

THE BLUE BOOK ON THE INNOVATIVE BLOCKCHAIN APPLICATIONS IN THE FIELD OF GOVERNMENT SERVICES IN BEIJING

(1st Edition)

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Preface

In the 18th group study of the Political Bureau of the CPC Central Committee, General Secretary Xi Jinping stressed that blockchain should be positioned as an important breakthrough for the independent innovation of core technologies and the development of blockchain technology and industrial innovation should be accelerated. In the meantime, he urged for the exploration of blockchain data sharing models to achieve joint maintenance and utilization of government data across departments and regions, promoting synergy in government services, and deepening the reform of "one-stop service" to provide better government service experiences to the people. The National Development and Reform Commission has clearly incorporated blockchain into the construction of new infrastructure and confirmed the important status and role of blockchain as a new technological infrastructure. A special blockchain workgroup has been set up in Beijing to promote the innovative development of blockchain technology comprehensively, covering aspects from breakthroughs of technology, demonstrations of applications, industrial and talent cultivation, etc.

Globally, the underlying core technology of blockchain 3.0, the technological foundation of the "programmable society," is not yet mature and we should work towards innovation and breakthroughs regarding the technology. There are many opportunities in the innovation and development of blockchain technology ecosystem, markets for application, and industry patterns. We need to seize the key and major opportunities while adhering to principles of independent innovation and application orientation. By focusing on addressing key and core technologies, conducting research and development on the independently

controllable underlying engine of blockchain, building an independently controllable blockchain technology ecosystem, exploring innovative application scenarios of blockchain, promoting the development of blockchain industries, probing the innovation of the blockchain application scenarios and the digital economy mode, and promoting the integration of blockchain technology and industrial innovation, we can lay a solid foundation to embrace the arrival of the "programmable society."

Due to the inherent trust mechanism of this technology, blockchain will become the cornerstone of the digital economy and digital society. As the "trustworthy" information infrastructure in the "new infrastructure," blockchain will play a key role in the new generation of integrated information technology and promote the development of the "programmable society." Government services will take the form of "programmable government services" based on blockchain in the blockchain 3.0 era, which is also an important part of the "programmable society." "Programmable government services" can promote and cultivate the infrastructure construction of blockchain and accelerate the construction of a digital government.

In terms of government data governance and government service collaborative applications, China has been making great efforts to promote the integration and sharing of government information systems for several years. These efforts provide support to certain effective government service collaborative applications, tackling the issue of scattered and segmented government data. However, most of the existing big data systems and applications focus on the process of data processing, ignoring the definition and clarity of the responsibility, rights, and interests in the process of data sharing. Therefore, it is difficult to ensure the real-

time synchronicity and consistency of data, and fundamental problems in sharing data and reaching synergy remain unsolved. The “programmable government services, ” based on blockchain 3.0 provides a new solution that is helpful to truly solve the problem of “data islands” and “value islands” to promote the joint maintenance and utilization of government data across departments and regions and support the collaborative application of government service businesses based on blockchain.

Since November 2019, the Beijing Municipal Bureau of Government Services, the Beijing Municipal Science & Technology Commission, and the Beijing Municipal Bureau of Economy and Information Technology have taken the lead in promoting the action plan for the application of blockchain in the field of government services. This has been identified as an important part of the overall layout of blockchain in Beijing. With the whole-process follow-up and in-depth participation of the integrated expert team formed by universities, research institutes, and leading enterprises in the industry, government departments which are responsible to take the lead in developing blockchain application scenarios, such as the Beijing Municipal Commission of Planning and Natural Resources, the Beijing Municipal Bureau of Commerce, the Beijing Local Finance Supervision and Administration, the Beijing Municipal Finance Bureau, and the four pilot districts of Haidian, Xicheng, Chaoyang, and Shunyi are working overtime to speed up the application of blockchain in government services. With 140 application scenarios implemented, preliminary results have been achieved in promoting data sharing and government services collaboration. Contributions in epidemic prevention and control as well as the resumption of work and production have been recognized.

Beijing holds itself “to be the most excellent,” and gathers the

technological research and development strength of China's first-class universities, research institutes, and enterprises to take the lead in exploring innovative applications, applications to generate value, and practical applications based on blockchain technology. Beijing continues to optimize the business environment, enhances experiences in receiving government services, and promotes the modernization of the capital's governance system and capabilities, aiming to achieve innovative blockchain applications in the field of government services to set a model for the whole country. Meanwhile, as a fast-growing emerging technology, the underlying foundation and upper applications of blockchain technology are still in the early stages of development, requiring constant thinking and exploring on the role, value, and application mode of blockchain technology in the field of government service, which is still in the early stages of the spiral development of "cognition-exploration-feedback-promotion."

There is no mountain too high to begin climbing. Under the unified planning and deployment of blockchain innovation and development in the whole city, and in the spirit of innovation and iterative optimization, the Beijing Municipal Administration of Government Services and other departments will continue to explore the implementation of blockchain in the field of government services. The Blue Book is not only the review and summary of the first phase of blockchain application innovation in the field of government service in Beijing, but also the summary and essence of the reflection and exploration of expert groups, relevant departments, pilot units, and industrial enterprises. We hope that the Blue Book will provide a reference to similar departments in providing government services. We are also looking forward to furthering communication with counterparts and

explore together how to make use of the new generation of information technologies, including blockchain, to provide a novel, fast, and solid support to ensure all government services can be “conducted online through one-stop services.”

Chapter 1. Blockchain is a “New Infrastructure” that will Advance the Modernization of China’s System and Capacity for Governance.

1. The achievements and bottlenecks of digital government construction in China

Digital government is an important part of the modernization of China’s system and capacity for governance. The Fourth Plenary Session of the 19th CPC Central Committee made it clear to “establish and improve institutions and rules governing the use of the Internet, big data, artificial intelligence and other technologies in administrative management, promote the construction of a digital government and strengthen the orderly sharing of data.” On March 31, 2020 when General Secretary Xi Jinping visited the City Brain, a smart city platform aiming to improve urban management in Hangzhou city, he highlighted that “harnessing cutting-edge technologies such as big data, cloud computing, blockchain, and artificial intelligence to innovate the methods, models and philosophies of urban management to make cities smarter with the construct of a digital, intelligent and smart government, is the only way to advance modernization of China’s system and capacity for governance.”

On the one hand, large scale construction and application have been carried out in the field of digital government in China for years, which has gone through several stages of innovation and popularization in accordance with the development of digital, network and smart technologies. In recent years, remarkable achievements have been made in the Internet Plus Government Services initiative and in government data

sharing. The practice has improved the efficiency of government staff and has been welcomed by the people in cities such as Beijing.

On the other hand, large-scale data sharing and collaborative handling of government service applications are also confronted with new challenges in real practices. First of all, the decentralized construction model adopted in China’s government services system has resulted in the data segmentation and isolated data islands. These problems have hindered the further optimization of the service application handling process. The concept and technology of blockchain can provide new technical tools, collaborative platforms and infrastructures for governments at all levels, including the Central Government, the People’s Government of Beijing Municipality and the governments at the district level of Beijing city, to promote data sharing across different government levels, departments and regions.

Secondly, data is the basic object of information technology processing and issues such as property rights confirmation, traceability, audit and credibility of data cannot be fundamentally solved by the above-mentioned large-scale IT applications. The underlying core technology of blockchain can help to establish the mechanism of data credibility, realizing the property rights confirmation, non-tampering and traceability of trusted data, which requires the further integration of the new generation of information technologies, including blockchain technology, in order to make new innovations and breakthroughs in technical systems and applications.

Last but not least, as the information concerning the status, certificates and licenses of various entities in the field of government services change very frequently, it is very important to keep this

information in real-time and accurate to ensure the effectiveness of the service application handling. Therefore, the use of blockchain technology to enable relevant parties to timely obtain and verify information can bring government service experience to a new level.

2. Blockchain 3.0: Building up the trusted infrastructures for digital government

“Programmable society” is a key feature of Blockchain 3.0. The “programmable society” takes smart contract as a bridge between the real world and the digital world, and leverages blockchain as the underlying trusted infrastructure to empower each industry. “Blockchain Plus” will bring huge changes and opportunities in the development of the digital economy. Digital government and the Internet Plus Government Services initiative are the main application scenarios of the programmable society based on blockchain 3.0, which will present the applications form of “programmable government” and usher the construction of digital government into a new stage. Based on the trusted infrastructures of Blockchain 3.0, “programmable government” reconstructs the network and data architecture and integrates them into an innovative blockchain platform with a trusted mechanism, which supports and improves the ever-growing number of innovative government service application scenarios.

(1) From digital assets to trusted infrastructures—the origin and development trend of blockchain

The blockchain technology originated in a groundbreaking paper called “Bitcoin: A Peer-to-peer Electronic Cash System” published in 2008 by a scholar known by the pseudonym Satoshi Nakamoto. After more than ten years of development, blockchain technology has been applied

in many scenarios. According to the differences in technical features and applications, the development of blockchain can be roughly divided into three stages: Blockchain 1.0, Blockchain 2.0 and Blockchain 3.0.

The Blockchain 1.0 era is represented by digital assets such as Bitcoin, aiming to realize the payments, circulation and other functions of digital assets. The Blockchain 2.0 era is a “programmable finance” era featuring smart contract applications represented by “Ethereum”. It is mainly used in the financial field to solve problems such as digital asset exchange and transfer and inter-bank transactions without the intervention of a third party. The Blockchain 3.0 era refers to the era of a “programmable society” that provides blockchain solutions for various industries. As a trusted infrastructure in the future, blockchain technology will extend its application to various industries besides the financial industry. A variety of complex business logic can be supported by the efficient collaboration among trusted mechanisms with blockchain as the underlying technology, which provides promising prospects to optimize government services and promote the construction of digital government.

(2) Developing “programmable government services” and pushing the construction of digital government into a new stage

In the 18th group study of the Political Bureau of the CPC Central Committee, General Secretary Xi Jinping stressed that the blockchain data sharing model should be explored to realize the joint maintenance and utilization of government data across departments and regions, promote the collaborative handling of service application of the people, deepen the reform of “one-stop services” and bring better government service to the people.

To implement the important instructions of General Secretary Xi

and to meet the deployment requirements of the Beijing Municipal Party Committee and the People's Government of Beijing Municipality on accelerating the blockchain technology and industrial innovation development, Beijing Municipal Administration of Government Services, Beijing Municipal Science & Technology Commission and Beijing Municipal Bureau of Economy and Information Technology jointly issued The Action Plan 2020 of Beijing Municipality on Blockchain Applications in the Field of Government Services in February, 2020. In March 2020, the Standing Committee of the Beijing Municipal People's Congress deliberated and adopted The Regulations of Beijing Municipality on Optimizing the Business Environment (hereafter referred to as "the Regulation"). Article 2 of the General Provisions of the Regulation clearly states "to build a data sharing and collaborative service application handling system based on the new generation of information technologies such as blockchain". In Article 17 of the Regulation, it is proposed to "establish an electronic Know Your Client (eKYC) based on blockchain to reduce the number of materials that enterprises need to provide". Article 28 proposes that "the government and relevant departments shall unify government service standards and make innovations on government service modes, promote the applications of blockchain, artificial intelligence, big data, Internet of Things and other new-generation information technologies in the field of government services, continuously improve the quality and quantity of government services, and provide standardized, convenient and efficient government services for market entities." Article 35 proposes that "electronic data generated in the applications of blockchain technology can be used as the basis and archived materials for the handling of government service application." Article 44 proposes that "blockchain technology shall be

used to promote the implementation of value-added tax electronic special invoices and other electronic bills”. It is manifested that the Regulation has provided the basis for promoting the applications of blockchain in the field of government services, and clarified the validity of electronic data, invoices and other electronic bills and the eKYC information generated in the applications of blockchain technology.

In order to push forward the process of optimizing the business environment and improving government service experience, Beijing has made full efforts to develop the “Internet Plus Government Services” technology focusing on blockchain, and speed up the construction and realization of “programmable government services”. “Programmable government services”, based on the trusted infrastructures with blockchain as the underlying core technology, and the comprehensive utilization of the new generation of information technology such as blockchain, big data, artificial intelligence and cloud computing, takes the form of applications facilitating government services and tasks by sharing government data in the phase of “programmable society”, which is based on blockchain 3.0. Based on the features of blockchain technology, such as distributed storage, transparency and credibility, tamper proofing, and traceability, “programmable government services” adopts consensus mechanism, distributed ledger technology (DLT) and smart contract to ensure the openness and transparency of government services, realize the reliable source tracing of government data sharing, optimize government services coordination and services processes, and improve the efficiency of government services, and usher the construction of digital government into a new stage.

(3) Building trusted infrastructures for digital government and

promoting the applications of “programmable government”

“Programmable government” is based on various information technologies including blockchain, big data, and artificial intelligence. It is an important application form in the blockchain 3.0 era and one of the goals of the new phase for the construction of digital government. The construction of “programmable government” can be unfolded into following three aspects:

First of all, trusted blockchain infrastructures for digital governments should be built. Blockchain is the foundation of trust for programmable government services and is the underlying trust mechanism for the future trusted Internet. The construction of blockchain trusted infrastructures and common underlying blockchain platform should be accelerated to avoid the isolation and dispersion among blockchain systems which may result in “isolated data islands” and “isolated value islands”. Adhering to the principle of independent innovation and industry leading, Beijing will take the lead in realizing the applications of blockchain in the field of government services, and promote the development of blockchain industry to drive the construction of blockchain infrastructures across the country.

Secondly, trust-based data sharing and exchange will be realized. Beijing will optimize the process of data sharing and exchange and the handling procedures of service application based on the basic trusted blockchain infrastructures, clarify the responsibilities, rights and interests of data sharing, build the big data services network and value network, and achieve the authenticity, credibility, real-time circulation, clear authorization and traceability of shared data, so as to promote the joint maintenance and utilization of government data across

departments and regions.

Thirdly, the collaborative service application handling based on blockchain should be deepened to promote the integration and innovation of the data scattered in government services and production services. The applications of blockchain government services have achieved preliminary results in Beijing. It is important to continue to promote the applications as planned to improve the basic general applications based on blockchain. Pilot projects will be further developed both in quantity and quality, to implement specific applications in different fields to optimize the process of service application handling and improve overall government service experience. In the meantime, the integration of big data in industry and government affairs should be promoted to enhance the connection and synergy between economic information and social information.

3.Promoting the innovative blockchain applications in the field of government services from the perspective of “New Infrastructure”

Blockchain is defined as the new technology infrastructure in the “New Infrastructure”, with both its function and significance to “connect” highlighted. On the one hand, blockchain connects existing proprietary networks and serves the information interconnectivity of proprietary networks of government, finance and manufacturing industry. On the other hand, blockchain can be integrated with cloud computing technology to serve the information exchange and value transfer between original diversified cloud networks and application platforms.

Based on a variety of technologies, such as distributed ledger technology underpinned by peer-to-peer communication, consensus mechanism, asymmetric encryption algorithm, and smart contract,

blockchain can build a strong foundation of trust for all parties involved and provide technical support for trusted data interaction among all parties on the chain. The introduction of blockchain technology in the government informatization reform can realize the authorized sharing of government data and the collaboration in service application handling, so as to consolidate the foundation of smart government construction.

Infrastructure construction based on the above technologies is required to solve the data credibility issue completely in the process of the construction of digital government and the “Internet Plus Government Services”, and to build a new generation of an applications-oriented integrated information system. Critical information infrastructure refers to facilities that are closely related to national security, society, economy and public interests. Given the current global and domestic technological eco-system in economic industry, the trusted infrastructure based on the blockchain 3.0 should be treated as a critical information technology infrastructure and an important part of the “New Infrastructure”. Therefore, the government is responsible for directing and planning the overall construction to provide support for innovative applications and practices as a whole on top of the trusted information infrastructures based on blockchain.

