Is Blockchain a Real Opportunity for Smart Cities Projects in China?
中国的智慧城市项目是否为区块链的大好机会？

Prof. Dr. Xiangfu ZHAO

School of Computer and Control Engineering, Yantai University

Blockchain Industry Research Institute, Yantai University

赵相福　博士、教授

烟台大学计算机与控制工程学院

烟台大学区块链产业研究院

Answer.

- Yes, it must be!

Outline

- **Introduction to China's Smart Cities**
- **China's smart city's current realization pain point**
- **Blockchain and its typical characteristics**
- **Blockchain and Smart Cities - Solve Pain Points**
- **Current application progress**
- **The outlook for the future**

Introduction to China's Smart Cities

- “Cities" new requirements: convenient, efficient, environmentally friendly, intelligent, livable
- Smart City: Integrated services in the urban space that cover hardware, software, management, computing, analytics, and more, i.e., using information and communication technologies (ICTs) to sense, integrate, store, process, analyze, predict, and respond to critical information in all aspects of urban operations, providing intelligent responses and supporting decisions to a variety of needs, including people's livelihood, environmental protection, public safety, urban services, business and industry activities, to create a higher quality of life environment for urban residents.
- Smart cities are based on information technology and digitalization, using artificial intelligence, big data, cloud computing, Internet of Things, mobile Internet, intelligent awareness terminals and other technologies to form urban operating systems.
- In September 2009, the city of Dibek and IBM built the first "smart city".

Introduction to China's Smart Cities

- Typical City - Hangzhou: Using Alibaba's "City Brain" platform, it can control thousands of traffic lights in the city, locate the location of urban public transportation, and analyze the expected urban traffic conditions. Hangzhou, with a population of 7 million, dropped from 5th to 57th place in China's most congested city, and the problem of traffic congestion in Hangzhou was solved by technology in the construction of smart cities.
- Cities with such systems could reduce commute times by an average of 15 to 20 per cent by 2025.
- From 2013, China set up the first batch of smart cities pilot, to now, China has become the world's largest number of smart cities.

Introduction to China's Smart Cities

- China's smart city ambitions are arguably the greatest in the world.
- Data show that by 2050, China's urban population will increase by about 292 million, by which time more than 58% of the population will live in cities. At present, china has more than 600 cities, including more than 160 cities with a population of more than one million, of which more than 95% of the sub-provincial cities, more than 80% of the municipal level cities, a total of more than 500 cities, are clearly proposed or are building smart cities.
- In terms of market size, China's 7.9 trillion yuan smart city market size in 2018 will reach 25 trillion yuan market size by 2022, with a compound annual growth rate of about 33.38 percent.

China's smart city's current realization pain point 1 - security and privacy

- Security issues: A large number of IoT smart terminal devices are exposed to public areas and are at high risk of cyberattacks, including data contamination, malicious endpoint access, DDoS network attacks, and the confidentiality and integrity of data and systems can be compromised at any time.
- Privacy issues: Trust and cooperation are the foundation of trusted smart cities, which cover many industries, such as public security, transportation, education, medical and other fields, and carry a large amount of sensitive information, which, if disclosed, will bring immeasurable harm to citizens, business and national information security.
- How to realize the full integration and sharing of data resources without sacrificing privacy is a subject that needs to be solved urgently.

China's smart city's current realization pain point 2 - information island problem

- The construction of smart cities in various places often lacks the planning and design of scientific systems, blindly keen on the construction of individual projects, resulting in the lack of organic links between projects, there are many problems in communication, such as the disunification of data structure and circulation interface, the degree of standardization is not high, the degree of connectivity is seriously inadequate, and so on, which greatly increases the cost of operation and maintenance, time-saving and labor-saving.
- The phenomenon of data silos will also lead to the inability of emergency linkage between the systems, and will lose the role of early warning and prevention.

