Blockchain-based Service Network (BSN)
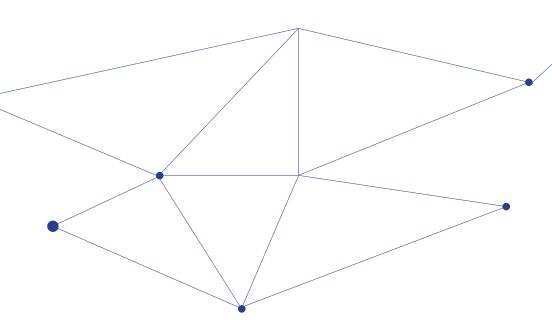
Introductory White Paper

BSN Development Association
February 5th, 2020

Contents

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Note:

1. The abovementioned entities participated in the writing or composition of this white paper, contributing valuable editing opinions and supplementary content.

2. The Blockchain-based Service Network Association will subsequently publish the Blockchain-based Service Network Technical White Paper and the Blockchain Service Network Business White Paper in the future.

3. This white paper was most recently updated on 5 February 2020, as revision 1.05.

Chapter I
Objectives

The Blockchain-based Service Network (hereinafter "Service Network" or "BSN") is a cross-cloud, cross-portal, cross-framework global infrastructure network used to deploy and operate all types of blockchain applications.

BSN aims to change the existing problem of the high cost of developing and deploying blockchain applications by providing public blockchain resource environments to developers, just like the internet, thus greatly reducing costs associated with the development, deployment, operations, maintenance and regulation of blockchain applications and, thereby, accelerating the development and universal adaptation of blockchain technology.

Chapter II
Permissionless Blockchains and Permissioned Blockchains

Three hundred thousand years ago, mankind began formulating language systems. Since then, the written word, telephone and telegram, computers and the internet have emerged as evolving mediums of communication. The development of alternate modes of information storage, transmission and computation has brought about one revolution after another in informatization, promoting the rapid development of human productivity. Blockchain technology based on internet data transmission

protocols and through the creation of a shared ledger mechanism—combined with the concepts of consensus, trust and equality demanded by modern society—further optimizes current production relationships and business logic and will lead the newest wave of the informatization revolution.

Currently, blockchain frameworks consist of two main types: public blockchains, or permissionless blockchains, and permissioned blockchains. Although blockchain technology has been under development for more than a decade, many people still confuse permissionless and permissioned blockchains, and their relationship with cryptocurrencies.

Under a permissionless blockchain framework, any user can anonymously enter or withdraw from a blockchain application and is not subject to administered data transactions or information diffusion. This type of framework has the characteristics of being transparent, private and completely decentralized. According to the requirements of current Chinese laws and regulations, it is very difficult to legally operate permissionless blockchains in China due to their lack of administration and liberal nature. Moreover, once a permissionless blockchain application is put into operation, it is very difficult to change or to flexibly adjust its internal business logic, resulting in a failure of permissionless blockchain technology to satisfy the requirements of most enterprise applications. At the moment, apart from being used for most virtual cryptocurrencies, there are practically no other information applications that use a purely permissionless blockchain framework.

A permissioned blockchain framework does not have the characteristics of being decentralized and transparent; rather, all business attributes are formulated by the application owner, and users are required to seek approval from the application owner before they are able to use the application. Under a permissioned blockchain framework, if the application owner is an alliance composed of multiple organizations, then all members of the alliance will commonly formulate all internal

mechanisms of the application. This type of permissioned blockchain structure is known as a consortium blockchain. If only one organization controls all application rights, privileges and regulations, then it is known as a private blockchain.

Consortium blockchain technology can be used to optimize the business flow of many traditional information systems, particularly in business scenarios that are not strongly centralized but rather are collaborative among multiple organizations and in which risks can be controlled. The shared ledger mechanism of consortium blockchains can greatly reduce the cost of ledger reconciliation under said business scenarios, increase the efficiency of data collection, increase fault tolerance, solidify the trust basis and prevent malicious counterfeits. At the same time, administrative organizations of all countries can effectively implement legal and technical regulation of consortium blockchain applications. For example, many countries are able to formulate their own regulatory policies in relation to the Libra consortium blockchain founded by Facebook but are powerless over the permissionless blockchain framework of Bitcoin.