4. Feasibility and significance of the innovative blockchain applications in the field of government services in Beijing

Beijing is the center for politics, culture, international exchange, science and technology in China. Besides, Beijing is also leading digital government construction and the “Internet Plus Government Services” practice of China. In terms of policy environment, the Beijing Municipal

Party Committee and the People’s Government of Beijing Municipality have implemented a series of important national policies on promoting the innovative development of blockchain and other new-generation information technologies, and have formulated an action plan on the applications of blockchain in the field of government services. Meanwhile, Beijing enjoys the first-class research and development strength and the industrial foundation in China, with a large number of leading institutions of higher education, technology enterprises, and a batch of academicians, professors and top-notch technical professionals. Beijing has also pioneered in the practice of data sharing and applications scenarios of government affairs data. A series of Internet companies with leading technologies, such as JD.COM and Baidu, have made endeavors in independent innovations and applications of blockchain, and have achieved remarkable results.

Blockchain technology has been closely integrated with digital government construction, and data sharing mode and government services collaboration mode based on blockchain have been explored in an active manner in Beijing. Beijing will be built as the vanguard to promote the modernization of China’s system and capacity for governance, providing a model for the practice of digital governance and offer reference on the establishment of government services blockchain applications to other provinces and cities throughout the country, as well as countries and regions along the Belt and Road Initiative.

Chapter 2. The Blueprint of Beijing Municipality for the Innovative Blockchain Applications in the Field of Government Services

Blockchain technology can lay a real foundation of trust featuring non-repudiation, and provide a complete set of governance framework for digital government services, offer a new perspective and technical approach to solve problems in the field of technology, mechanisms, procedures and implementation concerning “Internet Plus Government Services”, and contribute significantly to the continuous optimization of the business environment as well as the improvement of government services experience.

The significance of blockchain in the field of government services is mainly reflected in three aspects. Firstly, it facilitates data circulation and gives play to the value of data as a factor of production. Secondly, it promotes the collaborative service application handling, and deepens the reform of “one-stop services”. Thirdly, it increases government transparency, improves the governance capacity of the digital government, and enhances the credibility and executive ability of the government.

1. To break new ground for practice with unified thoughts and strategic planning

The application scenario of blockchain in the field of government services boasts its unique advantage, that is, unified planning and deployment from top to bottom. The overall planning and the top-level design of blockchain architecture in government services in Beijing

covers the following five aspects: 1) to build a set of unified technical and application standards of blockchain across the city; 2) to build the capacity on the circulation, openness and sharing of data based on the needs of government services provision; 3) to build the capacity on the collaborative handling of government services application cross different departments and regions; 4) to construct a blockchain-based governance architecture for the digital government with the aim to create a better government service experience; 5) to promote the formulation of relevant laws and regulations simultaneously, and ensure the orderly and compliant construction of blockchain.

In 2020, Beijing rolled out a series of policies, including The Opinions on Accelerating the Cultivation and Expansion of New Business Forms and Models to Promote High-quality Economic Development in Beijing, The Action Plan on Innovative Development of Blockchain in Beijing (2020-2022), and The Action Plan on the Applications of Blockchain in the Field of Government Services in Beijing (2020). These policies have been bundled into a package, providing a strong overall planning and top-level design for the innovative development of blockchain and the improvement of government service experience. On the basis of overall planning and top-level design, we will break new ground to promote the application of blockchain in the field of government services, which are driven by new application scenarios of government services.

2. To promote the construction of application scenarios continuously driven by demands

The Beijing Municipal Administration of Government Services, Beijing Municipal Science & Technology Commission and Beijing Municipal Bureau

of Economy and Information Technology jointly issued The Action Plan on the Applications of Blockchain in the Field of Government Services in Beijing in early 2020(hereafter referred to as the “Action Plan”). The Action Plan serves as the overall planning of blockchain application in government services scenarios to guide the continuous expansion of application scale and facilitate the implementation of demonstrative applications. In accordance with the deployment made in the Action Plan, relative departments, commissions and bureaus of the People’s Government of Beijing Municipality have launched the projects to pilot the applications of blockchain technology in the field of government services.

The initial application of blockchain in the field of government services have provided insights that the technical features of blockchain technology, such as transparency, non-tampering, and traceability, can meet the requirement of the development of “Internet Plus Government Services” in the long run. In the future, Beijing need to plan the application and promotion of blockchain in the field of government services from the aspects of standardization, interconnectivity and security. Relative departments, commissions and bureaus of the People’s Government of Beijing Municipality have fully opened the scenarios and data to promote the integration of government service data and economic information data. Additionally, the experience gained in the construction of the existing scenarios will guide the continuous optimization and improvement of new scenarios based on the ever-growing demand for government services. Once an application scenario comes to its maturity, the scale of application will be expanded, the users of each link will be encouraged to conduct the application thoroughly, and the application will be deepened or replicated in other cities and provinces. Since the construction and promotion will be

conducted as planned in an orderly way, the risk of repetitive construction and of generating new isolated information islands can be avoided. The influence of the “Beijing Plan” will be formed with synergized effort from multiple parties, and the achievements of big data construction in the field of government services over the past few decades will empower enterprises, and thus generate a driving force of economic growth.

3. To set unified standards and norms for government services

Policies have been introduced in Beijing to support the development of the blockchain industry. Adhering to the principle of being oriented by the market, being guided by the government, systematic planning and overall layout, Beijing is moving forward with the development of the blockchain industry, and fostering an integrated industrial ecosystem on blockchain featuring the collaboration among governments, enterprises, universities, research institutes, and end-users, thus laying a solid foundation for the application of blockchain in the field of government services. However, there are also a series of problems in the process of integration between applications of blockchain and government services. First of all, the blockchain industry is still in its early stage of development and is in want of a unified and effective decision-making basis and supervision mechanism that can guide the sound development of the industry. Secondly, there are differences among enterprises in their technology and R&D capability, which calls for a set of fair, authoritative and standardized evaluation, identification methods and selection guidelines. Thirdly, the capacity of risk-based regulation and security guarantee needs to be strengthened with the formation of a comprehensive governance system concerning blockchain. Last but not least, it is difficult to achieve the

interconnectivity among different blockchain systems. A lack of a set of cross-chain standard systems with industry consensus has hindered the development and application of blockchain technology.

In order to promote the applications of blockchain in the field of government services in Beijing, The Technical Specification of the Blockchain Platform for Government Services in Beijing (Draft)(hereafter referred as the “Technical Specification”) has been formulated under the guidance of the Beijing Blockchain Workgroup. The Technical Specification revolves around five principles (namely, ensuring compliance in industry supervision, developing forward-looking standards, guaranteeing interconnectivity, remaining secure and controllable, and pursuing independent innovation) and two requirements (namely, the basic requirement for the quality of blockchain platform and the requirement for the scalability of blockchain platform), with the aim to guide the sound development of the blockchain industry in Beijing. The Technical Specification provides a basis for decision-making and supervision for the government, a guidance on innovation of application for blockchain service providers and ideas of construction and development for parties in the blockchain industry respectively, so as to promote the collaboration among the parties in the blockchain ecosystem.

4. To open source to jointly build the underlying blockchain platform in the field of government services

It is necessary to build an independent and controllable blockchain platform to support the construction of the blockchain application in the field of government services in Beijing and to guarantee the compliance of applications and data security of blockchain in the field of

government services.

It is clearly stipulated in The Action Plan on Innovative Development of Blockchain in Beijing (2020-2022) that building the underlying open-source technology platform and ecosystem of blockchain, as well as promoting the construction of blockchain industry consortium are the key tasks at hand. It is important to encourage scientific research institutes, universities and enterprises, based on key and core blockchain technologies, to build an independent and controllable underlying open source technology platform, to explore and develop blockchain-based trusted integrated circuits, smart servers and operating systems, to build a blockchain open source community with global influence, and to foster an innovative and active blockchain open source ecosystem. At present, Beijing is promoting the construction of blockchain open source underlying technology platform to serve the subsequent applications of blockchain in the field of government services.

In order to support the innovative development of blockchain in the future, we will consider the following ideas in the process of constructing the open source blockchain platform in Beijing: data security should be taken as the key foundation when incorporating data and government service items to the blockchain; privacy protection should provide a strong guarantee for data sharing; personalized configuration of the platform should provide customized solutions for the application; cross-chain technology should be utilized as a bridge to achieve the trusted interconnectivity and scalability among multiple blockchain systems including the applications in government services in order to avoid the isolated data islands. With the core design concept to fuse technical features such as loose coupling, pluggability, modularization, backward

compatibility, the platform will be gradually empowered by the advanced theory, technology and code of underlying technology research, and will promote the continuous innovation of blockchain technology and application driven by applications.

5. To build a common infrastructure for government blockchain applications to be inclusive and easy to use

BaaS (Blockchain as a Service) can help enterprises, governments and developers build a dedicated consortium blockchain network more quickly and with a lower cost. In addition, the integration of blockchain and infrastructure of cloud computing has become the direction of technological development. In the complex and heterogeneous multi-cloud environment, the BaaS platform is expected to become the bridge to enable data exchange “cross-clouds”.

Directory blockchain is one of the core parts of the municipal big data platform. The responsibility, directory and system of all departments, commissions, bureaus and districts of the city have been locked “on the chain” to complete registration. It will lead to strong correlation between data and responsibility, achieve real-time detection of data changes, enable the traceability of the whole process of data access, in order to ensure the directories of all departments, commissions, bureaus and districts of the city are visible, available, and assessable. Next, the Directory blockchain system on both municipal and district level will be optimized and the design of basic technical architecture of the government services blockchain will be formed to construct BaaS for government services step by step. Services to support blockchain application will be managed as a whole and all departments, commissions, bureaus and districts of the city can share it

to support government services application scenarios.

The main consideration in the construction of BaaS for government services in Beijing is to provide functions and features that meet the needs of application and adapt to future technological development trends. For example, the feature of a one-stop service is that it provides one-stop blockchain deployment and operation services by integrating multiple cloud resources, an underlying framework, operating environment, encrypted key management, SDK and gateway API, etc. The feature of efficient interconnectivity enables all applications to be interconnected regardless of the underlying architecture. The feature of elastic resource allocation makes it possible to adjust the allocation of computing, network and storage resources in a dynamic manner concerning specific applications. The feature of secure environment provides a unified operating environment for government services, including but not limited to secure environment for algorithm, data, network, smart contract, interface, etc. The separation of blockchain platform and applications enables the application builder to conduct deployment, operation and maintenance with no need to consider the underlying architecture.

6. To safeguard the innovative development of blockchain in an all-round and multi-angled manner

The innovative development of blockchain in the field of government services hinges on the overall development of blockchain. Therefore, it is necessary to strengthen the guarantee and guidance in an all-round and multi-angled manner to create a favorable environment for the innovative development of blockchain.

In terms of industrial development, Beijing will take the opportunity

of the integration of blockchain technology, function expansion and industrial segmentation to accelerate the development of core and related industries concerning blockchain, and promote further integration of blockchain with advantageous industries such as artificial intelligence, big data, and Internet of Things. In terms of talent cultivation, Beijing will strengthen the introduction of global top-notch professionals, cultivate a number of leading figures and high-level innovation teams, and enhance the ability of continuous innovation in blockchain science and technology. In terms of regulations and policies, Beijing will do research and improve the risk management mechanism of blockchain, and strengthen the guidance and regulation of blockchain technology and applications.

7. The overall targets

In the future, Beijing will follow the requirements and direction specified in The Opinions on Accelerating the Cultivation and Expansion of New Business Forms and Models to Promote High-quality Economic Development in Beijing, The Action Plan on Innovative Development of Blockchain in Beijing (2020-2022), and The Action Plan on the Applications of Blockchain in the Field of Government Services in Beijing (2020) to facilitate the optimization of business environment. Beijing will promote the whole process of online government services to be electronic, streamline required materials and procedures, reduce the times of the on-site service application, and shorten the time limit of the service application handling, in order to fulfill the target of “all procedures can be conducted online and all kinds of services can be provided through the interconnectivity of the websites of related departments, commissions and bureaus”. Beijing will continue to use blockchain technology to

build infrastructure for smart government services, and will follow the route featuring trialing while applying, continuous optimization, and promotion of demonstration projects, to further promote the basic general technology platform and infrastructure of blockchain for government services, implement a batch of demonstrative applications, construct a number of business scenarios with a relevance to real demands, and achieve a batch of world-class technological breakthroughs, so as to enhance the satisfaction of the enterprises and individuals and to lay a solid foundation for the continuous expansion of blockchain applications and the development of the blockchain ecosystem.

Chapter 3. The Innovative Blockchain Applications in the Field of Government Services in Beijing

Beijing is steadily promoting the applications of blockchain in the field of government services through solving the key problems, removing the core bottlenecks and addressing the critical pain points in government services. Thanks to this effort, Departments of the People's Government of Beijing Municipality, such as the Beijing Municipal Commission of Planning and Natural Resources, the Beijing Municipal Commerce Bureau, and four pilot districts of Haidian, Xicheng, Chaoyang and Shunyi, have implemented 140 applications so far. As a result, materials required in government service application handling procedures have been streamlined by 40 percent on average. More than 310 categories of data have been connected, which is difficult to achieve under the traditional data sharing mode. For some matters that do require presence in person, the times of required on-site visits has been reduced from five or six times previously to only once. No paper certificates are needed in order to handle 253 items of service involving enterprises and 65 items of service involving individuals since the electronic certificates to be frequently used have been uploaded on-chain, thus streamlining 100,000 pieces of administrative materials throughout the year. The application of blockchain in the registration of real estate has enabled certain government services, such as "the transaction of stock of non-residential buildings among enterprises", to be applied and provided online, effectively reducing 100,000 occurrences of on-site visits. A service center for first-time loans has been set up,

and a platform for property rights confirmation and blockchain financial services for micro, small and medium-sized enterprises, as well as an information system for enterprise electronic identity authentication, have all been launched. As a result, the data that enterprises need to file and report has been reduced by 80 percent, and the time for opening a bank account has been shortened by 40 percent. A unified billing platform based on blockchain in the field of finance and taxation has been built, with blockchain-based electronic financial bills being piloted in the fields of medical treatment and donation. A blockchain service platform for international logistics of airports in Beijing has also been launched to improve the efficiency of foreign trade clearance. Applications of blockchain on the district level in the field of Zhongguancun high-tech enterprises identification, profession qualification registration for nurses, medical aid, etc. have been implemented in districts such as Haidian, Xicheng, Chaoyang, and Shunyi.

According to different roles blockchain technology plays and problems it is supposed to address in different application scenarios, blockchain applications in the field of government services can be categorized into three aspects, namely “data sharing and exchange”, “government services collaboration” and “electronic certificates and licenses”. “Data sharing and exchange” is a basic application of blockchain, which further improves the efficiency of the review process as data required to complete one single service item can be shared and exchanged among multiple systems; “Collaborative handling of service application” is an upgraded version of data sharing and exchange. The service items are categorized into different subjects, which are connected both in series and in parallel through blockchain. In doing so, the whole handling process of

certain subject-related items will be more efficient; “electronic storage of certificates and licenses”, which is also based on data sharing and exchange, uploads on-chain the electronic certificates and licences, which have special legal significance and business value. Certificates and licences are taken as the manifestation of data sharing and exchange, so as to enhance the credibility and verification efficiency of certificates, licences and related official documents.

Twelve excellent cases of innovative blockchain applications were selected by experts among a collection of cases. Beijing will introduce the understanding of the blockchain technology, solutions to existing problems, as well as the preliminary effects of each application in a structured way of case presentation.

1. The Blockchain Platform for International Logistics of Airports led by Beijing Municipal Commerce Bureau

Data sharing and exchange

The Blockchain Platform for International Logistics of Airports led by Beijing Municipal Commerce Bureau prioritizes the data sharing and exchange among six entities: Beijing Municipal Commerce Bureau, Beijing Customs District P.R.China, Beijing Municipal Tax Service, State Taxation Administration, the Airport Park and Cargo Terminal of the Capital Airport and DaXing Airport.

