storage

EpiK Protocol tapped on Filecoin's decentralized storage technology to achieve trusted storage. The underlying technology of Filecoin is IPFS [6] protocol, a peer-to-peer network for storing and sharing data in a distributed system. The protocol organizes the distributed devices into a unified file system and processes all files into a Merkle Trie structure, forming a unique Root Hash. This prevents the storage of duplicate data blocks and the nodes will only need to synchronize with Root Hash for consistency.

However, IPFS is lacking in an incentive mechanism and an anti-fraud mechanism.

Improving on IPFS, Filecoin (i) designed Proof-of-Storage to incentivise its ecosystem and (ii) combined Zero-Knowledge Proof to design Proof-of-Replication (PoRep) and Proof-of-Spacetime (PoSt) to prevent frauds.

Unlike traditional distributed databases such as Hadoop, Filecoin allows foreign parties to self-organize their idle machines into a unified distributed storage system, without having to trust each other. All parties are allowed to store and access data in a permissionless manner under consensus.

Similar to how Ethereum [7] is defining a decentralized computing framework, Filecoin is defining a decentralized storage framework. As a general storage framework which will encounter various storage application scenarios, Filecoin's Layer 1 network focuses on large file storage under extremely limited throughput.

---

[6] Docs.ipfs.io. 2021. What is IPFS?. [online] Available at: <https://docs.ipfs.io/concepts/what-is-ipfs/> [Accessed 16 February 2021].

[7] ethereum.org. 2021. Ethereum Whitepaper | ethereum.org. [online] Available at: <https://ethereum.org/en/whitepaper/> [Accessed 16 February 2021].

In EpiK Protocol's KG collaboration network, instead of large file storage, most files will exist as small bin-log files for effective and efficient collaboration. To achieve a seamless integration between both platforms, EpiK protocol relies on Filecoin core technology to customize a Filecoin Layer 2 storage network for KG collaboration network and collect KG data on Layer 2 through various incentives. The KG data will then be aggregated regularly into large snapshot files, before being stored permanently within the Filecoin network.

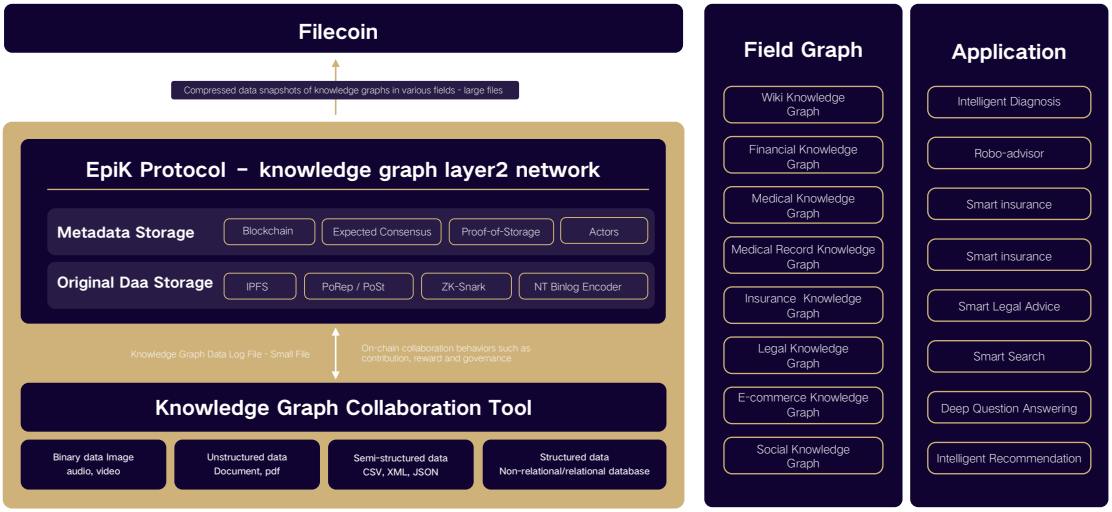

Fig.3 Authentication Protocol Trusted Storage Architecture Diagram

EpiK Protocol Layer 2 network retains the trust of Filecoin Layer 1 network while focusing on the collaborative efforts of constructing KG data of various domains, which are stored as bin-log files in EpiK Protocol network. Without permission from a centralized entity, anyone can download the bin-log files and execute them to restore a graph database locally. Users can upload the database snapshot to the Filecoin network for rewards as well.

2.2 Trusted Incentive

EpiK Protocol's Token Economy provides its ecosystem with a trusted incentive model. Tokenization creates a new way for the transfer of value based on blockchain technology - (i) tokens can be spent, transferred and exchanged and (ii) transactions are transparent and immutable. Without relying on third-parties verifications, tokenization is a programmable asset that can be utilized as a transfer of value with low costs.

