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China Securities Depository
and Clearing Corporation Limited

CSDC's Exploration on Blockchain Technology

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I. Overview of Blockchain Technology

Major Events in Blockchain Development

2008-09

- In Nov, 2008, Satoshi Nakamoto published the paper "Bitcoin: A Peer-to-Peer Electronic Cash System".
- In Jan, 2009, Bitcoin was born.

2012-14

- Bitcoin trading volume kept growing.
- In 2013, Bitcoin price rose sharply by over 100 times, and then slumped after the People's Bank of China (PBC) issued a notice on guarding against the risk of Bitcoin.
- In Feb, 2014, Ethereum project was presented to public.

2016

- In January, PBC held Digital Currency Seminar.
- In April, Chinaledger was founded.
- In November, R3 released code for Corda.
- 26,000 new projects on Blockchain had been created on Github by Dec, 2016.

2010-11

- In Feb, 2010, Bitcoin exchanges emerged.
- On May 22, 2010, a developer bought two pizzas using 10,000 Bitcoin, which is the first transaction of real consumption with Bitcoin .

2015

- In March, development of digital currency was promoted by a series of reports issued by UK government.
- In September, R3cev was founded to build a banking Blockchain alliance.
- In December, Linux Foundation initiated Hyperledger, an open source project.

2017

- In June, PBC opened a Digital Currency Research Institute.
- In August, hard fork occurred, and Bitcoin Cash was born.
- Domestic regulation of digital currency became stricter and ICO tended to calm.
- In December, Bitcoin futures began trading on Chicago Mercantile Exchange.

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Development of Blockchain Technology in China

Frontier of Industry

- Nearly 20 industry associations and consortiums, such as Chinaledger and The Financial Blockchain Shenzhen Consortium, have been set up from Dec, 2015 to the end of 2017.
- China's Ministry of Industry and Information Technology (MIIT) released "Reference Architecture for Blockchain" and "Data Format Specification for Blockchain" in 2017 in forums.
- Number of issued patents related to Blockchain in China has raised from 2 in 2014 to 428 by Jun, 2017.

National Policy

- MIIT published the white paper on Blockchain technology and its applications in the country in Oct, 2016.
- "National Informatization Planning for 13th Five-Year" was Issued by the State Council in Dec, 2016.
- "Information Technology Development Plan of China Financial Industry in 13th Five-Year" was issued by PBC in Jun, 2017.
- Public Notice of the PBC, CAC, MIIT, SAIC, CBRC, CSRC and CIRC on Preventing Risks of Fundraising through Coin Offering came out in Sep, 2017.

Exploration

- Technical validation in the areas of digital bill transaction , payment and clearing, electronic voucher depository, supply chain finance, logistics, etc.

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Concept & Characteristics

Blockchain is an underlying technology of digital currency, using cryptographic algorithm, peer-to-peer network and consensus mechanism, in which the distributed ledger is collectively maintained in a decentralized way.
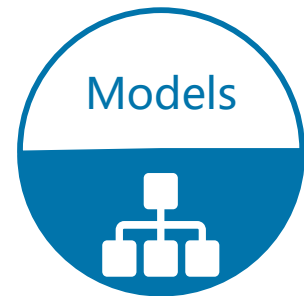
Features

- Decentralization
- Tamper-resistance
- Traceability
- Anonymity
- High reliability
- Programmability

Principles

- Consensus mechanism
- Cryptographic algorithm
- P2P communication
- Smart Contracts

Models

- Public Blockchain
- Consortium Blockchain
- Private Blockchain

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II. POC (Proof of Concept) Projects in CSDC

Overview of Blockchain Exploration in CSDC

- A **research group** was set up to study on Blockchain technology derived from Bitcoin.

- **Tentative analysis** of the impact of Blockchain technology on China's securities market and its applications in the depository and clearing business.

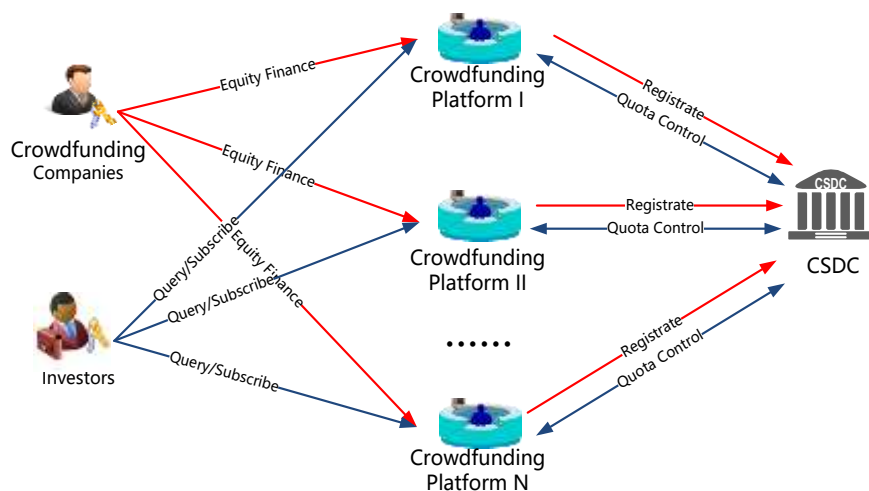- Conducting POC in an **equity crowdfunding** scenario.