(I) Existing problems or bottlenecks

In the traditional mode of airport international logistics, many kinds of entities and departments are involved in the complex customs clearance logistics process, such as trading enterprises, logistics enterprises, agencies, park operators and supervision departments. Data generated

from international trade logistics and customs clearance play an important role in the business and should be kept confidential, a situation which leads to the formation of data barriers. Without data integration, it is difficult to reach multi-department collaboration, making the the whole logistic process both time-consuming and inefficient. In the meantime, security issues, such as data errors and accountability, cannot be fully resolved. As a result, it is difficult to dispel the concerns of participants about data security and data ownership.

(II) Leveraging blockchain to solve the existing problems

Blockchain technologies can be applied to upload on-chain the information generated at the airport, like information of international trade documents, trade, logistics, customs clearance, and tax, to facilitate the storage of electronic certificates, verification and collaborative sharing in the process of international trade logistics, as well as customs clearance cooperation. Supported by blockchain technology, which enables more secure and more credible cross-border trade, the goal of making cross-border trade more efficient, secure and convenient will be achieved.

(III) The lectotype principles of blockchain technology

Based on the requirement of project design and customer analysis, and according to the lectotype principles of blockchain technology that include efficiency, compatibility, security and scalability, we have identified the features of blockchain technology as follows:

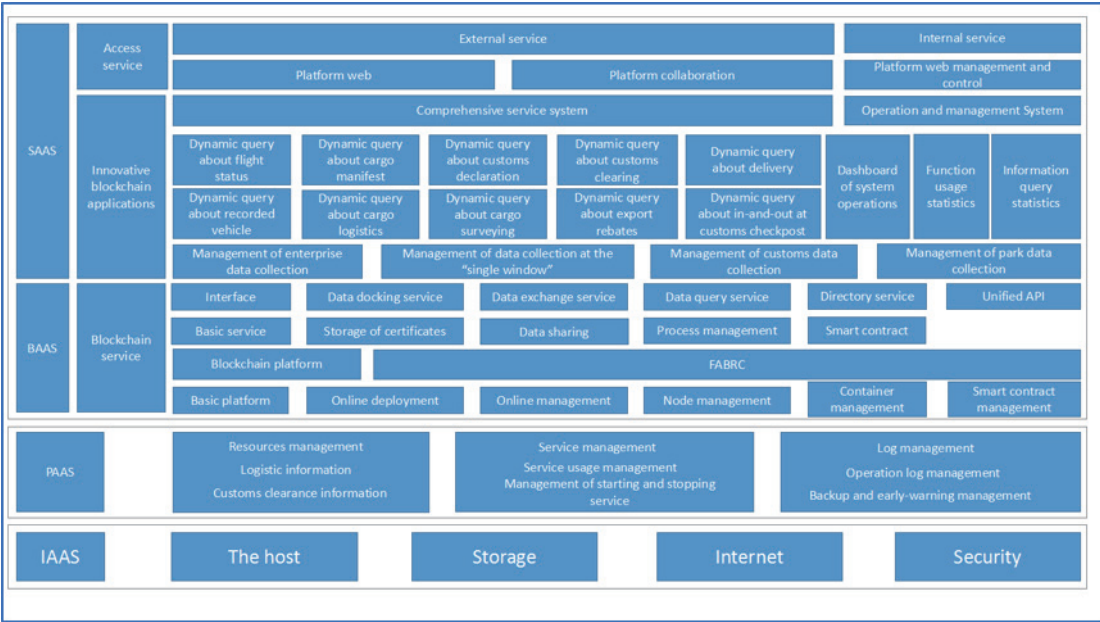
In terms of security, the technology should provide multi-pronged support, including privacy protection, cryptography algorithm and CA (Certificate Authority). At the user level, it should provide users with trusted, secure and convenient blockchain applications, and ensure that users have access to various solutions provided by the service platform.

The technology should provide a Web management control platform to support the operation and maintenance of the blockchain platform, and to identify the scale of blockchain deployment and the node motion status in a flexible manner.

The technology should support both a simple and easy mode of interface to facilitate the storage of certificates and the execution of smart contracts, and the access of the application should be authorized by encrypted keys.

(IV) Overall architecture

The overall architecture of the platform is constituted by four layers: SaaS, BaaS, PaaS and IaaS. The blockchain infrastructure platform is comprised of functions such as platform integration, interface development, platform CA integration, smart contract, and so on. The application service includes both access and blockchain application services, among which, access service includes external access for enterprises and internal access for government departments in charge. The blockchain application platform is comprised of three parts: comprehensive service system, operation and management system and data collection system. The comprehensive service system will serve entities covering foreign trade enterprises, logistics enterprises, warehouses and freight enterprises, etc. to provide functions such as dynamic query about the information concerning flight status and cargo manifest. Users of the operation management system are the departments responsible for the operation and maintenance of the blockchain platform. The main function of the operation management system is to showcase the operation situation on the blockchain platform for the users of the system.



(V) Effect of application

The operation of the blockchain platform for international logistics of airports has freed enterprises from obtaining logistics clearance data through multiple platforms, and has made it possible that the status information of each node of logistics clearance can be tracked through a "single window". Meanwhile, with the application of blockchain technology, government departments in charge can obtain the trusted online data shared by the enterprises and customs with just one-time query, which makes the evaluation of the business environment more timely and the management and supervision process more streamlined. From March, when it was first launched, to the end of May, over 3 million items of data generated in the customs clearance process have been uploaded on-chain, and 121 enterprises have queried about relevant data and verified various functions through this blockchain platform 7,784 times.

(VI) Inspiration and reflection

The implementation of the blockchain platform for the international logistics of airports makes it possible to query about the data chain of certificates stored on the blockchain platform by cooperative entities, trading enterprises and logistics enterprises. Due to the project, business operations have become both manageable and controllable, decision-making costs have been reduced, and the comprehensive competitiveness of foreign trade enterprises have been improved. On the other hand, since the blockchain makes it difficult to tamper and forge data, and all data is traceable, the level and efficiency of port supervision have been improved, the competitiveness of the port has been enhanced, and the trade environment has been optimized, which will provide stronger support to decision-making at the macro level.

2. Customs Clearance Facilitation in the Beijing-Tianjin-Hebei Region led by Beijing Municipal Commerce Bureau

Data sharing and exchange

The blockchain application for customs clearance facilitation in Beijing-Tianjin-Hebei Region led by Beijing Municipal Commerce Bureau is aimed at data sharing and exchange in the field of maritime transport in the region. It involves five entities: Beijing Municipal Commerce Bureau, Beijing Customs District P.R.China, Tianjin Port (Group) Co., Ltd., Tianjin Customs District P.R.China and Beijing Municipal Tax Service, State Taxation Administration.

(I) Existing problems or bottlenecks

The World Bank conducts business environment assessments of different countries every year. In order to obtain clear and accurate

data under the eight sub-indicators in the assessment, it is necessary to examine the time efficiency and the cost of imports and exports of Beijing enterprises in Tianjin Port and relevant ports in Hebei Province, which involves the acquisition of data concerning logistics and customs clearance data of ports in the Beijing-Tianjin-Hebei region. However, there are some problems in collecting the data, such as the lack of fixed data collection channels, ineffective data collection methods, and a lack of comprehensive data analysis.

(II) Leveraging blockchain technology to solve existing problems

Data has to be recorded at a variety of nodes in Beijing, Tianjin and Hebei. Such data includes the information of vessels, cargo manifest documents, dock loading and unloading, pick-up at yards, entry and exit at port gates of Tianjin Port, Tianjin Customs District P.R.China (under construction) and Tangshan Port (under construction). The data also includes the status of customs declaration and clearance of Beijing import and export enterprises at customs offices in Beijing, Tianjin and Shijiazhuang city. Such data recording methods can achieve synchronization and sharing of data in the field of maritime transport in the Beijing-Tianjin-Hebei Region, and ensure the authenticity and timeliness of data. This can resolve problems such as scattered data, a lack of fixed data collection channels, and ineffective data collection methods.

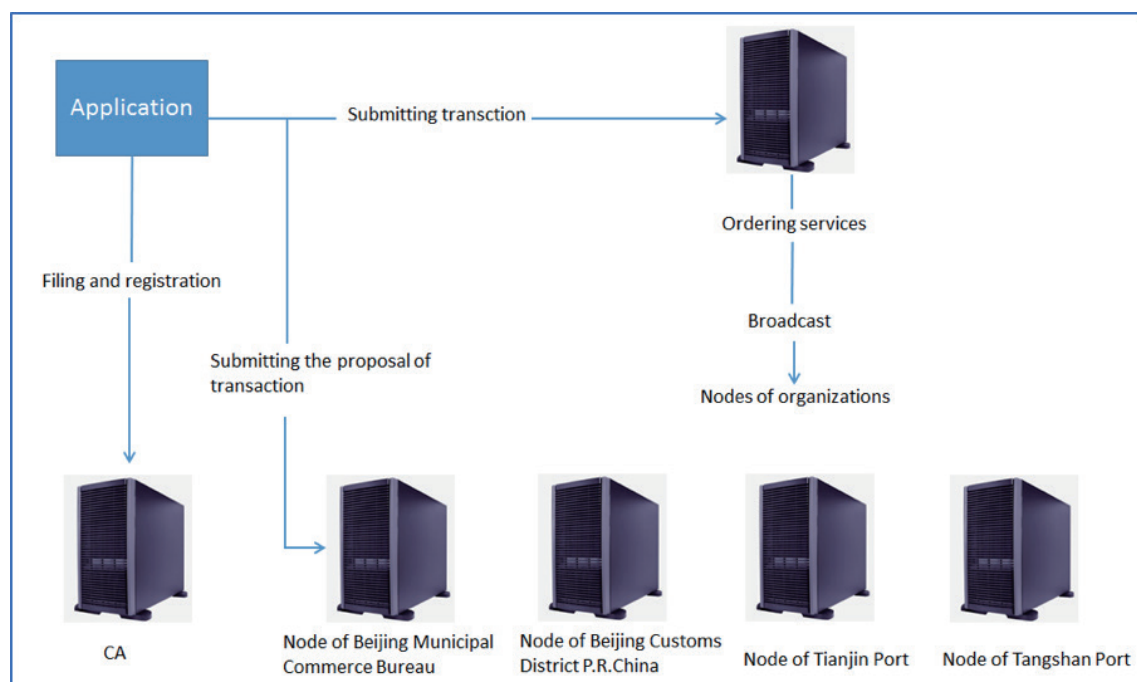
(III) The lectotype principles of blockchain technology

In selecting the type of blockchain technology to build the data sharing platform for maritime transport in the Beijing-Tianjin-Hebei Region, the following principles should be considered.(1) Data security: on-chain data is related to the import and export data and real-time customs clearance data of Beijing enterprises in the Beijing-Tianjin-Hebei region,

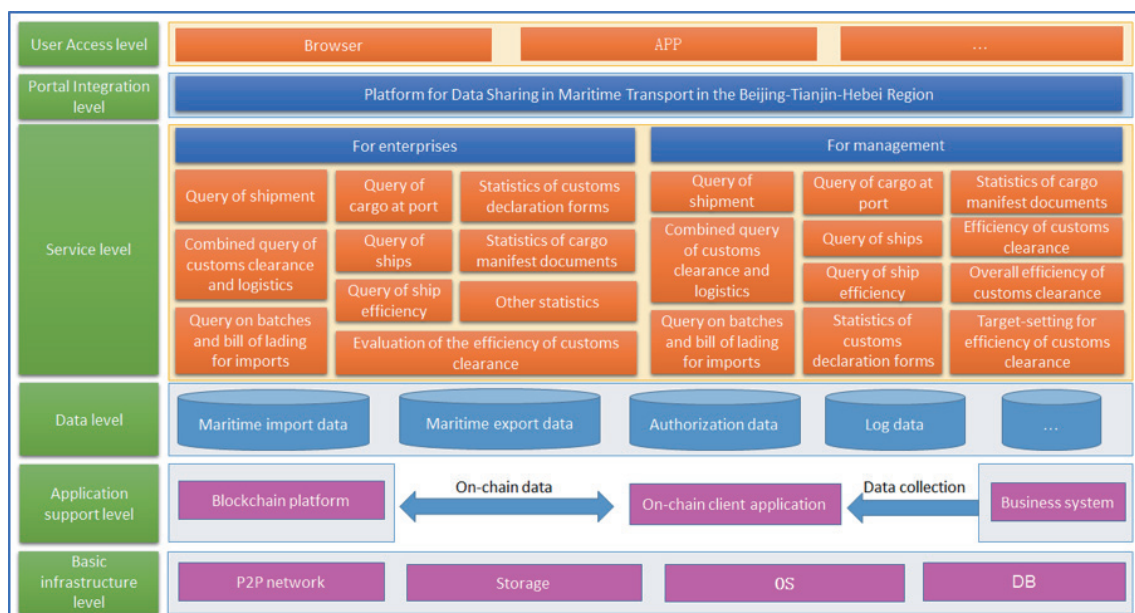
therefore it is important to ensure that the scope of data access can be controlled and that data exchange remains secure;(2) Scalability: since there are a variety of deployment nodes involving multiple departments in Beijing, Tianjin and Hebei, the blockchain technology has to meet the requirements of cyber security and data management of each department;(3) Ease of data management: the platform should be easy to manage and facilitate the monitoring of each node's operations and data exchange between nodes.

(VI) Overall architecture

This project adopts blockchain technology and plans to establish nodes in the Beijing Municipal Commerce Bureau (built), Beijing Customs District P.R.China (built), Tianjin Customs District P.R.China (under construction), Tianjin Port (built) and Tangshan Port (under construction). The overall architecture of the network is as follows:



In terms of the application, the system involves various import and export entities of maritime transport, including shipping companies, shipping agents, tally companies, yard companies, local customs, and customs office at ports etc. The customs clearance and logistics data of the import and export enterprises in Beijing, Tianjin and Hebei will be collected, including the key information on the customs declaration forms, status of customs clearance, dynamic reporting of ships, cargo manifest documents, loading and unloading at port areas, and gate information of storage yard etc. A one-stop platform providing information on customs clearance and logistics data has been developed for enterprises and a system for the Beijing Municipal Commerce Bureau to monitor the import and export entities of maritime transport in Beijing has been built. The main functions are as follows



As shown in the figure, the main layers include:

- 1) User access level via the browser or application.

2) The portal integration level allows both the enterprise users to submit data queries and the government users to manage the platform.

3) The business level limits data access based on different types of enterprises and also allows the management to control data access through authorization.

4) The data level includes on-chain data concerning deals obtained through the platform, including maritime import data, maritime export data, authorization data, log data etc.

5) The application support level allows data sharing by linking the on-chain client interface with data that needs to be uploaded on the blockchain platform. The on-chain clients are distributed and managed on the blockchain platform, which provides strong security.

6) The infrastructure level includes basic designs such as P2P network, storage, operating system, database, etc. which provide fundamental support to the application level above.

(V) Effect of application

The data-sharing system of maritime transport in the Beijing-Tianjin-Hebei Region has gathered 985,801 pieces of information, including 23,968 pieces of information on customs declaration forms, 78305 pieces of information on the status of customs clearance, 2,980 pieces of information on the dynamic reporting of ships that has avoided repeated construction and generating new information due to information isolation, and 882,544 pieces of information on loading and unloading of ships. The following processes have been accomplished, such as the whole-process tracing of single shipments, the real-time query by enterprises regarding the ships anchored at the port, and the real-time query about the ships anchored at the port during a single period. These processes support the

cross-border trade facilitation system for the Beijing-Tianjin-Hebei Region and promote the interconnectivity of information concerning customs clearance and logistics, as well as the business collaboration among Beijing, Tianjin and Hebei.

(VI) Inspiration and reflection

The lowered costs and enhanced efficiency of customs clearance drive the competitiveness of enterprises. The establishment of blockchain platform by foreign trade management departments such as the commerce bureau and the customs can comprehensively monitor the efficiency concerning ships, ports operation, customs declaration and clearance, thus optimizing the customs clearance environment, improving customs clearance efficiency, and providing the most direct data support. This enhances the competitiveness of the ports in the Beijing-Tianjin-Hebei Region, and smoothens the process of imports and exports of Beijing enterprises.