The circulation of EpiK Protocol's native token, EPK, builds the foundation of EpiK's Token Economy. While pursuing their personal interest, EpiK Protocol forms a collaborative relationship for the core participants of the KG network, to jointly create a knowledge graph.

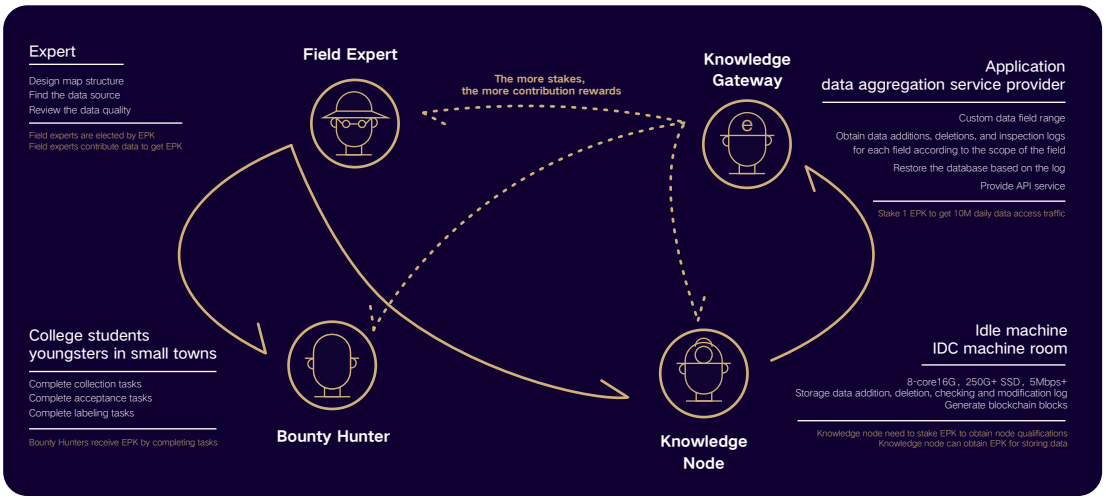

Fig.4 Schematic Diagram of EpiK Trusted Incentive

The core participants of EpiK Protocol ecosystems are: Domain Experts, Bounty Hunters, Knowledge Node and Knowledge Gateways.

Domain Experts (DEs) mainly organize and inspect data in the KGs. Under a strict supervision mechanism, they are also the ones who have the right to upload knowledge graph data. Domain Experts benefit by contributing high-quality knowledge graph data.

Parties who are interested to join as DEs must be nominated by existing DEs. These parties will need to gain the support of EpiK Protocol's community by getting their votes, where each 1 vote equates to the lockup of 1 EPK Token.

With a threshold level in place, DEs who have votes above the threshold will retain their positions while those who do not have sufficient votes will be disqualified as DEs. In the situation where DEs are caught uploading fake or junk data, the community can vote to remove them and those who nominate the delisted DEs will also be punished.

The task of generating knowledge graph data is arduous, and it is difficult for Domain Experts to complete them independently. This is where Bounty Hunters (BHs) come into the picture – Bounty Hunters generate income by mainly collecting, annotating knowledge graph data, and completing any additional tasks issued by Domain Experts.

Knowledge Node (KNs) are providers of storage and bandwidth for knowledge graph data, and they gain benefits by providing data storage and data access services. The more data stored, the higher the revenue; the greater the data download traffic provided, the higher the revenue. At the same time, in order to discourage data node from going offline at will, resulting in reduced data backups and reduced system security, all data node are required to stake a specific amount of EPK to qualify as Knowledge Node.

Knowledge Gateways (KGs) are the channels for users to obtain the latest knowledge graph data. They are required to stake EPK in order to obtain access to knowledge graph data.

As the demand for knowledge graph data on EpiK increases, more EPK tokens will be staked by Knowledge Gateways and Knowledge Node. This increases the demand for EPK tokens, and the corresponding value of EPK tokens.

All rewards will be automatically issued via smart contracts. Without manual intervention, the transactions and rewards from a large number of micro-contributions from various roles in the knowledge graph collaboration platform can be completed at a low trust environment and transaction costs. For a more detailed incentives model, see the *EpiK Protocol Economy Whitepaper.*

2.3 Trusted Governance

EpiK Protocol's trusted governance is built on top of Decentralized Autonomous Organization Technology (DAO), which manages an organization in a decentralized manner, using codes to enforce rules and immutability to tamper with data via blockchain technology. Any issues within an organization that will require governance can be resolved via DAO, where qualified individuals vote to decide on the results.

The usage of DAO technology as governance is objective and as such, contradictions will not be resolved immediately. However, DAO reduces the cost to determine the result, eliminating the need for manual counting, monitoring, arbitration, and enforcement under normal circumstances.

Under circumstances where interests are conflicted, every party can vote based on their own decisions and differing interests. As such, EpiK's DAO governance model is designed to maximize the community of interest when allocating voting rights, ensuring that all parties have a say in governance.