In traditional consortium blockchain applications, all participating organizations need to individually create, operate and maintain their own dedicated peer nodes and a corresponding consensus mechanism. These nodes require a physical server or cloud service, and all the nodes are linked via the internet or the cloud service's internal network, thereby forming an isolated blockchain application similar to that of a local area network. This type of traditional structure means that when participants of the application participate in the consortium blockchain of another organization, they are required to create a series of blockchain operation environments, resulting in an excessive burden on participants. Moreover, in most cases, server resources run at a low load or rest in an idle state. This high-cost deployment, operation and maintenance structure is the main current bottleneck toward blockchain development. In addition, there is no uniform technical standard for the underlying frameworks used by each local area network-style blockchain application; thus,

cross-chain and cross-framework data transmission becomes difficult and expensive, restricting blockchain technological transformation and commercial deployment. For this reason, there is an urgent need within the industry to create a public infrastructure network that is commonly recognized by all organizations.

The underlying intentions of the design and creation of the BSN are to provide a public infrastructure network that allows the low-cost development, deployment, operation, maintenance and regulation of consortium blockchain applications. As a global public network, BSN will support the underlying frameworks of both consortium blockchains and public blockchains. However, portal operators responsible for actual operations should carry out legally compliant filtering and administration in accordance with local laws and regulations concerning the support of underlying frameworks and the deployment of certain blockchain applications.

Chapter III
BSN Introduction

The BSN design and construction concept are derived fully from the internet: the internet is formed by the connection of all data centers using TCP/IP protocol, and the BSN is formed by the connection of all data centers using the creation of a set of blockchain operating environment protocols. Just as with the internet, the BSN is also a cross-cloud, cross-portal, cross-framework global infrastructure network.

There are three types of direct participants of the BSN: the first are cloud service providers that, through the installation of free BSN public city node software, make their cloud service resources (CPU, storage and bandwidth) accessible through the BSN and carry out sales through the BSN; the second are blockchain framework providers (specially designated consortium blockchains) that, in accordance with the

BSN's framework adaptation standards, make adaptations and then deploy them on the BSN so that developers can select the adapted frameworks to deploy applications; the third are portal operators that can use the BSN with existing cloud service portals or developers' portals to create Blockchain as a Service (BaaS) platforms quickly and at low cost and can then provide BSN-based blockchain application development, deployment and operating services to their own developers. The BSN is an open network; on the condition of compliance with BSN protocol standards, any cloud service provider, framework provider or portal operator can voluntarily join or remove themselves from the BSN.

Just as with the internet, direct users of the BSN are developers and technology companies. Blockchain developers can use any set of public city nodes globally through any BSN portal to purchase cloud resources in rate-charging standards of transactions per second (TPS), storage quantity and bandwidth and then select any pre-adapted framework to develop, deploy and manage blockchain applications at extremely low cost and with significant convenience. Blockchain application publishers need only to deploy the application to one or more public city nodes on the BSN and then participants are able to connect to the application practically at no cost through the public city node gateway. Within each public city node, all deployed applications will share server resources. In regard to high-frequency applications, public city nodes will be able to intelligently and automatically allocate individual high-processing function peer nodes. Regarding low-frequency applications, multiple applications will be able to share a single peer node. This type of resource-sharing mechanism enables the BSN to lower the cost of providing resources to between one-third and one-fifth of all necessary costs of traditional blockchain cloud services.

The BSN is an information infrastructure. Consider, for example, that there is no need for every household to dig a well to have a water supply; instead, each household shares the same water supply provided by the public water facility

built by the city, lowering social costs. Likewise, with BSN, blockchain application publishers and participants do not need to purchase any additional physical servers or cloud services to build their own blockchain operating environment; instead, they can use uniform public services provided by the BSN and lease shared resources as needed. This greatly reduces the publisher and participants' costs. Research reveals that according to current mainstream cloud service provider quotations in China, the lowest annual cost to build a traditional three-peer consortium blockchain local area network-style environment is approximately RMB 100,000. By using the BSN, one application requires just RMB 2000 to 3000 a year to form a chain and become operational. This will encourage a vast number of small-, medium- and micro-sized enterprises, and individuals such as students, to use the BSN to invent and innovate, thereby accelerating the rapid development and widespread use of blockchain technology. The development from the isolated framework of traditional blockchains to the resource-sharing framework of the BSN follows a path parallel to that of the development pattern of the internet, from its early stages as a collection of many isolated local area networks to its progressive expansion into a worldwide web infrastructure. The BSN can be viewed as the internet of blockchains.