3. The eKYC System led by Beijing Local Financial Supervision and Administration

Data sharing and exchange

The eKYC system led by Beijing Local Financial Supervision and Administration prioritizes data sharing among several entities including the Beijing Local Financial Supervision and Administration, the Operations Office (Beijing) of the People's Bank of China, the Banking and Insurance Regulatory Bureau of Beijing, National Computer Network Emergency Response Technical Team/Coordination Center of China (CNCERT/CC), Beijing Fintech Research Institute and commercial banks.

(I) Existing problems or bottlenecks

When enterprises go to the banks to open an account or apply for

financial services such as loans, they are required to bring along various supporting documents and fill in forms with relevant information. As banking services require professional knowledge, the information filled in the forms is often incomplete or incorrect, and not all the supporting materials are provided. Enterprise representatives often have to visit the banks more than once, which makes the process very time-consuming. At the same time, due to reasons such as dispersed data acquisition channels and incomplete data, banks take a relatively long time to verify the customers' identities and check their information, leading to poor due diligence of customers' profiles.

(II)Leveraging blockchain technology to solve existing problems

In order to streamline the process of submitting application material and filling up information to open an account or to apply for loans in a bank, banks are promoting the mutual recognition of application materials of customers among different banks. To avoid the duplication of form-filling and verification among different banks, blockchain technology will support a trusted consortium blockchain integrating three kinds of nodes, namely, the regulatory department, data support and business execution. These nodes will help to achieve form-filling and multi-dimensional verification of application information and form a fully-functional working mechanism of multi-party cooperation, mutual recognition of information and unified authentication through gathering trusted data from multiple sources.

(III)The lectotype principles of blockchain technology

Secure transaction data. The traditional blockchain can only keep the identity of the transactor anonymous. The eKYC system is able to achieve the above and also safeguard the security of transaction data.

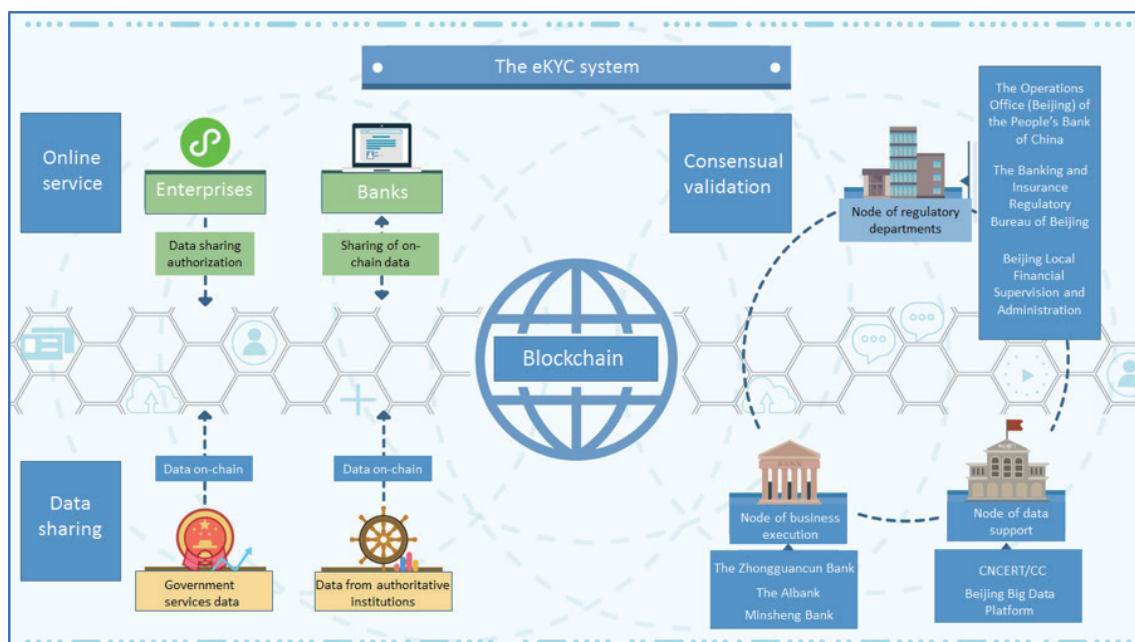
Fast transaction speed. Due to the multiple common nodes in the

public blockchain, it takes more time to validate transactions. The eKYC system is a consortium blockchain comprising multiple trusted nodes, which supports simultaneous transactions and has a suitable consensus mechanism with strong technical security. The consensus mechanism will bring about problems concerning cost of trust, security and efficiency, so it is necessary to choose the appropriate mechanism according to different scenarios. The eKYC system adopts the asynchronous Byzantine Fault Tolerance.

(IV) Overall architecture

The eKYC system has brought a convenient user experience to all parties, provided authoritative and trustworthy data service, and ensured real-time and effective supervision and regulation.

The online service has brought a convenient user experience to all parties. The eKYC system provides functions such as data sharing authorization and data management to optimize the user experience for enterprises. It also provides functions such as data acquisition and



updating of shared data for banks and financial institutions to speed up the business handling process and lower the risks of financial services.

The data service provides authoritative and trustworthy data. The eKYC system links up government service data, data from authoritative institutions and data from banks to help enterprises handle services concerning financial institutions. The data of enterprises that is confirmed by banks will become mutually recognized among the different banks once collected and shared by the eKYC system, facilitating a reliable system that contains shared data of enterprises.

It provides real-time and effective supervision and regulation. The trusted consortium blockchain comprises services nodes at banks, supervision nodes of authorities such as Beijing Local Financial Supervision and Administration and data support nodes of the CNCERT/CC. This consortium is conducive to the formation of on-chain consensual validation and trusted transmission of business operations, business processes and critical data, and enables an effective, real-time progress supervision.

(V)Effect of application

Beijing would like to take the first pilot case of the Top Resource Conservation & Environment Corp.(hereafter referred to as the company) opening a settlement account at Zhongguancun Bank when the eKYC system was launched on March 15,2020 as an example. When the company applied to open a settlement account at Zhongguancun Bank, the bank requested for data of the enterprise via the eKYC system. The system integrated the relevant verified data to streamline the process of opening the account, such as automatic form-filling and multi-dimensional verification of application information which reduced the time needed to verify the customer's identity and their information. So far, the eKYC

system has helped Zhongguancun Bank, the Albank and Minsheng Bank complete more than 50 pilot cases of enterprise data review during the epidemic prevention and control period.

(VI) Inspiration and reflection

The eKYC system has been included in The Regulations of Beijing Municipality on Optimizing the Business Environment as a major innovation to optimize the business environment for finance and credit in the capital. In the future, the eKYC system will rely on the “Changrong Project” which aims to provide convenient financing service to enterprises by connecting various financial service platforms in Beijing, and form a fully-functional working mechanism involving multiple parties and the mutual recognition of information and unified authentication. The eKYC system began by streamlining the submission of supporting material and form-filling to promote the one-stop online service of finance and credit services. This can help micro and small enterprises which have been plagued with problems such as difficult, expensive and slow access to credit. This system also leveraged technology to empower financial services by improving its quality and efficiency.

4. The Promotion of Using Financial Electronic Bills through Blockchain led by Beijing Municipal Finance Bureau



Data sharing and exchange; government services collaboration

The Beijing Municipal Finance Bureau is promoting the usage of financial electronic bills through blockchain. This project is focused on data sharing and exchange and collaborative service application handling, and pilot projects in Beijing Municipal Finance Bureau, one hospital, one school and two foundations have been carried out.

(I)Existing problems or bottlenecks

Financial bills are widely used in various fields and are closely related to enterprises' operations and people's lives. It is difficult to record the circulation status during the process, which makes it difficult for the financial regulatory department, the procurement/reimbursement department and the audit department to verify the claims. Since the financial electronic bills data is stored in financial regulatory department and entities which use such bills, the efficiency of data sharing and collaborative service application handling is limited by factors such as docking and access control under the current information system architecture.

(II)Leveraging blockchain technology to solve existing problems

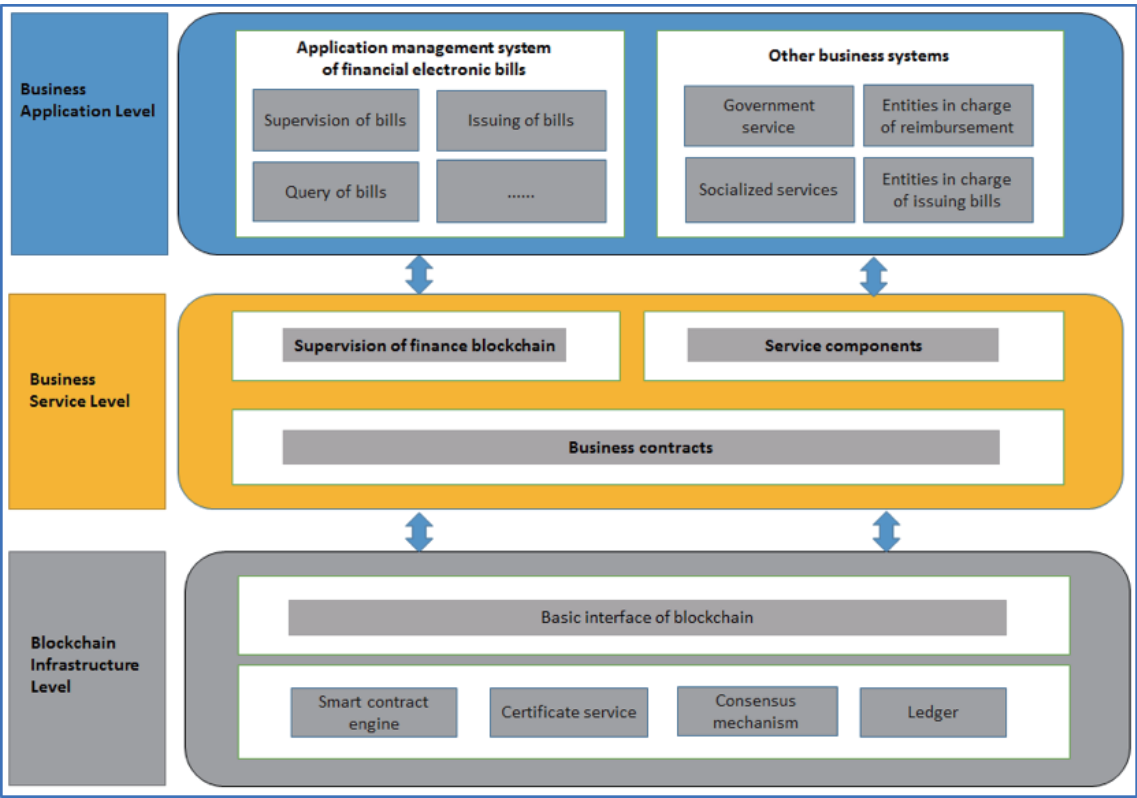
Due to its inherent attributes of privacy protection, trusted circulation, traceability, high cocurrency, decentralization and participation of multiple parties, the blockchain technology can help solve key problems regarding supervision and socialized circulation of financial electronic bills. For example, the application of blockchain technology provides a new solution for recording, supervising and printing of bills as well as updating the status, time and tracks of the reimbursement of bills. Authorized entities or individuals can locate relevant information and status of electronic bills according to key elements of bills, and this resolves the security issue of data sharing, reduces information asymmetry through measures to ensure data transparency, non-tampering and collective maintenance. It promotes a new transmission and trusted mechanism for transmission of information concerning bills.

(III)The lectotype principles of blockchain technology

The project adopts the business management model of “source

data uploaded on-chain, authorization, trusted circulation and smart supervision” to construct the blockchain network of financial electronic bills and establish a “consortium” for the socialized application of financial electronic bills. This facilitates information sharing of financial electronic bills and promotes the application of financial electronic bills in various fields. Detailed principles adopted in the pilot projects are as follows:

- (a) To fulfill the requirements of electronic bills service and meet the demand of issuing bills with high concurrency in a short time;
- (b) To prepare for changes in business operations caused by further policy adjustment and the business should be outlined by smart contracts;
- (c) The blockchain platform should be scalable to support the complex blockchain network structure;
- (d) The blockchain platform should be independent and controllable with no IPR risks involved.



(VI) Overall architecture

The blockchain infrastructure level provides the basic operating environment for blockchain, including basic services such as the basic interface of blockchain, smart contract engine, certificate service, consensus mechanism and blockchain ledger management.

The business service level will reduce the difficulty of developing the upper layer (business application level) and block off the lower layer of the blockchain. This blockchain also leverages technology to ensure that business contracts in the application level can be fulfilled and avoid wasting resources caused by repeated development.

The business application level will tap on the existing business systems of all parties, including the financial electronic bills system, and make minimal upgrades to the existing systems. The relevant blockchain service components will be introduced to the blockchain to dock functions between the existing system and the blockchain.

(V) Effect of application

Using financial electronic bills through blockchain has cemented the technical advantages into daily business operations. By the end of May, pilot projects on blockchain financial electronic bills have been implemented in the fields of medical care, charity and education, issuing a total of 64,404 on-chain financial electronic bills. Taking medical electronic bills as an example, after the payment is completed on the self-service machine, users can check their own medical electronic bills through the WeChat mini programs on their smart phones, and track the circulation of the bills in real time. Reimbursement of commercial medical insurance can be conducted in a convenient and efficient manner by submitting electronic bills and other materials online hosted on the blockchain.

Insurance companies can track and trace information of electronic bills on the blockchain, saving the time to settle claims, reducing the cost of review, and improving the customer experience.

(VI) Inspiration and reflection

The finance departments are the policy makers in charge of financial bills and the pioneers of this reform. The bill-issuing entities also rely on the policy and technology support of the finance departments to improve the efficiency and quality of services concerning financial bills. Therefore, the finance departments should make strategic plans and take the lead in solving key problems in the process of socialized application and providing support to bill-issuing entities by leveraging blockchain. It should aim to revitalize the business environment and speed up the improvement of public services to bring more benefits to enterprises and citizens.

5. Blockchain-based Financial Service Platform for Small and Medium Sized Enterprises (SMEs) in Haidian District

Data sharing and exchange; government services collaboration

The aforementioned platform is focused on the data sharing and exchange and collaborative service application handling among different types of entities, including the Haidian District Government, Beijing Financial Holdings Group, Beijing Academy of Edge Computing and Aibank, with pilot projects conducted in public organizations and state-owned enterprises (SOEs) in Haidian District and banks.

(I) Existing problems or bottlenecks

SMEs occupy an extremely important position in the national economy. However, it has been difficult, expensive and slow for SMEs to secure credit due to their poor credit status, imperfect financial system,

lack of assets to secure a loan, and weak anti-risk abilities. In order to solve the problem, the Haidian District Government, together with Beijing Financial Holdings Group, Beijing Academy of Edge Computing and Aibank, initiated the “Blockchain-based Financial Service Platform for SMEs”.

(II) Leveraging blockchain to solve existing problems

By leveraging blockchain technology, the platform can achieve effective risk prevention. Key data concerning property rights confirmation, such as the amount in accounts, remittance date, information of both parties, contract information, date of property rights confirmation etc. shall be stored on-chain. The consensus mechanism is adopted to ensure the secure and synchronized sharing of data concerning property rights confirmation across different nodes, which ensures the credibility and non-tampering of the property rights. All relevant entities of the platform, including small and medium-sized enterprises, government departments, state-owned enterprises, the finance bureau, the State-owned Assets Supervision and Administration Commission of the State Council, rights confirmation center and banks, can get to know the status of rights confirmation and financing of enterprises at any time according to the different levels authorization. This can effectively eliminate illegal operations such as adopting false account payment or false contract for financing, using the same right confirmation proof for repeated financing, etc.