In EpiK Protocol, two principles are upheld:

- Firstly, only the affected parties can participate in voting for the respective governance topic.
- Second, the weightage of voting power differs according to how heavily affected are the parties involved.

Based on this, EpiK Protocol divides the core participants into three groups (see Figure 5), namely the Global Group, the Storage Group and the Knowledge Group.

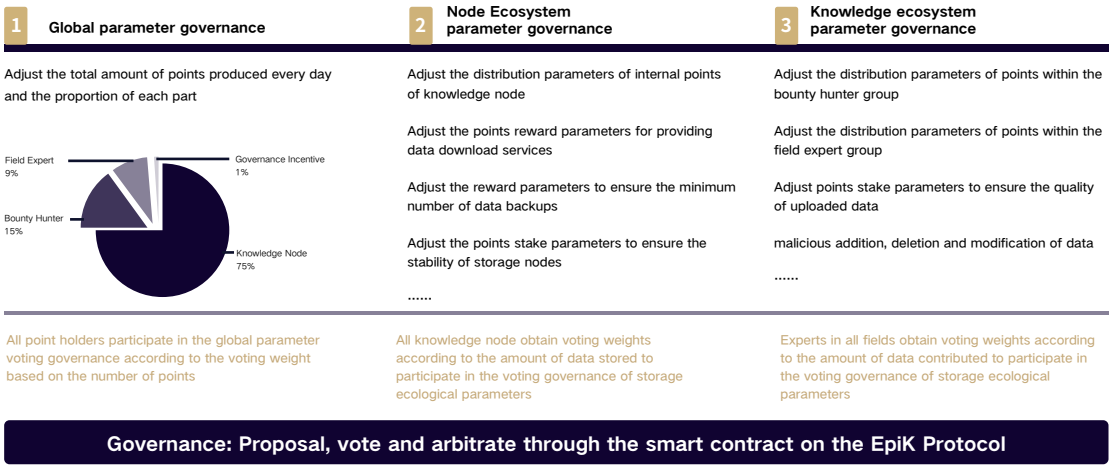

Fig.5 EpiK Trusted Governance Structure

The Global Group is responsible for the governance of global parameters, which are in place to uphold the interest of all EPK token holders. At different development stages, the degree of dependence of EpiK Protocol on each category of participant is different. Adapting to the dynamic changes based on market demand, the distribution of EPK to different participants needs to be dynamically adjusted as well. By locking up their EPK tokens, participants obtain the right to vote in the Global Group. Hence, the amount of EPK locked directly reflects the degree of binding between the participant and the Global Group's interest.

The Storage Group is responsible for the parameters governing the miners' interest. As EpiK's ecosystem grows, the amount of data stored, the size of backup, and download bandwidth requirements varies so that parameters must be adjusted accordingly. The more data the miner stores, the higher governance rights that miner has.

The Knowledge Group is responsible for the parameters governing the Domain Experts. As the population of Domain Experts and Bounty Hunters increases, reward allocations need to be adjusted according to the market's demand of different domains. Given that Domain Experts can be voted in by Bounty Hunters, only Domain Experts have governance rights and it is weighted according to the amount of data they have contributed after log transformation.

All proposals, voting and execution processes are carried out in the form of DAO, via smart contracts. For more detailed governance rules, refer to *EpiK Protocol Governance Whitepaper.*

2.4 Trusted Finance

EpiK Protocol's trusted financial capability is derived from Decentralized Financial Technology (DeFi). In the world of cryptocurrencies today, most users hold mainstream cryptos such as BTC/ETH. For these users to seamlessly participate in EpiK's decentralized knowledge graph ecosystem, a decentralized lending service will be made available (see Figure 6) on EpiK Protocol.