Chapter IV
BSN Framework

All public city nodes on the BSN are linked via the internet. Within any BSN portal, developers choose a framework and a certain number of public city nodes with desired TPS, storage quantity and bandwidth to publish a consortium blockchain application or a public blockchain node. Any developer can select at will any grouping of public city nodes to publish unlimited numbers of applications with different sets of peer nodes. Application participants can access any public city node

deployed by the application to participate in the relevant business with permission granted by the developer. Throughout the entire process, application developers and participants can focus their efforts on innovation and business execution without worrying about any additional costs of building and maintaining their own blockchain operations environment.

The architecture of the BSN comprises the following key parts:

I. Public city nodes

Public city nodes are a basic operational element of the BSN. Their main function is to provide system resources such as access control, transaction processing, data storage and computing abilities for blockchain applications. The owner of each public city node is the provider of cloud resources or data centers. The owner installs public city node software in the cloud resources and, once linked to the network, can create a public city node on the BSN. After the node is created, developers can then search for said public city node in each BSN portal and purchase its resources as one of its public city nodes deploying their applications. Once the use of a public city node's resources approaches its saturation point, the owner can add system resources at any time to increase the load capacity of the public city node.

According to the number and simultaneous requirements of already operational applications, each city node actively deploys a certain number of peer nodes, and, through a load balancing mechanism, high concurrency applications are actively allocated a single, dedicated high-performance peer node. Moreover, multiple low-concurrency applications will share a single peer node. This type of mechanism enables city node resources to be used with maximum efficiency and lowers the overall operating costs of the BSN.

In principle, the BSN is a multi-framework, multi-chain, multi-ledger blockchain

system. Each application deployed on a certain number of city nodes uses a dedicated channel for transaction processing, data communication and storage. There is complete isolation from channel to channel; however, if two applications share mutual authorizations, data can be mutually allocated. This type of mechanism thus guarantees the absolute privacy of each application while maintaining sufficient flexibility to carry out cross-framework and cross-chain business.

Smart gateways and pre-built chain code mechanisms deployed within public city nodes conceal the complexities of the BSN to external systems and allow developers of traditional business systems with absolutely no prior knowledge of blockchain development to use familiar programming language and operating environments to access the BSN and undertake blockchain data transactions, thus enabling traditional business systems to effortlessly possess blockchain functionality.

II. Blockchain framework

The blockchain framework can be viewed as the operating system of blockchain applications. BSN supports mainstream consortium blockchain frameworks and public blockchain frameworks. In terms of public blockchain frameworks, developers can purchase corresponding resources, select any given public blockchain framework, create public blockchain nodes through any BSN portal and connect the nodes to the main network of the selected public blockchain. According to the flexibility of the chosen framework, developers can also create their own public blockchain network on the BSN and continue to create even more nodes within or external to the BSN.

The current era of consortium blockchain frameworks are more diverse. In China alone, there are multiple mainstream frameworks. Each framework has its own consensus algorithm, transmission mechanism, development tools, etc. One of the original intentions of the BSN design is the expectation that it can create more complete development space for the frameworks, integrating developers, portals and

cloud resources with the frameworks so that framework operators can use the BSN to create better business models and build their own ecosystems, thereby offering a foundation to promote continued development of blockchain technology.

The mechanisms of consortium blockchain frameworks and public blockchain frameworks differ vastly. Adapting public blockchain to the BSN is quite simple, since most public blockchain networks are fully open-sourced. BSN development teams can easily implement the adaptation on their own. However, consortium blockchain frameworks mostly use local area network-style deployment concepts that totally differ from the "consortium blockchain public network" concept of the BSN. For this reason, if any consortium blockchain framework is to be deployed within the BSN, it must be adaptively developed in accordance with *Blockchain Service Network (BSN) Framework Adaptation Standards* and pass the framework adaptation audit. Once the framework deployment is complete, developers can choose a framework through any BSN portal to carry out application development and deployment. Given that all consortium blockchain frameworks are adapted for the BSN in adherence with a series of unified protocols and standards such as encryption algorithms and Gateway SDK, developers can use the same private key and the same Gateway APIs to simultaneously access different applications on different frameworks on the BSN. This greatly conveniences the developers' use of the BSN and at the same time realizes cross-chain data interactivity among different frameworks.