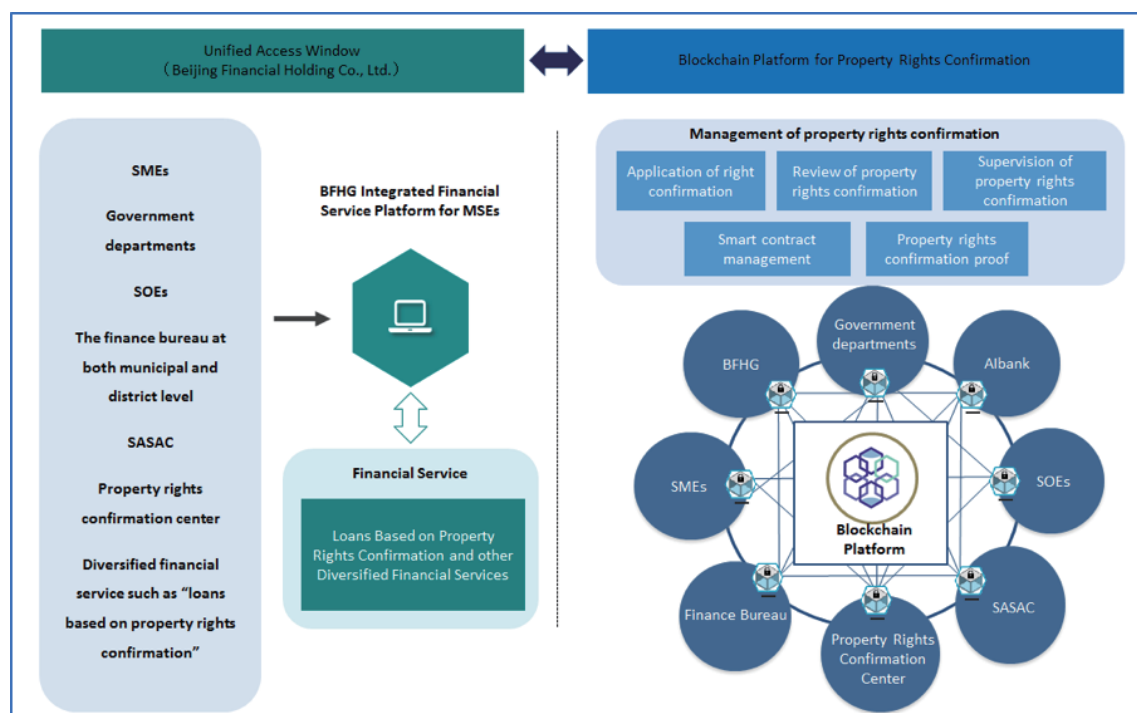
(III) The lectotype principles of blockchain technology

Based on the principle of pursuing independent innovation while remaining secure and controllable, we adopted the underlying blockchain platform developed by the Beijing Academy of Edge Computing. There is a large amount of contract information regarding procurement by the government and state-owned enterprises on the platform, of which the

contract value and status of contract execution are business secrets. Therefore, it is necessary to build an independent and controllable blockchain platform to ensure the secure sharing of data and protection of private information through multiple security measures, such as data encryption, digital signature and etc.

(IV) Overall architecture

The platform takes the government's and state-owned enterprises' procurement contracts and confirmation of accounts receivable as an entry point and uses the financial service platform for micro and small enterprises of Beijing Financial Holding Co., Ltd. as the unified entrance, to gather financial resources, such as financing assurance, asset management and etc. to provide comprehensive supply chain financial services for micro, small, medium sized enterprises. There are five nodes on the blockchain platform, namely the Rights Confirmation Center, Beijing Financial Holding Co., Ltd., the finance bureau, the State-owned Assets Supervision and Administration



Commission of the State Council and Albank. Once registered and logged on the financial service platform for micro and small enterprises, enterprises can submit an application for the rights confirmation concerning the contract with public organizations on the municipal and level and state-owned enterprises, as well as accounts receivable. The property rights confirmation center will conduct a formal review of the application. Once approved, the application will be distributed automatically to the corresponding Party A and relevant regulatory departments. Party A shall conduct the review within the specified time limit, and the confirmation proof will be generated based on the blockchain platform. Party B can apply for financial products, such as the “loans based on property rights confirmation”, provided by the financial institutions. The bank may conduct examinations of the application for financing, credit granting management and loan release management.

(V) Effect of application

The platform takes advantage of the procurement data of the government and state-owned enterprises as well as blockchain characteristics such as multi-party consensus and non-tampering to ensure the credibility and non-tampering of the rights confirmation. It provided high quality credit certificates for small and medium-sized enterprises, resolved the banks’ concerns regarding rights confirmation of accounts receivable and the authenticity of contracts, and provided small and medium sized enterprises with quick access to financing. Small and medium sized enterprises can complete the application process under 1 minute and obtain the rights confirmation from Party A within 5 days once all the application material is submitted. Compared to the traditional financing model, the platform makes it possible for credit transmission of enterprise transactions and broadens the financing channels for

enterprises. Enterprises can fill in the information online such as the loan amount, interest rate and length of maturity, which can be correlated with the property rights confirmation proof, enabling them to access quickly the financial products such as Loan based on Orders provided by the banks. The banks will review the property rights confirmation of enterprises online and conduct credit approval based on the information of contract and accounts receivable very quickly.

(VI) Inspiration and reflection

Supply chain finance is one of the effective ways to ease the difficulties in financing faced by SMEs. However, there are still many problems in practice, among which the biggest challenge is property rights confirmation. Information is dispersed across various entities which makes it difficult to ensure the authenticity of transactions. With a poorly-working credit transmission mechanism, the supply chain finance has not solved the financing difficulties of SMEs as intended. The blockchain-based financial service platform for SMEs makes full use of the technological advantages of blockchain and can form a long-term mechanism with a sound regulatory system and clear process system. This provides a more secure and transparent solution for tackling financing difficulties faced by small and medium-sized enterprises.

6. Blockchain-based Registration System of Real Estate led by Beijing Municipal Commission of Planning and Natural Resources



Data sharing and exchange; government services collaboration; electronic certificates and licenses; including seven scenarios

By giving full play of blockchain technology in data sharing and exchange, government services collaboration, and electronic certificates

and licenses, the blockchain-based registration system of real estate led by Beijing Municipal Commission of Planning and Natural Resources has been applied in seven scenarios, namely, the transaction of non-residential buildings stock among enterprises; mortgage registration; mortgage cancellation registration; interspousal transfer of house ownership; streamlining required materials through the interconnectivity of the websites of related departments, commissions and bureaus (the “integrated online service”); optimizing registration and transaction of real estate through the “integrated online service”; and uploading electronic certificates and licenses of real estate on-chain and promoting such application. Such system involves 11 entities including Beijing Municipal Commission of Planning and Natural Resources, Beijing Municipal Commission of Housing and Urban-Rural Development, Beijing Municipal Tax Service, State Taxation Administration, Beijing Municipal Bureau of Market Regulations, Beijing Municipal Civil Affairs Bureau, Banking and Insurance Regulatory Commission, Beijing Housing Fund Management Center, Beijing Electronic Power Corporation, Beijing Gas, and Beijing Gehua CATV Network Co., Ltd.

(I) Existing problems or bottlenecks

(a) Credibility issues concerning the promotion and application of electronic certificates and licenses;

(b) Large amount of applications for mortgage registration and mortgage cancellation registration, which leads to overload of review and approval work;

(c) Repeatedly submission of materials and time-consuming process of tax verification concerning the transaction of non-residential buildings stock among enterprises;

(d) Too many materials required concerning interspousal transfer of house ownership;

(e) Low usage rate of shared data and too many forms to fill in for online registration;

(f) The procedures of handling service applications through the “integrated online service” needs to be further improved.

(II) The connection of real estate registration and blockchain application

(a) The process and result of sharing data of real estate registration among government departments of public security, civil affairs, industry and commerce will be uploaded on-chain to achieve the tracibility of the whole process of data sharing. The process and result of automatic examination and approval, as well as the result of real estate registration is uploaded on-chain, which makes the instant smart approval of mortgage cancellation registration possible.

(b) Relevant departments can compare the information of the electronic cetificates and licenses presented by the applicants with that stored on-chain to verify the authenticity of such information. Relevant departments can also obtain electronic cetificates and licenses by using query function from the blockchian to facilitate the handling of service applications.

(c) Building a consortium blockchain with departments engaged in real estate registration, banking, water supply, power supply, gas supply and heating supply, optimizing requirements for business environment reform, and leveraging new technologies and information sharing to streamline the process of real estate registration and reduce required materials, in a bid to bring convenience to enterprises and the general public.

(III) The principles of design and selection

(a) Fully leveraging big data platform and Directory blockchain to exchange and share data among different commissions, offices and bureaus;

(b) Following the unified standards and norms of Beijing to build blockchain platform;

(c) Streamlining the process, and reducing required materials and the time of applications handling to ensure simplified procedures for enterprises and individuals in accordance with the requirements of business environment optimization;

(d) Designing and optimizing the process based on approval rules and data status, to ensure the security in approving process and avoid risks;

(e) Complying with the Classified Protection of Information System Level III to ensure the security of data interaction;

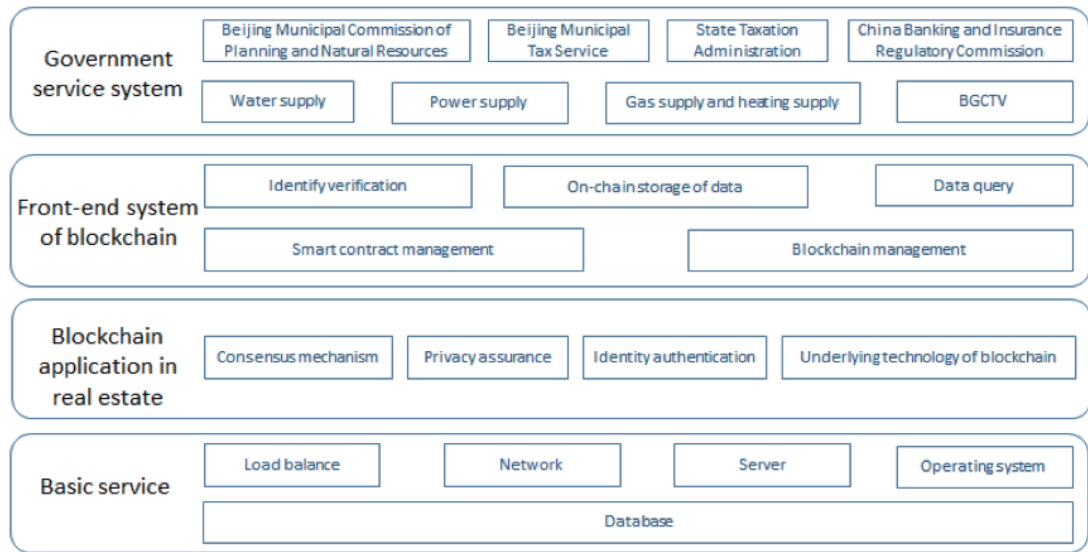
(f) Designing the blockchain platform in accordance with the principle of simplicity, ease of management, security and orderly proceeding.

(IV) Overall architecture

(a) Government Service System: as a system closely related to users, it records the behavior of users or the results, and uploads the recorded data on-chain through the front-end system of blockchain;

(b) Front-end System of Blockchain: the storage platform of certificates and licenses interacts with the blockchain through the front-end system, a system which is designed to deal with the request, verification and interaction of the platform and ensure the consistency and fault tolerance of the data on the platform

(c) Blockchain System: blockchain application in real estate uploads the data generated in Government Service System on-chain to meet such



requirements as data sharing and non-tampering.

(d) Basic Service Load: the load balance is struck based on on the current network structure and the service load is allocated by the network structure to a single node to ensure that once a certain node crashes, the whole system can still work normally and finish the handling of service applications.

(V) Effect of application

The blockchain-based data sharing mode has enabled the Beijing Municipal Commission of Planning and Natural Resources to obtain the shared data from the departments of public security, market regulations, civil affairs, tax service and taxation administration and housing and construction. Among them, the data from the departments of public security and market regulations have been shared across the country. Civil affairs departments have opened the data of marriage registration since 2003 in Beijing for sharing. The information concerning payment of deed tax has been shared among tax service departments and the information of online signing of contracts has been shared among housing and

contruction departments.

(a) Reducing the times of on-site visits. It is expected that about 1.2 millions visits to the registration center will be reduced. Since the implementation of the system, 100,000 visits have been reduced.

(b) Streamlining required materials. A number of copies of materials for application, such as the Identification card, marriage or divorce certificate, business license, tax payment certificate, will be streamlined. It is estimated that 400,000 pieces of materials will be reduced annually.

(c) Shortening the time of application handling. It is estimated that 4.2 million hours will be saved for the applicants. Meanwhile, online application handling enables the staff of government service center to skip the “procedure of acceptance”, which will save their time, and reduce the number of service window in service halls.

(VI) Inspiration and reflection

Through the sharing of electronic certificates and licenses and the common use, maintenance and review of government data cross different departments and regions, the blockchain-based mode of data sharing can enable “data to be uploaded on-chain and service quality to be bettered”, reduce required materials, on-site visits and shorten the time of application handling, enhance the satisfaction of enterprises and individuals and lay the foundation for the continous expansion of blockchain application.

7. Blockchain-based Multi-end Use of Electronic Certificates and Licenses led by Beijing Municipal Administration of Government Services



Data sharing and exchange; government services collaboration; electronic certificates and licenses

By giving full play of blockchain technology in data sharing and

exchange, government services collaboration, and electronic certificates and licenses, the block-based multi-terminal use of electronic certificates and licenses led by Beijing Municipal Administration of Government Services involves more than 60 entities at both municipal and district level including Beijing Municipal Administration of Government Services, Beijing Municipal Bureau of Economy and Information Technology, the Shunyi District People's Government, the Xicheng District People's Government and the Dongcheng District People's Government.

(I) Existing problems or bottlenecks

Considering the problems enterprises and individuals may face when they apply for government services, such as forgetting to bring certificates and licenses with them, repetitive submission of required materials and difficulty in verifying certificates and licenses, and based on the achievements made by the municipal certificate and license center, Beijing Municipal Administration of Government Services explores how to apply the blockchain technology to cross-regional and cross-departmental sharing of electronic certificates and licenses, focuses on solving the problems such as preventing the data from being stolen or tampered with, facilitating the authorization of the use of electronic certificates and licenses, and informing the public of the traces of use of their certificates and licenses, etc..

(II) Leveraging blockchain to solve existing problems

The features of blockchain, namely distributed storage, non-tampering and traceability, have enabled Beijing Municipal Administration of Government Services to build a trusted environment for multiple parties to involve themselves in authentication of the application of electronic certificates and licenses, provide the basic whole-process technical support for data security, authorization application and cross-regional mutual

recognition of the application of electronic certificates and licenses and ensure the application of electronic certificates and licenses in government services to be more reliable, secure and efficient.

(III) The lectotype principles of blockchain technology

(a) Maturity. Based on the applicability of government service scenarios and by selecting the solutions concerning consortium blockchain, the standardized and fast-accessible construction services of blockchain applications can be provided.

(b) Compliance. Blockchain information service providers shall select relevant technical support entities from the recorded list of blockchain information services in accordance with the requirements stipulated in The Regulations on the Blockchain Management Information Services issued by the Cyberspace Administration of China.

(c) Security and privacy assurance. Precise data sharing should be achieved without any information disclosure, and the data owners have full ownership and control over their own data.

(d) Scalability. The technology architecture can be more inclusive and elastic, a feature which enables the implementation of the distributed ledger technology (DLT) in various legal and regulatory environments in the future.