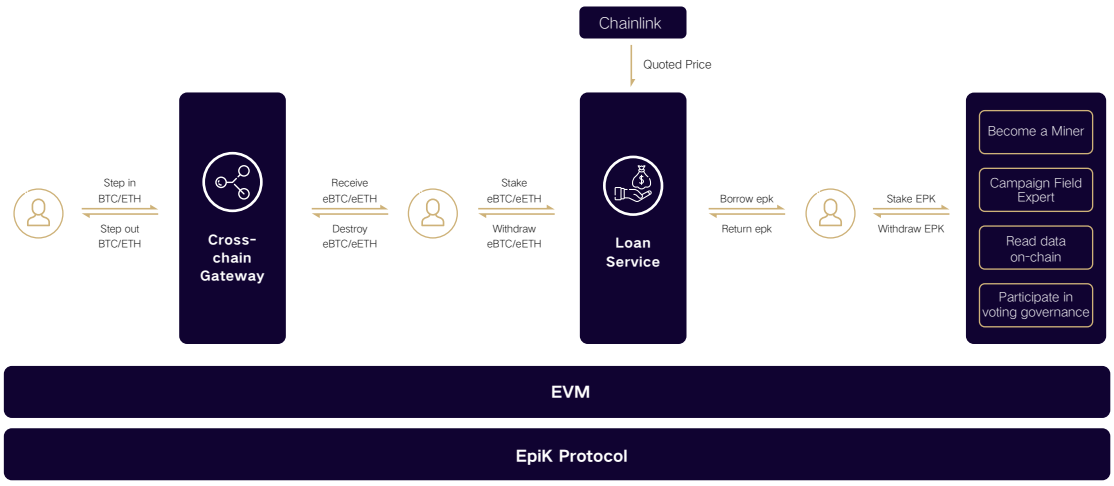

Fig.6 EpiK Trusted Financial Lending Service Flow Chart

The figure depicts a scenario where mainstream crypto holders enjoy dividends from participating in EpiK Protocol's decentralized knowledge graph ecosystem.

Firstly, the user converts BTC to eBTC through the cross-chain gateway on EpiK Protocol. Then, he/she shall stake eBTC to borrow EPK tokens through EpiK's lending service. With the received EPK tokens, he/she may consider the various routes to participate in EpiK's ecosystem:

- Mine EPK: Stake EPK to become a node; or

- Be a Domain Expert: Vote for yourself or others to become a Domain Expert to receive continuous EPK rewards; or
- Simply retrieve data: Stake EPK to download any required knowledge graph data.

When exiting the EpiK's ecosystem, unstake any staked EPKs, return them to EpiK's lending service and retrieve the previous staked eBTC and convert it back to BTC via the cross-chain gateway. The eBTC will be burnt upon return.

With the integration of Ethereum Virtual Machine (EVM), EpiK Protocol can not only support Compound[8]-like lending services, but also easily interact with other DeFi platforms such as Uniswap[9] and Hegic[10] , providing a smooth entry for any interested crypto holders to explore EpiK's decentralized knowledge graph ecosystem.

---

[8] Compound.finance. 2021. [online] Available at: <https://compound.finance/documents/Compound.White-pa-per.pdf> [Accessed 16 February 2021].

[9] Uniswap.org. 2021. [online] Available at: <https://uniswap.org/whitepaper.pdf> [Accessed 16 February 2021].

[10] GitHub. 2021. hegic/whitepaper. [online] Available at: <https://github.com/hegic/whitepaper/blob/master/Hegic%20Protocol%20Whitepaper.pdf> [Accessed 16 February 2021].

3. Technical Architecture

Figure 7 depicts EpiK Protocol's technical architecture to achieve the above mentioned four trusted capabilities.