At the moment, the BSN already supports Hyperledger Fabric and other consortium blockchain frameworks currently being adapted, including Fabric with Chinese SM2/SM3 Encryption Algorithm, FISCO, BCOS, CITA, XuperChain, Wutong Chain and Brochain. In regard to public blockchain frameworks, BSN currently supports Ethereum and EOS.

III. BSN portals

When purchasing cloud resources and publishing applications on the BSN, developers can operate within any BSN portal. Like the internet, the BSN also uses a multiple

portal strategy. Enterprises with developer resources such as cloud service providers, framework providers and large application developers can apply to create a BSN portal. This portal can be a standalone BaaS website or BaaS service added to the existing cloud service portal or the developer's community portal. Within the BSN portals, developers can purchase BSN resources, deploy applications, manage applications and so on.

Each BSN portal has extremely high levels of autonomy and independence. Aside from the purchasing of resources and deploying of applications, all other functions are provided by the portal itself, such as user registration and management, billing and payment systems, and developer communities. Each portal collects its own fees, and once it has deducted its own revenue, the balance is paid to a settlement company authorized by the BSN on a weekly settlement basis. The settlement company then redistributes fees to the corresponding cloud service provider, framework provider and BSN operations teams.

Each portal independently manages its own users, and user information is not shared with the BSN. Applications published within the portal cannot be seen through other portals. The portal user interface and other non-BSN functions are completely designed, created, operated and maintained by the portal administrator.

Although the BSN supports both public blockchains and consortium blockchains, every portal operator is obliged to undertake filtering and administration of permissible applications and public city nodes in accordance with their own country's laws and regulations. For example, deploying or operating public blockchain nodes on BSN portals and public city nodes is not permitted within China.

IV. BSN Network Operations Platform

The Network Operations Platform of the BSN is managed by dedicated technical

teams from several BSN founding members including China Mobile, China UnionPay and Red Date Tech. After adding cloud resources to the BSN, cloud service providers only need to maintain the hardware and networks. The daily maintenance of public city nodes is performed by the BSN teams. Each BSN portal is also only required to carry out daily maintenance of its own portal, and the BSN organizes integrated operations maintenance of applications deployed to the BSN through any given portal. However, each party is required to create a coordination mechanism with the BSN operations team to facilitate the prompt handling of any suddenly arising circumstances.

The BSN Network Operations Platform includes functions such as public city node management, application management, maintenance management, billing and settlement management, CA management and supervision management.

Chapter V
BSN Advantages

I. Cost savings in blockchain application development, deployment and operations

The BSN provides a one-stop-shop blockchain operation environment, whether for consortium blockchain applications or for public blockchain nodes, so that developers do not need to individually purchase cloud services or hardware servers in order to build and maintain their own blockchain environments. Public city nodes' load balancing mechanisms and resource-sharing principles allow the BSN to provide long-term, high-performance, stable and reasonably-priced blockchain services to

all developers. Furthermore, the minimal cost of chain-building is reduced to just RMB 2000 to 3000 (USD 300 to 400) per year, giving all enterprise and individual developers access to the blockchain industry.

II. Lower barrier to entry for blockchain application development

There are very few developers that are proficient at blockchain-related programming languages. Smart gateway and pre-built chain code/smart contract mechanisms on public city nodes vastly open up possibilities to developers who have no prior knowledge of blockchain so that they can use the BSN with ease and can add blockchain functionality to traditional business systems. In the future, the BSN will mimic traditional databases and the internet to become a conventional choice for developers in the process of product design, system development and business operations.

III. Easier access to blockchain applications

When users participate in several isolated consortium blockchain applications, they need to have different private keys and a different set of APIs to access each application. This makes participating in applications a repetitive and overly complicated process. On the BSN, users can enjoy using the same private key to access all the applications with different frameworks on a given public city node at any time through one single set of APIs. This convenient structure also enables users to perform cross-chain and cross-framework data transmissions as long as permissions are granted by all involved applications.

IV. Provides flexible access modes

Application participants can access nearby public city nodes via the internet or

dedicated line connections and thereby, access the BSN. The majority of consortium blockchain applications are related to finance, transactions and payment business types. In order to guarantee the security of information, many financial business systems require that data be transmitted over a dedicated line. Most traditional cloud service providers use centralized data centers, and because the cost of using cross-region dedicated lines is extremely high, many cloud services providers are unable to provide complete dedicated line services to blockchain applications. Furthermore, the BSN will have public city nodes in many cities worldwide, with all of them supporting local dedicated line access, the cost of which is lower than that of cross-region dedicated lines.