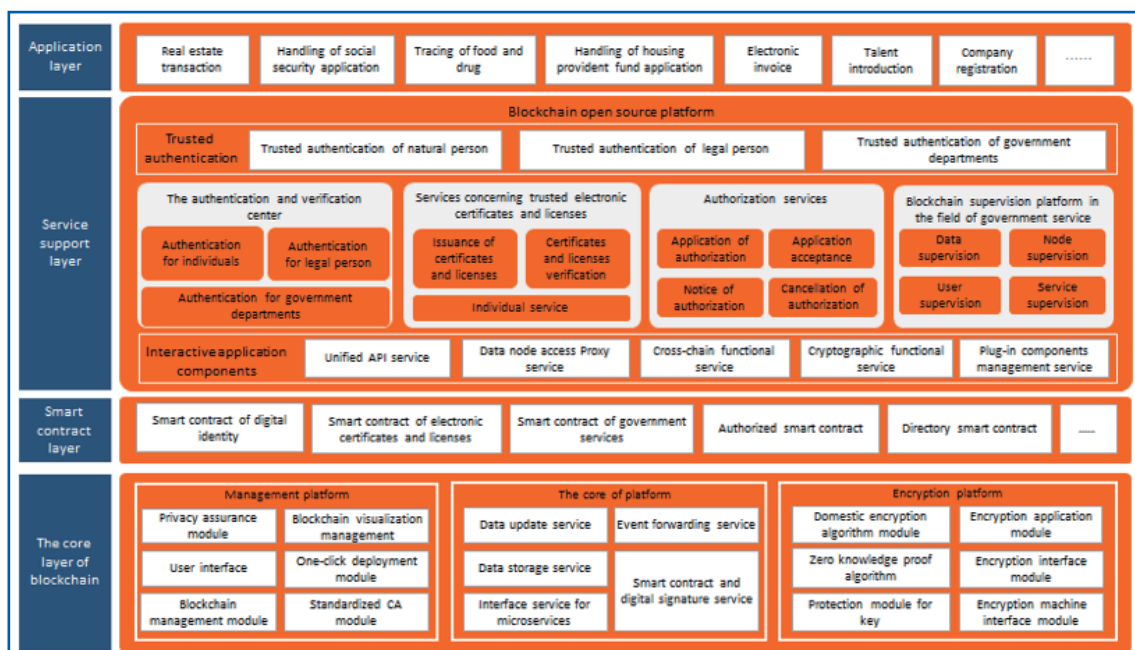
(e) To adopt the domestic blockchain platform with independent intellectual property rights.

(IV) Overall architecture

The overall architecture of this project is unfolded into four layers. Based on the existing resources, the core layer of blockchain (basic support layer and service presentation layer) is designed to avoid repetitive construction and waste. Among these two layers, the core of the platform is incorporated with a consensus mechanism based on an endorsement

model, a tamper-proof and traceable mechanism of public management of data which is formed through ledger management for the joint recording and maintenance of ledgers at different nodes, an identity management mechanism at each node based on digital signature, and a privacy assurance mechanism which has been enabled by the encryption platform through multiple cryptography technologies. The management platform helps users realize the rapid deployment and convenient blockchain management network and provides a variety of functions such as blockchain network parameter management, CA management of network users, node management and smart contract management.

The smart contract layer sets the norms and standards for the coding, publishing, and verification of the smart contracts in different application scenarios, to support blockchain applications in the field of government service, such as digital identity, electronic certificates and licenses, and government affairs. The service support layer links the underlying network of the blockchain and the service systems of each participant to integrate



and consolidate the function of interface calling and cryptographic service of each data node and provide a blockchain API which enjoys an easy-to-use REST style with multiple functions. The application layer provides the application scenarios concerning real estate transaction, handling of social security application and tracing of food and drug.

(V) Effect of application

By the end of April, more than 97 percent of government services at both municipal and district levels could be applied and handled online. With the support of more than 60 entities at both municipal and district level, Beijing Municipal Administration of Government Services, together with Beijing Municipal Bureau of Economy and Information Technology, the Shunyi District People's Government, the Xicheng District People's Government and the Dongcheng District People's Government, has been promoting the application of electronic certificates and licenses vigorously at comprehensive service window. So far, 7 kinds of frequently used electronic certificates licenses, such as electronic business license, Identification card and household register have been used. Therefore, 253 items involving enterprises and 65 items involving individuals in the Government Service Center of Beijing Municipality can be handled through mobile phone authorization.

(VI) Inspiration and reflection

Beijing Municipal Administration of Government Services has been taking advantage of blockchain technology to reduce the times of on-site visits by enabling information transmission and collaborative handling among different government departments, which have made governments at all levels serve the people in a proactive way, enhanced the sense of gain of the people and lowered the operational cost. In doing so, the goal

of improving the quality and efficiency of government services can be achieved and the business environment in Beijing can be optimized.

8. Pilot Project of Blockchain Application in the Field of Government Services in Haidian District



Data sharing and exchange; government services collaboration; electronic certificates and licenses; including 100 scenarios

Based on the achievements of the pilot project of blockchain application in 2019, Haidian District has launched a national model of “Blockchain Plus Government Services”, introducing 100 scenarios, such as high-tech enterprises accreditation in Zhongguancun, applying for opening a gallery, applying for unemployment insurance on a monthly basis, applying for training subsidy for high-skilled talent, and applying for Beijing Science and Technology Award. This project involves more than 20 entities including the Human Resources and Social Security Bureau of Haidian District, the Health Commission of Haidian District, the Public Resources Center of Haidian District, the Sports Bureau of Haidian District, the Commerce Bureau of Haidian District and the Culture and Tourism Bureau of Haidian District.

(I) Existing problems or bottlenecks

The government services of Haidian District are confronted with four major problems. Firstly, rights and responsibilities of each department are not clear when the scattered data are shared, which leads to potential risks of information security in the sharing process. Secondly, applicants are required to submit a large number of materials and therefore the service experience needs improving. Thirdly, working staff may have difficulties in identifying the authenticity of materials and the efficiency of manual

verification is relatively low. Last but not least, a large amount of paper document needs to be archived once a service application is handled, and the whole handling process is hard to trace and supervise.

(II) Leveraging blockchain to solve existing problems

As the first pilot district in Beijing to promote the all-round application of blockchain technology in the field of government services, Haidian District enables the on-chain validation of shared data via the query interface and encrypted transmission in a manner of “available yet invisible”, to ensure data security and the non-tampering of sharing process. Applicants can be authorized via the facial recognition function of “Haidian Tong” (a government service APP launched by Haidian District), or at the comprehensive service window in the government service hall of Haidian District through “scanning the code before facial recognition”. Enterprises can apply for more than 1,600 government services without submitting the materials that have already been uploaded on-chain once their electronic business licenses are authorized. Furthermore, a leading group of blockchain technology and a blockchain working group have been established to further expand the applications of blockchain in the field of government services. Led by the Government Services Administration of Haidian District, with the participation of the various departments, based on the technical support of blockchain for government service provision in four aspects: presentation of the electronic certificates and licenses and right confirmation (authentication of general information), reduction of materials required for authentication (from the applicant side by extracting materials stored on blockchain), instant approval upon the verification of the electronic certificates and licenses (verification is facilitated in the process of examination and approval), certificates traceability (trusted

traceability through the service application handling process), the steering group and the working group are dedicated to further optimizing the handling process.

(III) The selection principles of blockchain technology

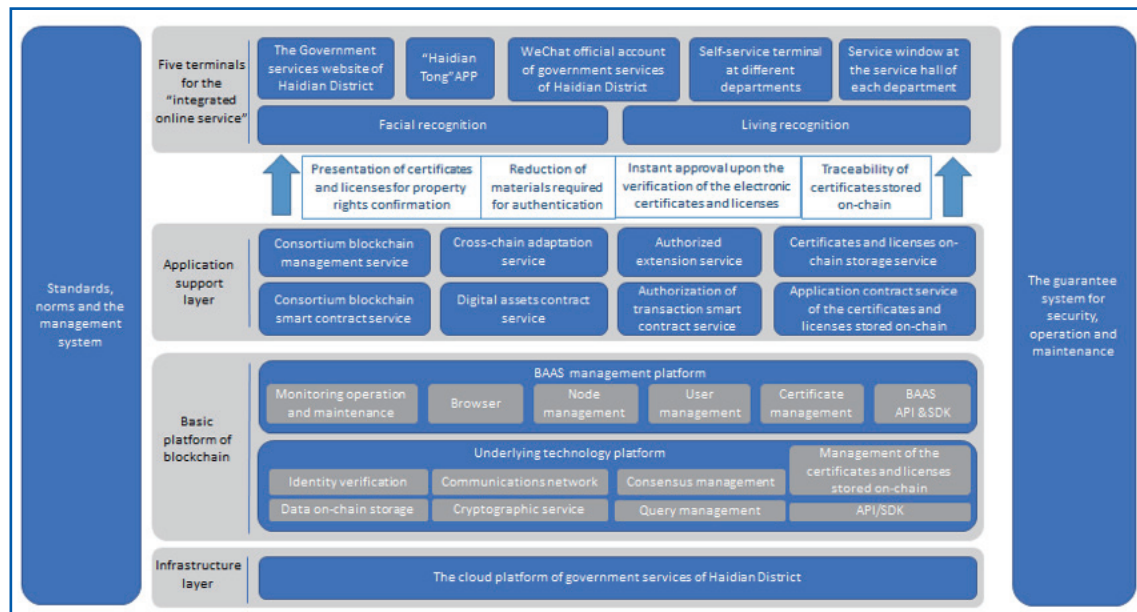
(a) Being independent, secure and controllable. Based on independent and controllable blockchain platform, as well as the cloud platform of Haidian District and the internet security guarantee system concerning government services, a variety of technologies need to be adopted to ensure secure, stable and reliable operation of the platform.

(b) Being standardized and scalable. It is important to promote the standardization of the process of uploading government service data on-chain and the standardization of the interface for the development of application system, to ensure the secure circulation of sensitive data on-chain. The platform is able to add new nodes in a flexible manner and expand its capacity to an unlimited range based on the demand of the people for government services and application scenarios.

(c) Being adaptable and iteratedly updated. The blockchain platform for government services in Haidian District can expand the function of upper application to meet an ever-growing number of service applications and the demand for new application scenarios. Additionally, all kinds of functions can be configured in a flexible manner to ensure rapid development and deployment, as well as iterative upgrading.

(IV) Overall architecture

The government services blockchain implemented in Haidian District is composed of 5 sub-chains: 1) Certificates and licenses chain: the HASH value generated through the encryption algorithm of all kinds of information concerning certificates and licenses generated will be uploaded on-



chain for the verification of certificates and licenses and the query about verification results; 2) Authentication chain: it provides credentials for the authentication of users and systems to ensure sharing of authentication information and provide the identity of individuals, commissions, bureaus and offices for verification, and business systems; 3) Authorization chain: it records the authorization information of users to ensure the authorized use of authorized certificates and licenses and the traceability of authorization information; 4) Directory chain: it uploads on-chain the directory information that can be shared among relevant commissions, bureaus and offices; 5) Event chain: it records the data generated throughout the whole process and provides evidence for tracing.

(V) Effect of application

By the end of May, nearly 300 data for 31 types of certificates and licenses have been put on-chain for application. So far, the blockchain technology has been applied in the E-government Service Center of Haidian District, “Haidian Tong”, WeChat App, Self-service Terminals and

comprehensive service window at the government service center, enabling the real-time verification and authentication of materials and identities concerning 1,621 government services at the district level. The material to be submitted in the already implemented application scenarios have been reduced by more than 44 percent. 45 service items can be handled online and 30 service items only requires a one-time visit in person. As a result, the platform has generated 1,988 pieces of documents and witnessed 16,013 times of extraction of certificates and licenses stored on-chain.

(VI) Inspiration and reflection

The blockchain platform of Haidian District boasts the advantage of keeping the existing system as it is, following the existing process and maintaining original data. The transmission of data enables the handling of government service applications through the “integrated online service” and encourages cross-departmental collaboration in the field of public services. With focus on the two life cycles of individuals and enterprises, the mechanism of one “file” for each individual and one “file” for each enterprise has been established with the on-chain data to provide multi-level smart guidance and personalized services in different scenarios. The service has been provided in a proactive and precise manner to cover the lifecycle of individuals and enterprises with the combination the statistics and social data to be shared on the blockchain in the future.

9. Pilot Project of Blockchain Application in the Field of Government Services in Xicheng District



Data sharing and exchange; government services collaboration; electronic certificates and licenses; including nine scenarios

By giving full play of blockchain technology in data sharing and

exchange, government services collaboration, and electronic certificates and licenses, the pilot project of blockchain application in the field of government services in Xicheng District has introduced nine scenarios such as enterprise cancellation, verification of marriage registration certificates for mainland residents, medical aid to people in need of social assistance. This project involves a number of entities including Xicheng District's Administration of Government Services, Bureau of Science, Technology and Information, Bureau of Civil Affairs, Human Resources and Social Security Bureau, Commission of Planning and Natural Resources, Commission of Housing and Urban-Rural Development, Commission of Urban Management, Bureau for Market Regulation, Bureau of Healthcare Security, Bureau of Financial Service.

(I) Existing problems or bottlenecks

On the one hand, enterprises and individuals are faced with a series of problems when applying for government services, such as the long handling process of their applications, a large number of materials to be submitted, long wait, and multiple on-site visits in person to different departments and windows. All these problems have led to poor service experience and low efficiency of handling process; on the other hand, government departments are unwilling to open their own data to each other and are afraid of using the data shared by other departments. Additionally, the mechanism for data tracing is not perfect enough, and the rights and responsibilities of each department are not clear when their data are shared. These problems have hindered the collaborative service application handling among government departments and degraded the quality of government services.

(II) Leveraging blockchain to solve existing problems

Through the establishment of the basic blockchain platform of Xicheng District and the integration of such platform and the data sharing and exchange systems and government service systems at both municipal and district level, a sound operating environment and platform infrastructures of blockchain can be provided for government services; Through the establishment of blockchain-based government services platform and the integration of the handling processes in different blockchain application scenarios, the data calling and verification based on application scenarios can be enabled, the business logic can be integrated, and on-chain and off-chain data can be converged, and the the handling process can be optimized and the efficiency of data sharing concerning government services can be further improved.

(III) The lectotype principles of blockchain technology

(a) Deeply analyzing the pain points, and integrate the existing process of acceptance, examination and approval and focusing on the improvement of efficiency to enable blockchain application platform to play a bigger role to support and facilitate the government service application handling .

(b) Making full use of the data exchange platform at district level, the sharing and exchange platform on both municipal and district level and the achievements gained in the construction of the municipal directory blockchain, so as to achieve data integration and utilization and to ensure the effectiveness and reliability of data.

(c) Supporting the upscaling of blockchain application in more government service scenarios through multi-layered chains. The highly complicated underlying mechanism and atomic functions of the blockchain are shielded from related government service systems through the

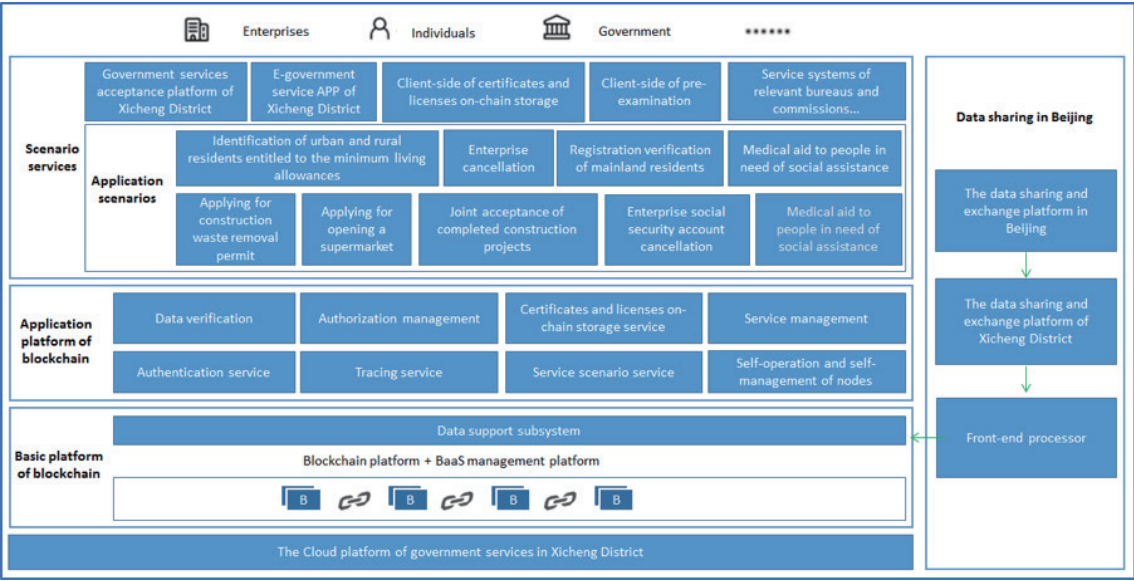
encapsulation of SaaS. In the meanwhile, the platform can provide general service based on scenarios to the general public.