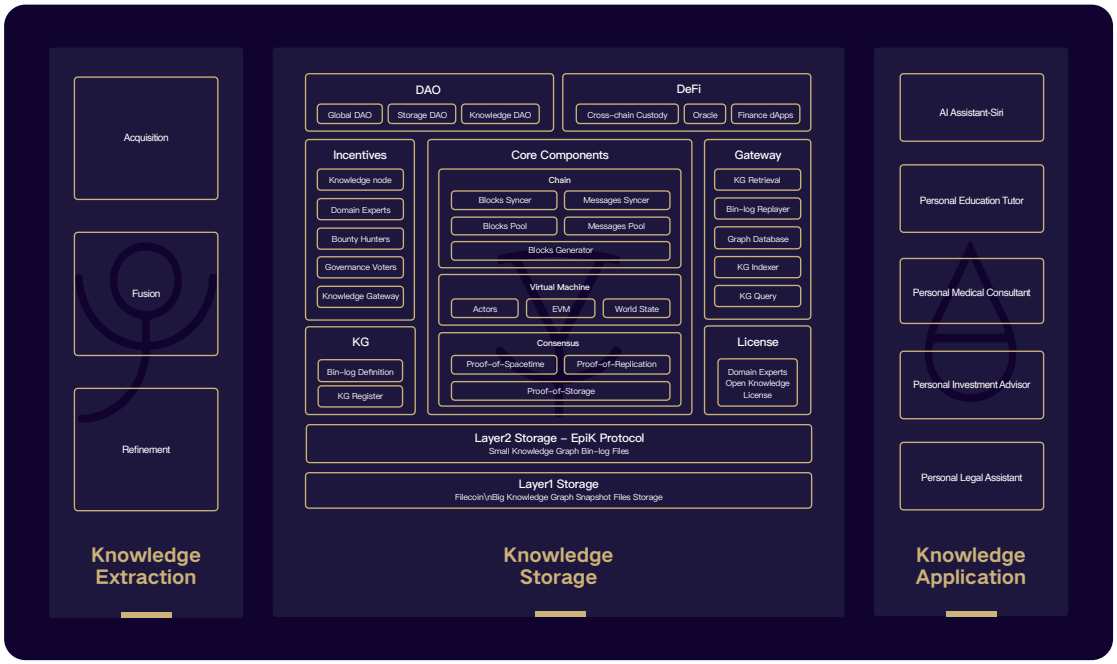

Fig. 7 EpiK Technical Architecture Diagram

3.1 Underlying Storage

The construction of knowledge graphs requires a large amount of micro-collaboration, hence, small bin-log files will be generated during the collaboration process and will be stored on the customized Filecoin Layer 2 Network. Anyone can accumulate these small bin-log files from various domains into large knowledge graph snapshot files at any time, and transfer the large snapshot files to the Filecoin Layer 1 network for permanent preservation and get incentives. Hence, Filecoin's Layer 1 Storage Network sits as the foundation of EpiK's technical architecture, and above it sits EpiK Protocol's customized Filecoin Layer 2 Storage Network.

3.2 Core Components

Structured on top of the underlying storages, EpiK Protocol's core components are made up of Consensus Mechanism, Virtual Machine and Ledger On-Chain.

Consensus Mechanism mainly follows the Proof-of-Storage, Proof-of-Replication and Proof-of-Space-time from Filecoin. However, EpiK Protocol chooses a unified 8M sector size (which is much smaller than Filecoin's 32G sector size) to handle the large number of small files in the EpiK Protocol. This creates an opportunity for a large number of low-level node machines which are unable to participate in storage FIL in Filecoin Layer 1 Network, as they can now turn to storage in EpiK Protocol, maximizing the node storage capabilities.

In addition to being compatible with Filecoin's Actor mechanism, EpiK Protocol is also compatible with the latest Ethereum Virtual Machine (EVM), thereby creating a linkway for smooth migration or integration of existing application resources in the Ethereum community, including DAO dApps (e.g., Aragon[11]) , Oracle[12] services (e.g. Chainlink[13]), and DeFi dApps (e.g. Compound).

3.3 Smart Contract

Based on Filecoin's Actor contract model, EpiK Protocol encodes on-chain incentive rules for each ecosystem participant (e.g., Domain Experts, Knowledge Node, Bounty Hunters, Voters and Knowledge Gateways).

Based on the EVM contract model, EpiK Protocol migrates the governance and financial services from the Ethereum ecosystem to the knowledge graph collaboration ecosystem.

During collaboration within EpiK Protocol, behaviors of each participant will be recorded in the event status. When a rule is triggered, it will be automatically enforced to reward or penalize the corresponding user accordingly, and the rule will meet consensus across the network quickly, locking the results, preventing any manipulation.

---

[11] GitHub. 2021. aragon/whitepaper. [online] Available at: <https://github.com/aragon/whitepaper> [Accessed 16 February 2021].

[12] BlockchainHub. 2021. Blockchain Oracles. [online] Available at: <https://blockchainhub.net/blockchain-oracles/> [Accessed 16 February 2021].

[13] Link.smartcontract.com. 2021. [online] Available at: <https://link.smartcontract.com/whitepaper> [Accessed 16 February 2021].

3.4 Knowledge Graph and Knowledge Gateway

The unit of the knowledge graph data in EpiK Protocol is bin-log files smaller than 8M, and each bin-log file contains a series of ordered operations. These operations include updates to the knowledge graph schema and n-tripple data of each domain. Only Domain Experts can upload bin-log files in their respective responsible domains, so each bin-log file carries traceable information, which in turn is inherited to every operation in the file and is further inherited to each n-triple data of the EpiK Protocol knowledge graph.