China's smart city's current realization pain point 3 - inefficient

- In the construction system of smart cities, the flow direction of data is to circulate from bottom to top along the pyramid system architecture
- Perceived data needs to be filtered and cleaned in multiple layers, and then responded by a central decision analysis model, which greatly reduces the efficiency of system processing
- Especially in the two major applications of intelligent traffic and intelligent security, the system can only store, secure and share data, but also can not do real-time, accurate and efficient analysis and decision-making, so it can not completely solve the problem of urban traffic congestion and security emergency

China's smart city's current realization pain point 4 - user participation is insufficient

- Data collection is mainly passive collection, and user participation is insufficient.
- At this stage, the intelligent city perception is mainly video and image, limited by equipment coverage and data acquisition dimensions, the gap between system functions and user needs is often large.
- The function construction of a single system is not closely related to the needs of users, and the public and other government departments are less involved, which can not really achieve the purpose of people-oriented construction.

Blockchain and its typical characteristics

- Blockchain is an organic combination of distributed data storage, point-to-point transmission, consensus mechanism, encryption algorithm and other mature computer technologies.
- Blockchain technology is a new distributed infrastructure and computing method that uses blockchain data structure to validate and store data, distributed node consensus algorithm to generate and update data, cryptology technology to secure data transmission and access, and intelligent contracts composed of automated script code to program and manipulate data.

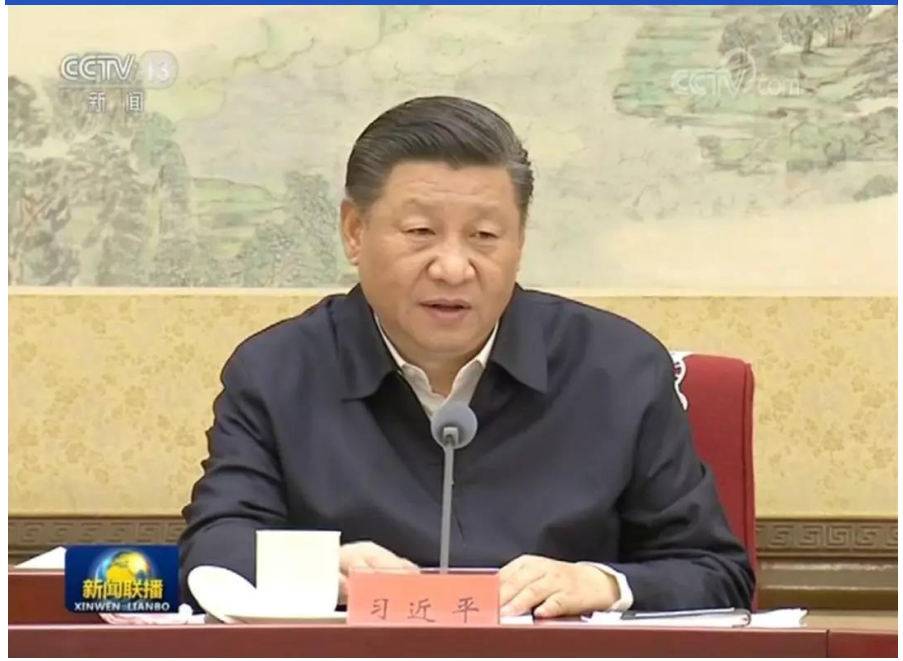
Blockchain and its typical characteristics

- **Centered**: distributed ledger storage, non-centralized institutions, node equalization, data co-maintenance
- **Tamper-proof**: When information is verified and added to the blockchain, it is stored permanently and synchronized across the network, and tampering is extremely costly (unless more than 51% of nodes can be controlled at the same time), effectively preventing malicious data tampering
- **Transparency**: Legitimate nodes and participants can query blockchain data through exposed interfaces
- **Privacy**: Through encryption and account management systems, a user's identity or privacy information can be protected
- **Autonomy**: Based on consensus mechanism, all nodes can safely exchange data, build trust system based on fair rules and open data, and get rid of the trust of specific nodes
- **Autonomy**: With the consensus and trust mechanism of blockchain data, smart contracts deployed on blockchain are executed independently, avoiding the problem that traditional contracts are not controlled and difficult to execute in the process of performance.

Blockchain and its typical characteristics

- **Core technology**
- **Encryption algorithm**: The use of cryptology to ensure the security of the transfer, storage and access of ledger data
- **Consensus mechanism**: Policies and methods for blockchain participants to agree on certain data, behaviors, or processes between nodes under preset rules. Consensus algorithms are used to generate and update ledgers to ensure that each node has the same recognition (consensus) for trading in each block.
- **Smart contracts**: Smart contracts make blockchain programmable. Smart contracts formed using programmable scripts can also be stored and consensused at various nodes like transactions, and smart contracts can be invoked when conditions are met to manipulate transactions in the ledger.