(d) Application of blockchain can be extended to different areas in a flexible manner through the encapsulation of application components layer, so as to meet the expectation that the blockchain platform should be of high performance, high scalability, high compatibility and ease of use.

(IV) Overall architecture

(a) Basic platform of blockchain. With a multi-layered and pluggable logic architecture, the blockchain platform framework has encapsulated the core technology; The data sharing center conducts the unified management of data sharing based on blockchain relying on the basic platform; The basic platform supports each bureau and office to manage its own shared data resources and meet its own demand for data sharing based on the system, and to share and transfer data on-chain.

(b) Application platform of blockchain. The platform provides various functional features and functional configuration management based on the blockchain, supporting data to being uploaded on-chain and the



implementation of application scenarios. Through the encapsulation of the general service application handling process and functional interface of the blockchain, the application platform has enabled blockchain data calling and verification based on application scenarios, integration of business logic, and integration of on-chain and off-chain data.

(c) Scenario services. Nine application scenarios have been implemented in the field of government services, with “Xicheng E-government Service APP” and the comprehensive management platform of Xicheng District as the major terminals, and with the aim to bring convenience to the people and provide multiple channels for the handling of service applications.

(V) Effect of application

Application Scenarios	Effect of Application
Enterprise cancellation	The relevant information used to be made public in newspapers now is made public online, which has reduced materials by 16.7 percent.
Verification of marriage registration certificates for mainland residents	Linking the household registration information from public security to ensure on-site instant verification with no need to pay visits to local police stations
Medical aid to people in need of social assistance	Submitting only one piece of material to realize 66.7% material reduction, instant verification, the electronic form of result releasing.
Identification of urban and rural residents entitled to the minimum living allowances	6 items of data from 5 departments are gathered to enable the checking of the latest data of the people who apply for the minimum living allowances at any time
Enterprise social security account cancellation	Reducing one piece of document required for applicants to submit.
Registering a small loan enterprise and modifying its registration information	Reducing one time of on-site visit and one piece of material of applicants, speeding up the verification process and shorten the time for pre-examination.

Application Scenarios	Effect of Application
Applying for opening a supermarket	“one form to fill and to be approved by different departments”; it is expected to save seven days in the process by skipping four steps and reducing six pieces of material used to be provided repeatedly.
Applying for construction waste removal permit	The information declared by enterprises is verified by multiple parties; At least four pieces of materials are reduced and at least two working days for approval are saved.
Joint acceptance of completed construction projects	The times of on-site visits for on-site acceptance is reduced to once to the minimum and the efficiency and accuracy are improved.

(VI) Inspiration and reflection

In general, the blockchain technology has improved the efficiency of instant mutual-trust among government departments, between government and enterprises, and between government and the general public, and catalyzed the transformation of government in data governance. First of all, the application of the blockchain in the field of government services can be extended from one single point to more fields, and gradually expanding the depth and breadth of application. Second, the exploration of the “Blockchain Plus” has fundamentally improved the timeliness of data acquisition, smoothness of the integration of government services and the timeliness of government services. Third, a data supply and demand system cross different regions, departments and government levels has been established based on the features of the blockchain. Last but not least, the government’s ability to organize data has been strengthened, the collaboration among governments in data sharing has been deepened, the service application handling efficiency of all departments at all levels has been improved, which contribute to the improvement of the comprehensive strength of the government in social governance and government services.

10. Pilot Project of Blockchain Application in the Field of Government Services in Chaoyang District



Data sharing and exchange; government services collaboration; electronic certificates and licenses; including five scenarios

“Chaohaoban”, an APP for the application and handling of the subject-related service items in Chaoyang District, gives full play of blockchain technology in data sharing and exchange, government services collaboration, and electronic certificates and licenses, and introduces five scenarios such as applying for the set-up of a barber shop and medical insurance reimbursement and, involving three entities including the Bureau of Government Services and Bureau for Market Regulation of Chaoyang District, as well as Beijing Municipal Bureau of Economy and Information Technology.

(I) Existing problems or bottlenecks

The front-end collection and back-end archiving of materials concerning the subject services are two separated systems, which results in the manual entry during the archiving. The scenario of medical insurance reimbursement involves enterprise identity authentication and the issuance of medical insurance reimbursement credentials. In traditional online application, the applicant has to fill in a large amount of information manually since the data is not connected, which leads to unpleasant experience, and application handling staff has to verify the corporate information through manual search, which results in low efficiency. In the meanwhile, the data on the medical insurance reimbursement credentials is not standardized, which requires a second-time manual input.

(II) Leveraging blockchain to solve existing problems

Identity authentication can be conducted in a faster and more

convenient way by linking data of enterprises stored in the bureau for market regulation through blockchain. Materials required such as the “Acknowledgement Letter of Notification” during the application handling can be stored on-chain through connecting the government service micro-platform to ensure that the materials cannot be tampered with or denied, and to correspond to the documents in the archiving system to facilitate further management.

In the scenario of medical insurance reimbursement upon electronic credentials, blockchain can enable, in a more standardized and low-cost way, data sharing between the government service center, the bureau for market regulation and the healthcare security bureau so as to reduce the necessity of second-time manual input and improve the efficiency of government services.

(III) The lectotype principles of blockchain technology

This scenario involves authentic materials and data of the applicant and is of high demand, so the underlying technology of blockchain should be independent, secure and controllable. It should also be industry-leading based on the assessment of official institutions in the field to support the service requirements of the scenario.

(IV) Overall architecture

The data of legal persons stored in the bureau for market regulation has been linked using the two-layer architecture system consisting of “municipality-level directory chain” and “district-level application chain”. Interaction with the application chain has been achieved through the Chaoyang District government service micro-platform. In the meanwhile, the government service micro-platform uploads on-chain the materials submitted and the status of application handling to ensure that the

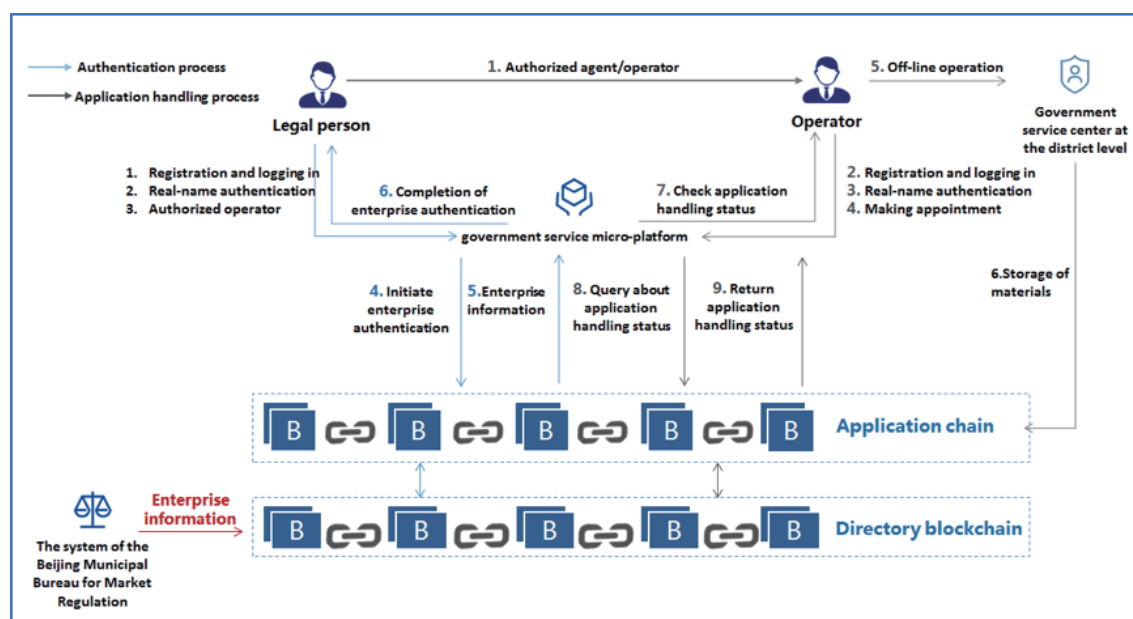
materials cannot be tampered with. The status of the application handling can be checked through the government service micro-platform, which enhances the satisfaction of the applicant.

(V) Effect of application

Applicants can directly make appointment online, and the information for appointment will be automatically transmitted to the system, reducing the manual input of five types of data. Documents such as “Acknowledge Letter of Notification” can be put on-chain to ensure that the materials cannot be tampered with. During the three weeks after online subject-related services such as applying for the set-up of a barber shop became available, more than 400 types of materials had been stored on-chain, and the daily application handling had reached 3 to 4 times on average. In the scenario of medical insurance reimbursement upon electronic credentials, handling procedures have been reduced from 7 to 6, enterprise authentication can be completed instantly, the reimbursement credential can be issued online and a second-time manual input by handling staff has been avoided.

(VI) Inspiration and reflection

Through carrying out the pilot blockchain project, the government service center in Chaoyang District has realized the important role of the blockchain technology in achieving the “one-stop online service” and the “integrated online service”; and the need of adopting new technologies such as blockchain to ensure a secure and controllable implementation of brand-new government service policies such as the “approval system based on the Acknowledgement Letter of Notification”, and empower government services with technology and supporting policies.



11. Pilot Project of Blockchain Application in the Field of Government Services in Shunyi District

➡ Data sharing and exchange; government services collaboration; electronic certificates and licenses; including six scenarios

By giving full play to blockchain technology in data sharing and exchange, government services collaboration, and electronic certificates and licenses, the pilot project of blockchain application in the field of government services in Shunyi District has uploaded on-chain data concerning review and approval of more than 20 items, such as enterprise registration, environment evaluation and food licensing issued by different commissions, bureaus and offices, with seven types of electronic certificates and licenses including the ID card and driving licence being shared. Five themed applications, such as “applying to set up an import food supermarket”, have been reviewed and approved by different government departments by combining multiple forms into one for enterprises and natural persons and extracting specific information

from the form for government departments to conduct specific review. A total of 103 individual applications at district-level, 280 applications concerning legal persons, and 26 applications in scenarios in towns and streets have been implemented, involving more than 30 commissions, bureaus and offices. The waiver of documents for government services has been supplemented by facial recognition and authorization of PAD at the comprehensive service window to acquire electronic certificates and licenses based on the blockchain technology. This streamlines the process by reducing information and materials to be submitted and enhances the experience of enterprises and individuals.

(I) Existing problems or bottlenecks

There are still problems in handling the services: there are multiple steps and materials to submit; data between the commissions, bureaus and offices is not connected and applicants have to re-submit the same materials, such as business license and legal person ID card; the Commissions, bureaus and offices have to check and review the materials respectively as they lack trust in one another's reviews; the original certificates and licenses are required and authorizing a third party to handle the application is likely to cause leakage of the private information of enterprises and individuals; the archives are in hard copy and it is difficult to trace the service process.

(II) Leveraging blockchain to solve existing problems

The government service platform based on blockchain technology in Shunyi District has enabled the data sharing of certificates and licenses based on user authorization on the blockchain platform. The data cannot be stored or downloaded throughout the entire process, which ensures the security and reliable sharing of electronic certificates and licenses to

avoid information leakage and to ensure that information of individuals is protected. The non-tampering characteristic of blockchain technology has been used to store the entire process and ensure its traceability.

(III) The Lectotype Principles of Blockchain Technology

(a) Unity of the platform's technology: providing the core components of the blockchain platform, such as privacy protection, consensus mechanism etc., and integrating the technology with the infrastructure to ensure the unity of the platform.

(b) Rationality of the platform application: building the themed government service function according to different scenarios and relying on the blockchain platform to provide convenient services.

(c) Security of the whole process: making use of blockchain ledger security, smart contract security, encryption technology and distributed storage to ensure that information cannot be tampered with.

(d) Scalability: the blockchain technology platform is scalable to support flexible expansion according to business development.

(e) Compliance of the independent and controllable technology: the information service of blockchain follows The Regulations on the Blockchain management Information Services issued by the Cyberspace Administration of China and adopts domestic blockchain platform with independent IPR.

(IV) Overall architecture

There are five layers of the blockchain themed services in Shunyi District: business presentation, business application, business support, smart contract and the core of blockchain.

Business presentation layer: providing service interface on mobile devices, PC and self-service terminals, etc.

Business application layer: providing scenarios of themed service items such as “applying to set up an import food supermarket”.

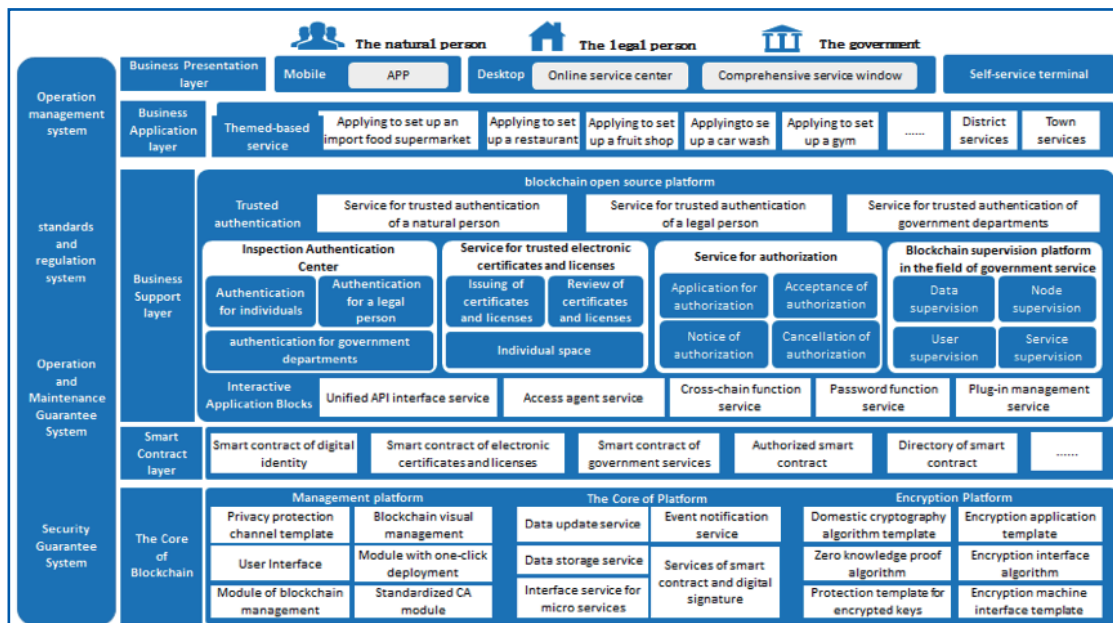
Business support layer: by leveraging the intermediary service capacity, this layer provides identity verification of the natural person, the legal person and organizations, verification service and supervision of government services blockchain.

Smart contract layer: providing the design, release and review of specifications of the smart contract based on business scenarios as well as applications to support digital identity, electronic certificates and licenses, and government services.

Core blockchain layer: providing the functions of the blockchain platform, such as the core, encryption and management, adopting domestic encryption algorithm which is compatible with the blockchain platform developed by domestic mainstream manufacturers.

(V) Effect of application

(a) Ensure secure data sharing. The data sharing of the 7 types of electronic certificates and licenses, such as ID card and driving licenses



and the sharing data field in enterprise registration and environment evaluation have enabled the data sharing among different commissions, bureaus and offices. This automated verification requires enterprises/individuals to fill in just one form and file one application, reduces the on-site visits and streamlines the materials to be submitted.

(b) Ensure security of private information. The platform is docked with the unified identity verification and electronic certificates and licenses center at the municipal level to safeguard the protection of private information of certificates and licenses on-chain. Data cannot be stored or downloaded throughout the whole process to avoid information leakage and to ensure that information of individuals is protected.

(c) The storage of the whole process operation can be traced. The data of application and issuance of certificates and licenses are uploaded on-chain and kept in the archive at the critical nodes of application, authorization and issuance of the themed services, to ensure open and transparent data usage. The process is traceable and cannot be tampered with.