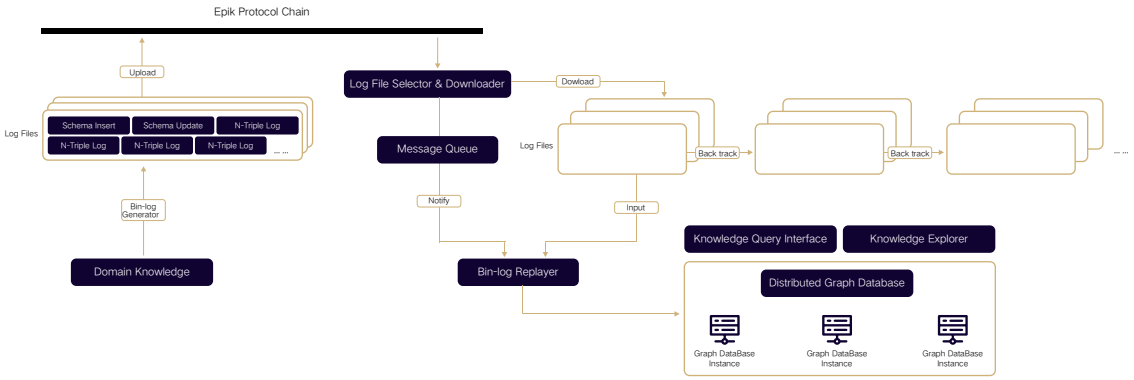

Fig. 8 Schematic Diagram of EPIK Knowledge Gateway Data Flow

A typical knowledge graph data flow is shown in Figure 8: Domain Experts use various bin-log conversion and generation tools provided by EpiK Protocol to convert knowledge graph data from various sources into formatted bin-log files, before uploading them to EpiK Protocol Network to increase the contribution of experts in this domain. The bin-log file will be backed up and saved by Knowledge Node around the world, and a CDN network will be formed spontaneously. When there is a need to read data, the demander can configure its own filters, such as which domain to read, etc., and start the configured knowledge gateway.

It will synchronize the on-chain data, download the filtered bin-log files and replay all operations in the files in order, and restore a graph database containing the required knowledge graph data locally. The demander can further perform queries based on the synchronized graph database, which contains the retrieved knowledge graph data.

3.5 Open-source License

EpiK Protocol is an advocate of the open-source knowledge movement. Anyone can become a domain expert in accordance with the rules, contributing to the knowledge graph data and gaining benefits. Users of EpiK Protocol can also stake EPK accordingly to access knowledge graph data in different domains. These actions do not require any centralized authority's permission.

EpiK Protocol believes that the open-source knowledge movement will once again profoundly improve the efficiency of collaboration between human and AI, AI and AI. Every domain expert has the right to define the open-source license in their domains. The license will be attached in the domain expert's application information and stored in EpiK Protocol permanently.

4. Ecosystem Construction

The ecosystem of EpiK Protocol consists mainly of the Storage Group and Knowledge Group. In terms of storage, EpiK Protocol focuses on idle smaller capacity node machines whose performances are inadequate to participate in storage FIL (Filecoin's native token). We collaborate with these mining partners to build EPK storage services, including node machine hosting, storage pools, cloud computing, cloud node machines and computing power tokens, etc., supplementing the Filecoin mining ecosystem.

In terms of knowledge, EpiK Protocol covers the whole process from the schema definition of knowledge graph data, to the extraction of knowledge graph data, and to the application of knowledge graph data. The knowledge graph data is predominantly demanded by experts from various domains of knowledge who have systematic knowledge structure, for example university professors with deep subject knowledge in the school, opinion leaders with rich information channels in the community, or talents, popular writers, etc. In addition to the community-voted Domain Experts, EpiK Protocol Foundation will regularly recruit Domain Experts to increase the diversity of the demand for knowledge graph, and to differentiate into more subdivisions.

The production of knowledge graph data will mainly be initiated by Domain Experts. EpiK Protocol will collaborate with various crowdsourcing platforms and professional annotation teams to help Domain Experts complete the distribution of manual tasks and cooperate with data annotation training institutions, expanding the number of Bounty Hunters available.

The application of EpiK's knowledge graph data will evolve from interesting applications to more useful applications as the dataset improves in quality and quantity. EpiK Protocol will also collaborate with various data analysis competition platforms, to seek more value of on-chain knowledge graph data.

5. Use Case Scenarios

On-chain knowledge graph is the first step in the cognitive intelligent application. Its efficiency in data processing and knowledge processing inference will upgrade existing AI products and provide more effective solutions, potentially even as new forms of commercial products. According to the *Knowledge Graph Industry Whitepaper for New Infrastructure of Artificial Intelligence* jointly released by the Cognitive Intelligence Laboratory and iResearch Institute at the end of 2020, it is expected that the scale of economic growth driven in China by knowledge graphs will exceed 15 billion dollars. Adopted from the above-mentioned *Knowledge Graph Industry Whitepaper*, here are some potential use case scenarios of knowledge graphs:

5.1 Knowledge Graph for Healthcare

Healthcare is an industry flooded with massive data and heterogeneous sources and limited to data with strong professionalism and complex structure, which makes it a challenge for data fusion. Facing such tremendous amount of medical data, KGs play a pivotal role in healthcare industry for both patients and medical practitioners. In recent years, there has emerged a tremendous amount of medical smart applications, which is aroused by digitalization of medical resources, expansion of biomedical knowledge and proliferation of historical data. Therefore, an efficient KG integrating and delivering method is imperative, which serves to ease the shortage problem of medical resources. Applications mostly seen are:

・Smart Medical Guidance services for patients, accurately matching symptoms with the departments and doctors, so that it improves patient experience and ensures balanced allocation of medical resources.

・Intelligent Medical Auxiliary Diagnosis for doctors, which integrates medical information and historical data, thus are able to optimize treatment plan and save costs.

・Question Answering System(QA) assists in market expansion for pharmaceutical corporates, which answers frequently-asked questions and gather data to refine user portraits, making it possible to reallocate labor resources and increase customer conversion rate.