“我国在区块链领域拥有良好基础，要加快推动区块链技术和产业创新发展，积极推进区块链和经济社会融合发展。”



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加快推动区块链技术和产业创新发展

把区块链作为核心技术自主创新重要突破口

习近平在中央政治局第十八次集体学习时强调

- 要强化基础研究，提升原始创新能力，努力让我国在区块链这个新兴领域走在理论最前沿、占据创新制高点、取得产业新优势
- 要抓住区块链技术融合、功能拓展、产业细分的契机，发挥区块链在促进数据共享、优化业务流程、降低运营成本、提升协同效率、建设可信体系等方面的作用

新华社北京10月25日电 中共中央政治局10月24日下午就区块链技术发展现状和趋势进行第十八次集体学习。中共中央总书记习近平在主持学习时强调，区块链技术的集成应用在新的技术革新和产业变革中起着重要作用。我们要把区块链作为核心技术自主创新的重要突破口，明确主攻方向，加大投入力度，着力攻克一批关键核心技术，加快推动区块链技术和产业创新发展。

浙江大学教授、中国工程院院士陈纯就这个问题作了讲解，并谈了意见和建议。

中共中央政治局各位同志认真听取了讲解，并进行了讨论。

习近平在主持学习时发表了讲话。他指出，区块链技术应用已延伸到数字金融、物联网、智能制造、供应链管理、数字资产交易等多个领域。目前，全球主要国家都在加快布局区块链技术发展。我国在区块链领域拥有良好基础，要加快推动区块链技术和产业创新发展，积极推进区块链和经济社会融合发展。

习近平强调，要强化基础研究，提升原始创新能力，努力让我国在区块链这个新兴领域走在理论最前沿，占据创新制高点，取得产业新优势。要推动协同攻关，加快推进核心技术突破，为区块链应用发展提供安全可控的技术支撑。要加强区块链标准化研究，提升国际话语权和规则制定权。要加快产业发展，发挥好市场优势，进一步打通创新链、应用链、价值链。要构建区块链产业生态，加快区块链和人工智能、大数据、物联网等前沿信息技术的深度融合，推动集成创新和融合应用。要加强人才队伍建设，建立完善人才培养体系，打造多种形式的高层次人才培养平台，培育一批领军人物和高水平创新团队。

习近平指出，要抓住区块链技术融合、功能拓展、产业细分的契机，发挥区块链在促进数据共享、优化业务流程、降低运营成本、提升协同效率、建设可信体系等方面的作用。要推动区块链和实体经济深度融合，解决中小企业贷款融资难、银行风控难、部门监管难等问题。要利用区块链技术探索数字经济模式创新，为打造便捷高效、公平竞争、稳定透明的营商环境提供动力，为推进供给侧结构性改革，实现各行业供需有效对接提供服务，为加快新旧动能接续转换、推动经济高质量发展提供支撑。要探索“区块链+”在民生领域的运用，积极推动区块链技术在教育、就业、养老、精准脱贫、医疗健康、商品防伪、食品安全、公益、社会救助等领域的应用，为人民群众提供更加智能、更加便捷、更加优质的公共服务。要推动区块链底层技术服务和新型智慧城市建设相结合，探索在信息基础设施、智慧交通、能源电力等领域的推广应用，提升城市管理的智能化、精准化水平。要利用区块链技术促进城市间在信息、资金、人才、征信等方面更大规模的互联互通、保障生产要素在区域内有序高效流动。要探索利用区块链数据共享模式，实现政务数据跨部门、跨区域共同维护和利用，促进业务协同办理，深化“最多跑一次”改革，为人民群众带来更好的政务服务体验。

习近平强调，要加强对区块链技术的引导和规范，加强对区块链安全风险的研究和分析，密切跟踪发展动态，积极探索发展规律。要探索建立适应区块链技术机制的安全保障体系，引导和推动区块链开发者、平台运营者加强行业自律、落实安全责任。要把依法治网落实到区块链管理中，推动区块链安全有序发展。