(VI) Inspiration and reflection

The application of blockchain technology in government services data sharing gives full play to the value of blockchain, innovates the mode of data sharing, and enables the secure and reliable sharing of data. By combining facial recognition and blockchain technology, the ownership, management rights and use of data, as well as the security management mode have been further clarified in identity verification, authorization of electronic certificates and licenses, verification of electronic certificates and licenses, application of electronic certificates and licenses etc. The blockchain platform plays an important role in optimizing the government service process, promoting the sharing of government data, reducing the

operating cost of “digital government” and improving the efficiency of collaboration of government services, thus promoting the transformation of the “Internet plus government services” from “information services” to “value services” and “trust services”, and advancing the modernization of China’s system and governance.

12. Application of Blockchain Technology in the Field of Government Services in the Beijing Economic-Technological Development Area



Data sharing and exchange; government services collaboration; electronic certificates and licenses; including two scenarios

The work chain platform built in the Beijing Economic-Technological Development Area has developed and implemented two application scenarios, namely, “one-stop” service platform and the management platform of “review, management and execution”. This involves six entities such as the Bureau of Economy and Information Technology, the Science and Technology Commission, the Housing Fund Management Center, the Finance Bureau, the Bureau of Public Security, and the Bureau for Market Regulation of the area.

(I) Existing problems or bottlenecks

We have to leverage the technological advantage of blockchain in implementing government services, such as the approval system based on the Acknowledgement Letter of Notification and the pilot project regarding the transfer management of “standard land”. More efforts have been made in the sharing government data, streamlining the approval materials, optimizing the approval process, reducing the application costs, improving the efficiency of collaboration, and building a trusted system, so that there will be “no more than one in-

person visit for administrative approval”. This can help to build a world-class business environment in the Beijing Economic-Technological Development Area.

(II) Leveraging blockchain to solve existing problems

Based on the operating situation of the three government services systems of the Beijing Economic-Technological Development Area, Beijing fully leveraged key blockchain characteristics, namely, distributed storage, tamper-proofing and traceability to support five general applications scenarios. These scenarios include: a) establishing enterprises’ digital identities and credit system; b) streamlining materials using blockchain electronic certificates and licenses; c) guarantee of the authenticity of data upon electronic storage on-chain; d) accessing cross-departmental data support to verify data in an intelligent manner; e) uploading the approval process on-chain to ensure traceability.

(III) The lectotype principles of blockchain technology

Adhering to the principle of “one blockchain to support multi-application” in planning and design, the technology adopted should support multi-chain and cross-chain operation. The blockchain platform should be independent and controllable, and adopt domestic encryption algorithm to provide a complete set of solution with outstanding technology to ensure security.

(IV) Overall architecture

Adhering to the principle of being independent, secure and controllable and abiding by the unified standards and specifications issued by Beijing, the building of the blockchain in the Beijing Economic-Technological Development Area is split into three stages. It will enable the

“integration of information of enterprises registered in Yizhuang via the cloud and on-chain.”

First of all, different data ledgers have been utilized on the blockchain platform to support the demands of various government information systems on the blockchain technology. Secondly, the government information system and the work chain will be integrated in stages, taking the projects of “review, management and execution” and “policy fulfillment” as the starting point, to create a model. Finally, the cross-link connection with systems such as the Beijing Directory chain and the unified identity authentication platform will be implemented step by step to enable the electronic, tamper-free and traceable archives of government services.

The underlying technology of blockchain will be independently developed, and it should support customized requirements, boast high performance and mass data storage of different government applications. The goal is clear and logical business segregation and protection of relevant data by refining the classification of ledgers for different types of authorization.

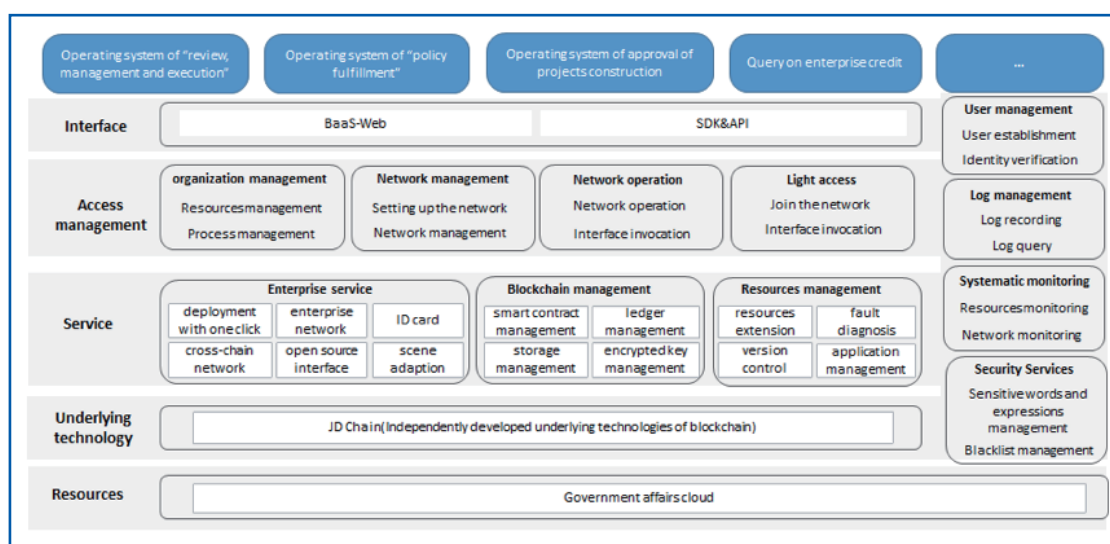
The technology of the blockchain platform will be encapsulated in an optimized manner. The Web console, SDK and API interface are provided to support access to a variety of government blockchain applications in the future with the decoupling at the interface from the platform and the application system. There are three major capabilities of the platform to provide business service, resource management and monitoring, operation and maintenance, including rapid deployment, management of users, certificates and smart contract in the work chain, and real-time monitoring of intelligent operation and maintenance of the work chain.

(V) Effect of application

Filling in only one declaration form will enable the staff to check the information on-chain once authorized. There is no need to submit or repeatedly fill in on-chain information, such as the enterprise identity, electronic certificates and licenses and other electronic materials. The department responsible for review can check the on-chain data and acquire data from other department through one click, cutting the time to review from several weeks and several days in the past to several minutes. When implementing the “approval system based on the Acknowledgement Letter of Notification”, a company’s credit score can be used as a basis for monitoring, thus facilitating the promotion of the system.

(VI) Inspiration and reflection

The blockchain technology has been used in the enterprise digital identity. A scientific and comprehensive enterprise credit rating system has been built after a long period and business data accumulation and constant adjustment of the credit evaluation model. Supported by the system, the review and approval process in government services has gradually evolved from relying on requirement-based approval to relying



on the comprehensive credit information of enterprises. This meets the government's goal of streamlining administrative services and enhancing incorruptible governance based on the informationization of government services.

Chapter 4. Summary and Prospect

The information generated and accumulated in the field of government services not only supports government services, but also should serve the society in a controllable way, playing a greater role in areas such as credit, education and health care. However, the traditional way of implementing the "Internet Plus Government Services" initiative and the informatization of government services, mainly using modern information technologies to provide technological support for government services, is more prone to be "service-oriented and demand-driven". In the meanwhile, the change cycle of government services is relatively long, which means the planning and implementation of the informatization could be conducted during a relatively long period of time, therefore the informatization often lags behind the requirements of government service development.

With the development and deepening of the "Internet Plus Government Services" initiative, higher requirements have been put forward for the informatization of government services for enterprises and the public. On the one hand, based on the guidelines on the establishment of the "Internet Plus Government Services" system, it takes the integration and interaction of services, technology and innovation to break up isolated information islands to achieve interconnectivity, to standardize service elements and to streamline service procedures. Data-driving and procedure reform have become key factors for the innovative, in-depth and sustainable development of the "Internet Plus Government Services" initiative. On the other hand, the new generation of information technologies represented by big data, artificial intelligence and blockchain, no longer just focuses on

service demands, and provides a novel perspective, technological support and efficient operation for the further development of the Internet Plus Government Services initiative from the dimension of the integrated development of technologies and service demands.

The new generation of information technologies including blockchain features the rapid development of the technologies and the fact that people's knowledge and understanding of them need to be acquired and constantly updated through practices. Therefore, the traditional way of "launching and planning in the first year, tendering and bidding and constructing in the second year and putting into operation in the third year" can no longer meet the new requirement of the fast development and deepened reform of government services. The situation of "the demands would no longer exist at the time of related online systems initial implementation" facing the traditional informatization projects needs to be changed urgently. Beijing has made efforts from the following aspects to innovate the applications of blockchain in the field of government services: 1) focusing on the pain points and difficult issues through the top-level design and planning by applying the blockchain technology; 2) establishing integrated teams from universities, research institutes, enterprises and government agencies; 3) gradually optimizing the application and technology platform based on the principle of polishing up products, forging ahead in small steps and constantly iterating learned from the leading Internet companies; and 4) efficiently exploring feasible and innovative pilot applications through enabling government officials, academic and research experts, and technical experts of industries to share wisdom and experience via exchanges in technologies, products and applications.

The pilot scenarios and the innovative applications in the first stage have proved that the blockchain technology can provide newer perspectives and technologies for problems concerning the technology, mechanism, process and implementation of the "Internet Plus Government Services" initiative. However, as the blockchain technology itself is in the process of rapid development, people's cognitions to the blockchain technology differ, with different perspectives and based on different backgrounds, and their understanding of key characteristics, core value and application scenarios of the blockchain technology also vary. For now, the underlying technology of the blockchain, mostly designed for digital asset transaction scenarios and financial scenarios, faces technical bottlenecks such as insufficient throughput, insufficient expansibility and uncontrollable storage cost, and does not fully match the scenarios of government services. Therefore, the future-oriented and blockchain3.0-based "programmable government services" and "programmable society" scenarios are urgently needed. In order to enable the blockchain technology to better meet the scenarios and service requirements, breakthroughs in a batch of core and key technologies are needed, such as improving the self-developed and innovative consensus algorithm, optimizing the distributed ledger structure, and improving the efficiency of the smart contract and peer-to-peer communication networks, so as to develop core underlying technologies and platforms.

Following the guideline of "encouraging innovation, advancing rapidly, and continuously learning from practice", Beijing Municipal Administration of Government Services, working with pilot project undertakers, expert groups and implementation units, have explored an innovative model which rapidly integrates the new generation of information technology into the government services through integrated discussions and technological

demonstration and with a manner of seeking common ground while paying attention to differences during the process of exploring innovative blockchain applications in the field of government services. Within a short period of half a year, Beijing's innovative blockchain applications in the field of government services, covering multiple steps of planning, demonstration, selection, development, application and operation, has been advanced at the "Internet speed" and truly follows the "Internet Plus" spirit of "product-oriented, encouraging innovation, rapid iteration, and tolerance with efforts in trials".

This Blue Book on the Innovative Blockchain Applications in the Field of Government Services in Beijing (1st Edition) is a summary of Beijing's experience in this phase and a small step in the exploration of the innovative blockchain applications in the field of government services. After preparing the Blue Book, the task force for Beijing's innovative blockchain applications in the field of government services will continue to march forward to contribute to 1) the innovation of Beijing's government services; 2) the construction of a high-quality digital government which is more targeted, diversified, intelligent and convenient; and 3) the modernization of Beijing's governmental governance to create a new benchmark for digital governmental governance. We sincerely welcome more government service agencies, universities, relevant experts and innovative enterprises to join us to seek the further development of the Internet Plus Government Services initiative.

Appendix 1: Expert Group of the Beijing Blockchain Workgroup

General Technical Team

Dong Jin (Full-Time), Dean of Beijing Academy of Edge Computing

Zheng Zhiming, Academician of Chinese Academy of Sciences, Professor of Beihang University

Zheng Weimin, Academician of Chinese Academy of Engineering, Professor of the Department of Computer Science and Technology, Tsinghua University

Chai Yueting, Director of National Engineering Laboratory for E-Commerce Technologies

Cao Peng, Vice President of Beijing Jingdong Financial Technology Holding Co., Ltd.

Zheng Haojian, Vice President of Tencent, Head of Tencent Blockchain

Xiao Wei, Chief Blockchain Scientist of Baidu

Expert Group in the Blockchain Application in Government Services

Huang Gang (Group Leader), Vice Dean of Institute for Artificial Intelligence, Peking University

Yu Yanan, Product Manager of the System Department of Baidu Blockchain

Wang Meng, Head of the Blockchain in Government Services, Ping An International Smart City Technology Co., Ltd.

Liu Quan, Head of the CCID (China Center for Information Industry Development) Blockchain Research Institute

Liu Wenjing, Director of Blockchain Product Application Team, Beijing Jingdong Financial Technology Holding Co., Ltd.

lv Zhaohai, Vice President of Beijing Syswin Zhengtoon Science and Technology Group Co., Ltd.

Shao Bing, Head of the Tencent Cloud Blockchain

Zou Tao, Strategy Director of Ant Blockchain Product Department of Ant Group

Meng Fanliang, Head of Blockchain Department of Huawei

Tang Lin, Director of Blockchain Research and Development Center, Beijing Academy of Edge Computing

Appendix 2: Main Participants of the Organizing Units for the Blockchain Application in Government Services in Beijing

Beijing Municipal Administration of Government Services

Wang Jun, Piao Xueru, Zhu Qin, Xi Ying, Wang Yi, Li Zunwei,
Fu Xiangbo, Gao Wenbin, Liu Qian, Li Yiming

Beijing Municipal Science and Technology Commission

Xu Qiang, Xu Xinchao, Tang Chao, Zhou Yuan

Beijing Municipal Bureau of Economy and Information Technology

Pan Feng, Liu Xu, Zhu Haodong, Zhao Yanfang, Jia Xiaofeng, Gao Song

Beijing Municipal Commerce Bureau

Wu Xiangyang, Wang Jiefu, Xu Yaoguang

Beijing Local Financial Supervision and Administration

Li Yan, Liu Yang, Meng Yang

Beijing Municipal Finance Bureau

Zhang Hongyu, Pei Geng, Jin Liwen, Zhu Lijun, Qin Zhaolei

Beijing Municipal Commission of Planning and Natural Resources

Xiao Ping, Zhan Yi, Pan Jiawen, Ren Haiying, Song Zhihong, Ren Chao,
Luan Peng, Tan Luyuan

Haidian District People's Government of Beijing Municipality

Zeng Jin, Li Junjie, Lin Jianhua, Ma Xueyin, Hu Yuguo, Chen Huiying,
Chen Lei, Wang Jianqiang, Shu Bilei, Li Nan, Chen Qifei

Xicheng District People's Government of Beijing Municipality

Nie Jieying, Xia Shumin, Yang Qiu, Yu Xinzhan, Lin Haibo, Ma Zhenfeng,
Wei Shuxue

Chaoyang District People's Government of Beijing Municipality

Wang Zhimian, Li Xiaojing, Liu Lin, Tian Wei

Shunyi District People's Government of Beijing Municipality

Zhi Xianwei, Jiang Huiqin, Li Fei, Zhang Mingyu

**Beijing Economic-Technological Development Area Management
Committee**

Chen Xiaonan, Zheng Haitao, Wang Yanhai, Wang Feicheng

Appendix 3: Technology Implementation Units of Blockchain Application Scenarios in Government Services in Beijing

(In no particular order)

**National Computer Network Emergency Response Technical Team/
Coordination Center of China**

Beijing Academy of Edge Computing

Beijing Financial Holdings Group

Beijing Institute for Fintech Research

Beijing Institute of Surveying and Mapping

Beijing Zhonghai Jiyuan Digital Technology Development Co., Ltd.

Beijing OWINFO Technology Co., Ltd

Beijing Jingdong Financial Technology Holding Co., Ltd.

Beijing Syswin Zhengtoon Science and Technology Group Co., Ltd.

CCB (China Construction Bank) Fintech Co., Ltd.

HUAWEI Technologies Co., Ltd.

Ping An International Smart City Technology Co., Ltd.

Hangzhou Qulian Technology Co., Ltd.