5.2 Knowledge Graph for Education

The combination of knowledge graph and machine learning algorithm realizes Intelligent Adaptive Learning, supporting upper-level intelligent application. KGs tap the potential of educational field data by constructing knowledge systems based on modularized curriculum, managing teaching resourcing and tracking individual learner's pace, which delivers a visualization of the interaction between educator and learner, interlinking static learning process data and dynamic data in pedagogical scenarios. A Digital middle platform based on knowledge graph, integrating educational resources, thus creates a closed loop of value for adaptive learning under the guidance of data. Applications mostly seen are:

・Ontology Models extracted from modules, enabling knowledge network to perform relational query.

・Customize learning pathway for individual learners, developing intelligent adaptive learning system.

・Continuous, real-time, actionable data that furnishes examination feedback embedded with student progress, envisaged a personal knowledge graph for exercise push and effective tutor.

・Fragmented multi-source heterogeneous data processing, semantically organizing teaching resource in graph structure for balanced call, to construct standardized linked dataset for machine learning algorithm training.

5.3 Knowledge Graph for City Governance

KGs aggregate isolated data scattered in various government departments and various fields of production and life to realize the exchange of multi-source data, so as to conduct in-depth storage of governmental affairs data and social data. There are needs for huge stock governance and refined development in modern cities. As the data sources of urban public management expand from governmental data to traffic, video, environment, other urban operational perception data and corporate data, KGs facilitate public security by delivering intelligent applications. Applications mostly seen are:

・Smart urban utilization applications such as risk alert, holographic archives, data retrieval, funnel analysis, comparative judgement, group portraits and self-service reports to empower the city's Intelligent Public Management System.

・Data asset management platform including metadata unified view, data quality control and traceability, knowledge fusion via extracting entity, time, relationship and attributes, constructing knowledge base that understands the needs of different parties.

・Through multi-tenant technology and data security technology, constructing Smart Emergency System, Smart Regulatory System and Medical Brain via Distributed Computing and Decentralized Storage, which maximizes the efficacy of data factors, before obtaining the precise supply of government services, scientific governmental decision-making and efficient social governance.

5.4 Knowledge Graph for Public Security

KG technology plays an important role in solving the problems of data correlation and data value storage, empowering Intelligent Clue Analysis and Case Early Warning. With the advent of cross-departmental collaboration and integration, the knowledge graph extracts entities such as people, things, places, institutions, and virtual identities through data analysis, text semantic analysis, and other methods. Attributes, time and space, semantics, characteristics, location connections, etc. are interconnected to build a multi-dimensional, multi-layered network of relationships between entities and entities, entities and events. KGs promote the evolution of public security intelligence research and judgment, efficiently assists the public security's prevention and control, thereby achieve accurate crime prediction and early warning in the future, which unlocks the true value of big data. Applications mostly seen are:

· Distributed Storage, Association Analysis, and Semantic Reference are applied on knowledge extraction, ontology layer construction and combat application development.

· Summarize and Visualize the expertise accumulated in the public security department, the KGs convert them with technical algorithms to integrate crime and prediction models, which realizes key personnel location correlation analysis, material correlation analysis, gang relationship analysis, abnormal event storage, similar case inference etc.

5.5 Knowledge Graph for General Manufacturing

The general manufacturing industry has the characteristics of large dataset and complex knowledge structure, and tremendous event knowledge and quantitative knowledge also exist. The KG technology classifies and models basic manufacturing data to realize multi-faceted coordination of the entire manufacturing process. By knowledge classification and modeling of the basic data such as factory workshops, labor resources, material components, equipment fixtures, process flow, faults, etc., It integrates quantitative knowledge and event knowledge through knowledge extraction, mining the complex relationships between entities, thereby builds a manufacturing knowledge service platform. Through KGs, a Full Life Cycle is established between product planning, design, production, trial production, mass production, implementation, service, marketing, and enterprise management. Applications mostly seen are:

· Research trends of benchmarking products for R&D department, providing decision-making support for new product market positioning.

· Dynamically manage productional floor knowledge for manufacturing, providing real-time, on-site guidance for production users.

· Structural management of senior technicians experience, providing diversified search methods for users, to improve worker proficiency and reduce maintenance costs.

・It integrates the knowledge content of environment, incineration, water supplies, molds, energy management and other related industries, thus better manages the internal connections of the manufacturing system through rapid query and relational inference of trends, anomalies and commonalities, further transforms knowledge into decision-making.

5.6 Knowledge Graph for Smart Construction

Knowledge graphs for the construction engineering industry are built on BIM data and specifications._ As a three-dimensional model carrier with rich semantic information, BIM is the digital expression of_ the physical building. The construction industry is a labor-intensive industry with dynamic and complex industry structure. KG technology brings innovation as to coordinate the entire process in various aspects, thus enhance resource management capabilities, production efficiency and product quality. Applications mostly seen are:

・KGs classify and aggregate BIM into several knowledge ontologies, which integrates with Knowledge Extraction, Knowledge Fusion and Knowledge Processing, realizing the reuse and organized management of the knowledge from drawing design, drawing review, construction, inspection, to the whole process of building operation and maintenance, aligned with different project types, stages and goals.