习近平指出，相关部门及其负责领导同志要注意区块链技术发展现状和趋势，提高运用和管理区块链技术能力，使区块链技术在建设网络强国、发展数字经济、助力经济社会发展等方面发挥更大作用。

Blockchain and Smart Cities -- Addressing Pain Points -- New Opportunities

- **Blockchain technology**, by means of its core technical characteristics, re-establishes social trust and becomes an important support for the orderly operation of smart cities, which can effectively solve the problem of shared trust among multiple entities.
- The development of **smart city** will certainly increase the openness, sharing and utilization of public data resources, and the natural advantages of blockchain technology can separate data ownership and use rights, and promote data fusion between different government departments, different industries and different enterprises
- Blockchain technology, which is the second generation Internet-value Internet-important value transmission protocol, will become the infrastructure of smart cities, especially in the series of infrastructure reconstruction projects at the bottom of the financial industry, and the self-controlled blockchain technology will become the core competitiveness.

Blockchain and Smart City - Solve Pain Point 1 Security and Privacy

- Blockchain can ensure the security of the terminal of the whole intelligent city system through strict identity verification mechanism and crypto-based data encryption mechanism.
- Each end device will have its own public-private key pair, and the blockchain system maintains a list of terminal identities through smart contracts and audits whether the device has access to the node and uploads the data, thus avoiding maliciously interrupted access and data contamination.
- Each terminal data will be transmitted encrypted to ensure that there will be no data leakage during the data transfer process.

Blockchain and Smart City - Solve Pain Point 2 Information Island

- Blockchain breaks down data silos between traditional smart city systems.
- Blockchain is particularly suitable for data sharing across enterprises and systems, with the original data or data fingerprints of each system chained without changing the original system. Data sharing must realize the identity verification of blockchain, and the fusion of CA technology will be the original anonymization of blockchain into a trusted blockchain, through authentication and consensus permission settings to divide the rights and responsibilities between systems and people.
- Blockchain is provided with a strict and precise timestamp mechanism, and with its own non-tamperable, traceable properties, any processing of data will be traced and traced on the chain. In addition, the increase in data dimensions has greatly improved the accuracy of big data analytics and artificial intelligence algorithms, and enables more accurate and targeted service and management models.

Blockchain and Smart City - Solution Pain Point 3 Treatment Time

- Blockchain protects edge computing.
- Edge computing is an effective means to improve the time-thy-time of intelligent city system, but the equipment security problem, maintenance and construction cost and accuracy problem of edge computing can't be widely used on a large scale.
- Blockchain distributed data storage mechanism and point-to-point network topology can be well integrated with edge computing applications, blockchain non-tamperable data storage characteristics can improve the data security of edge nodes, authentication and permission control can provide access mechanism for devices exposed to public areas, data encryption management can provide privacy protection functions for edge devices

Blockchain and Smart City - Solve Pain Point 4 Participation Enthusiasm

- Blockchain technology can maximize the motivation of citizens for social governance.
- Traditional, centralized public regulatory platforms or self-media platforms do not have credibility, nor can they prove themselves.
- The real identity and credible data in the blockchain architecture provide the guarantee for the public to upload all kinds of illegal and illegal information through the mobile terminal, the blockchain records the illegal and illegal acts in the system, and gives some incentive to the public's effective supervision behavior, so as to improve the public's participation and enthusiasm in urban management. Once found to be illegal and illegal, the actions of the regulator will be linked to personal credit, bank credit and other important areas, to form a certain degree of binding force on the public.

Current application progress

- **Key scenarios for smart city blockchain technology applications:**
- **People's Livelihood Services (Smart Medical, Smart Education)**
- **Urban governance (smart government, smart transportation, public safety)**
- **Industrial Economy (Smart Internet of Things, Smart Industry)**
- **Eco-liveable (smart energy, smart new retail)**

Current application progress-people's livelihood: smart medical care, intelligent education

- **Smart medicine:** blockchain technology for native data encryption certificate, privacy protection, authorization sharing, timestamp traceability, asset right and other technical applications, to promote the development of medical information, medical data storage and sharing, medical information tracing, medical insurance reform and other application scenarios.
- **Education data security storage and sharing**: the education data stored in different blocks, the nodes on the chain through a specific protocol to achieve the authorization of data resources sharing, to solve the problem of data silos in the field of education.
- **Educational business process optimization**: building a centered education system, improving the monopoly of traditional services and resources by schools and government agencies, exploring the feasibility of qualified educational institutions to carry out educational services and issue relevant certification, and realizing the complementarity of formal education and social education resources.
- **Education Smart Contract**: Using blockchain's smart contract technology, we can build an efficient and intelligent network learning community, realize the automated execution of education resource upload, authentication, flow and sharing, reduce the cost of resource sharing, improve the efficiency of resource sharing, and monitor the ecological environment of the community in real time.