V. Rapid expansion mechanism

In order to allow the BSN to enjoy high-speed development and obtain widespread use, as witnessed with the internet, the BSN supplies free software and technical support to cloud service providers so that they can easily create a public city node on the BSN at no cost and immediately access the BSN marketplace through the BSN portals. On the other hand, any portal operator can effortlessly add BaaS on its website and begin providing blockchain services to its customers in a short period of time by installing a BSN portal empowering platform. The BSN is the result of a cluster of group efforts and contributions. Like the internet, there is no sole owner of the BSN.

Chapter VI
BSN Development Association

The Blockchain Service Network Development Association (BSN Development Association) is responsible for development, operations and maintenance of the BSN.

All matters of the BSN, including regulatory design, technical standards, development and operations management, business models and pricing are determined and implemented by the BSN Development Association. The BSN Development Association was established by six entities, which are also the BSN founders:

1. Government Agency: State Information Center of China

2. Telecommunications Industry: China Mobile Communications Corporation Design Institute Co., Ltd. and China Mobile Communications Corporation Government and Enterprise Service Company

3. Financial Industry: China UnionPay Corporation and China Mobile Financial Technology Co., Ltd.

4. Software Industry: Beijing Red Date Technology Co., Ltd.

The BSN is a vast engineering project, requiring continuous innovation and optimization. The BSN Development Association welcomes all organizations that share the same vision and have the relevant experience to join the effort, including but not limited to supervisory authorities, telecommunications carriers, financial institutions, cloud service providers, hardware producers, software developers and marketing promoters.

Chapter VII
BSN Development Planning

I. Global deployment

With the great support of China's three telecommunications carriers, China Mobile,

China Telecom and China Unicom, the BSN has already created almost one hundred public city nodes in China. Furthermore, the BSN Development Association is currently in discussions with global carriers, cloud services providers and other companies within the blockchain industry, mapping out issues surrounding local deployment of public city nodes and portals in all countries around the world. It is expected that by the end of 2020, there will be approximately two hundred public city nodes worldwide. To a certain extent, the BSN optimizes the blockchain underlying operations environment and creates new standards for deploying and managing blockchain applications. It provides a foundation for the fast spread and adaptation of blockchain technology at a global level. As the BSN takes hold in countries around the world, it will become the only global infrastructure network autonomously innovated by Chinese entities.

II. Adaptable toward data transmission for all types of pioneering technologies

Right now, there is rapid development in pioneering technologies such as 5G, the Internet of Things and AI. These technologies all bring about significant requirements in terms of the high concurrency, high frequency and high flow-rate of data transmission and storage, and test centralized systems to their limits. The BSN will be able to keep pace with these pioneering technologies and provide fixed-point, fixed-orientation data adaptation solutions, thus further promoting the BSN as a core infrastructure to support the development of a digital economy and smart cities.

III. Adapting more blockchain frameworks and establishing more portals

The BSN will continue to adapt for global mainstream consortium blockchain and public blockchain frameworks. The BSN is currently already adapted or being

adapted for consortium blockchain frameworks including Fabric, FISCO, BCOS, CITA, Xuperchain, Wutong Chain and Brochain and the public blockchains Ethereum and EOS. In the future, the BSN will continue to adapt mainstream frameworks and give developers even more choices.

The BSN will continue to welcome and support the establishment of BSN portals by telecommunications carriers, cloud service providers, underlying framework providers, technology media operators and large-scale application developers from all global regions and to expand its provision of services to developers around the world to the greatest possible extent.

IV. Future core system open sources

Once a comprehensive set of protocol standards for the BSN has been formulated, the BSN Development Association will open source public city node systems and portal empowering systems. Anyone will be able to obtain the source codes, subject to the allowed scope of copyright and protocol limitations, and can publish their own modified and optimized version, enabling public city nodes and portals to provide developers and end users with a more complete, flexible and stable service environment.

V. Second generation dedicated internet

The ultimate objective of the BSN is to become the internet of blockchains. Traditional internet has facilitated, in a low-cost manner, the instantaneous transmission of data between two computers anywhere in the world, and the BSN, in a low-cost manner, will facilitate the mutual trust of data between multiple business organizations anywhere in the world.

Chapter VIII

BSN Web Portal

Please visit the BSN official portal **http://www.bsnbase.com** for the latest BSN status report or to use the Blockchain-based Service Network.