・The smart construction is embraced by assembling information into a knowledge graph for the construction engineering industry based on BIM data and specifications, improving the specifications and efficiency of the BIM drawing review at the design stage, thus assists quality management and decision-making at the construction stage, and finally enhances data flow and analysis capabilities at the operation and maintenance stage.

5.7 Knowledge Graph for Intelligent Risk Control

The combination of knowledge graph and machine learning reshapes the intelligent risk control process in the financial sector. As the explosive growth of financial data in recent years, traditional risk control systems are found inadequate, while Intelligent Risk Control System based on algorithms and knowledge graphs builds Risk Control System that better satisfies financial industry. It builds ontology models and extracts entity on authoritative experience and rules in a real-time manner,- which dynamically depicts comprehensive user portraits. The introduction of KG engages in a knowl- edge platform generated from thousands of heterogeneous financial data, tapping the underlying value of the data to support upper-level applications (e.g., the construction of annotation system, the summarization of investment relationship, industrial chain risk warning, and intelligent fee collection). Application mostly seen are:

・Anti-Fraud Application that provides inconsistency inspection based on the knowledge graph, integrating known fraud elements and customer risk feature information database.

・Internal Audit and Control Application, data storage on the supervised personnel's account to prevent internal and external collusion and other violations.

・Anti-Money Laundering Applications and Potential Risk Prediction for Industry and Customer.

5.8 Knowledge Graph for Smart Investment Advisor

Data collection and integration in the financial sector is a pain point in the investment research field. Traditional investment research analysts need to collect information through multiple channels, integrate and model scattered data on personal experience, which consumes a lot of time and labor. Given that financial data has the characteristics of extremely high timeliness, and the high turnover rate of the industry, the consistency of the report is hard to be guaranteed. As a result, The KG products solves the needs of various sources by greatly reducing the costs of data collection and thus improves the efficiency of investment research. Applications mostly seen are:

・The KG technology integrates NLP technology to automatically capture key information, including structured non-real-time data: Wind, industrial and commercial data, industry chain data; unstructured non-real-time data: corporate announcements, financial reports; structured real-time data: stock commodities quotes; and unstructured real-time data: financial news, social media.

・KGs abstract the development and changes of various industries into the digital level, providing underlying infrastructure for knowledge query and application development.

・In addition to the static domain graph, KGs also build an event graph based on time series analysis to capture network reports and news events.

・The two combined derives the development context and trend of events from the inherent logic of the industry and real-time information, sorting out the context and providing data support for subsequent research and judgment applications, thereby undercovers more investment opportunities.

6. Roadmap

- **2020.Q3 -** Release Testnet "Obelisk"

With the launch of testnet “Obelisk”, the pre-storage plan of the testnet will be activated as well. Simultaneously, the Economic Whitepaper will be released, together with the recruitment of EpiK's first batch of Domain Experts.

- **2021.Q1 -** Release Mainnet v1.0 "Rosetta"

Mainnet v1.0 "Rosetta", EpiK Protocol, alongside the first official knowledge crowdsourcing product – Knowledge Mainland v1.0 will be launched. Governance Whitepaper will be also published and EpiK Protocol will work on an open source, customized high-performance and scalable knowledge gateway development framework.

- **2021.Q3 -** Mainnet v2.0 "Hammurabi" released

With the launch of the mainnet v2.0 "Hammurabi", EpiK Protocol will integrate the Ethereum Virtual Machine, and release the decentralized governance platform - Knowledge Congress v1.0. During this period, the knowledge crowdsourcing products and knowledge gateway framework will also release their new versions.

- **2021.Q4**

EpiK Protocol will release a decentralized financial application center-Knowledge Bank v1.0, including cross-chain services, oracle services and lending services. Expect new versions of knowledge crowdsourcing products as well.

- **2022 – 2072**

After completing the infrastructure construction, EpiK Protocol Foundation will continue to recruit domain experts for the ecosystem, cultivate bounty hunters, expand the application of the knowledge graph, and expand the scale and quality of the on-chain knowledge graph for the next 50 years.

7. Epilogue

If you intend to promote the open-source knowledge movement with EpiK Protocol and translate human knowledge into a knowledge graph to broaden AI's horizon, please do not hesitate to enter EpiK Protocol official website epik-protocol.io and contact EpiK Protocol Foundation.

It is an epic sermon from carbon-based life to silicon-based life that will last at least 50 years

It is undeniable that the sermon will come sooner or later

The sermon, good or bad, is destined to be extraordinary