Current application progress-urban governance scenario: intelligent government affairs, intelligent transportation

- **E-government**: Blockchain technology provides a secure and trusted environment for cross-level and cross-sectoral data connectivity, independent authorization of access parties and access data, and data sharing through blockchain networks.
- **Power supervision**: blockchain technology can break the information island, through blockchain links to various departments of documents, data movement, multi-sector, multi-information cross-sharing, to ensure real-time update of information, for digital anti-corruption (big data detection) to provide new means and sources of data.
- **Efficient traffic governance**: the Internet of Things can obtain road and traffic information in real time, blockchain can achieve low-cost connectivity between these IoT devices, cross-system data transmission, sharing sink to the blockchain layer, reduce the complexity of intelligent transportation systems, promote the efficient and intelligent operation of the overall transportation network.

Current application progress - industrial economy: smart Internet of Things, smart industry

- **Smart Internet of Things Internet of Things (IoT) device scale access**: Internet of Things data industry upgrade brings a huge number of device access, it is expected that the number of public network machines to machine connections more than 100 million, "central cloud and small-scale deployment" of the traditional form of Internet of Things communication has been unable to meet the development needs. Blockchain technology can solve the problem of the scale of the Internet of Things, through multiple blockchain nodes to participate in the verification of the Internet of Things system, the Information in the Internet of Things recorded in a distributed ledger, replacing the role of the central cloud, at a lower cost to achieve the interconnection of connected devices.
- **Smart industry security**: to blockchain smart contract consensus execution way to obtain and verify device identity, device owners to access the policy published to the blockchain, and through smart contract policy management, device visitors to the device access to comply with the policy, in the process of device operation and use, with blockchain technology can not tamper with device-related operating status data, to ensure that the industry chain enterprises can access trusted, consistent device operation data.

Current application progress - ecological livability: smart energy, smart new retail

- **Smart energy energy production**: energy production data produced by the hardware infrastructure of energy manufacturers, localized storage, often form an island of data, can not produce information value. By combining with IoT equipment, on the basis of data acquisition, blockchain technology can be used to realize the trustworthy, secure storage and sharing of production data, improve monitoring accuracy, mine data value, and create an information base for government supervision and co-ordination and enterprise collaboration.
- **Smart new retail commodity traceability**: Blockchain allows participants in the entire life cycle of goods (including origin, producers, channels, retailers, brands, consumers, etc.) to be integrated into supply chain management, building a data trust base through multi-participation data maintenance to meet product lifecycle traceability and data reliability issues.

Current Application Progress – Top Ten Smart Cities and Blockchain

The outlook for the future

- Blockchain technology is being applied in various fields of smart city construction and has become an important driving force for smart city construction and digital city transformation.
- Blockchain is set up with a strict and precise timestamp mechanism, and any processing of data will leave traces and traces on the chain, increasing the scientific effectiveness of big data analysis in the data sharing process. Blockchain technology will play a guiding role in the overall construction of smart cities.
- However, the technical barriers of blockchain itself still exist, how to carry out the large-scale application of blockchain landing scene, how to serve the public and promote the real economic development is a major issue for the future of blockchain.
- Compared with the sky-high talk, more need to be down-to-earth large-scale small applications

The main references

- 1. 2020 Blockchain and Smart Urban Development Layout Guide . https://www.sohu.com/a/364413883_100217347
- 2. Blockchain and Smart City White Paper. https://www.sohu.com/a/402481094_100017903
- 3. Scheming - Blockchain Applications Urgently Need Model Innovation - 2019 Trusted Blockchain Summit Report
- …

- Some related content and pictures from the network, here to thank!
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Thank you for your attention