Stage 1 2016

Stage 2 2017

- **Studying** the Blockchain technology **in-depth**, with emphasis on the Ethereum platform and Smart Contract technology.

- Selecting **securities pledge** business to **build Blockchain POC project**.
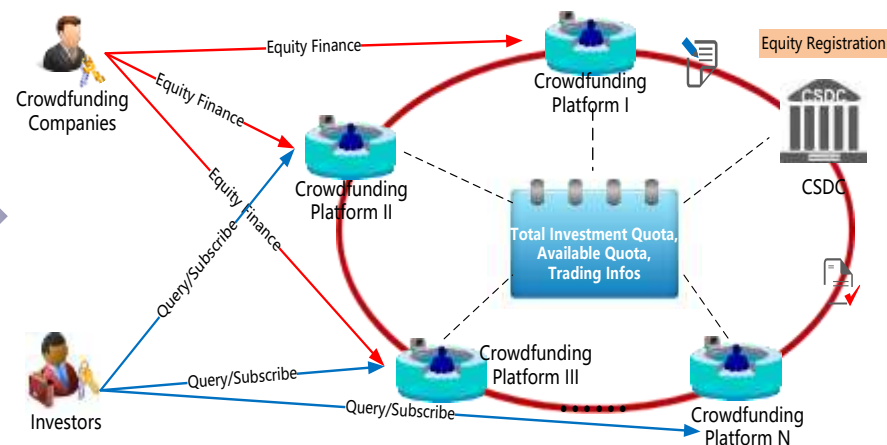
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Traditional Mode

Equity Crowdfunding's quota control is implemented by CSDC in a centralized way, facing challenges to provide 7*24h service.

Blockchain Mode

Each Crowdfunding platform can share quota data in real-time manner and provide nonstop service even if any node is closed.

Characteristics of Equity Crowdfunding Quota-Control Blockchain

- **7*24h operation and distributed deployment**

  The relevant parties can directly handle business through Blockchain, reducing intermediate links.
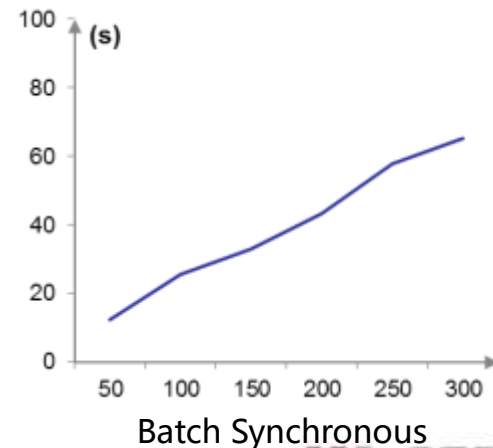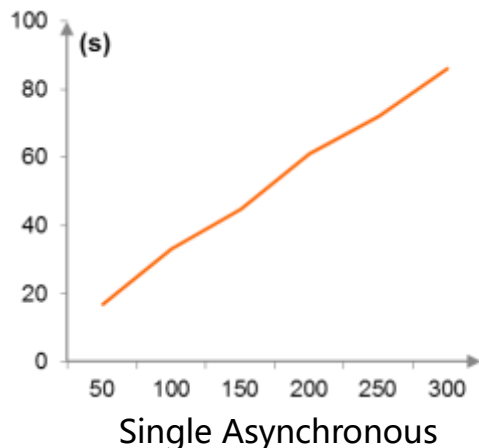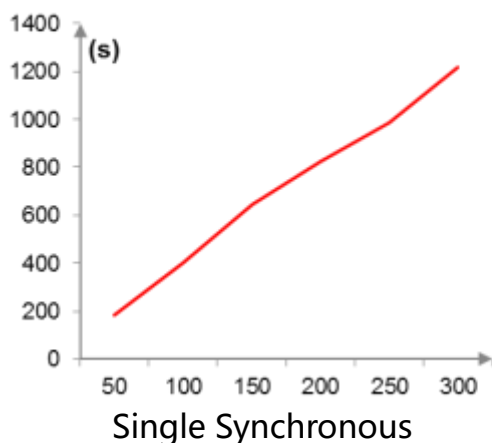
- **Data sharing**

  Data sharing and tamper-resistance meet credibility and real-time processing requirements.

- **Lower performance**

  Cryptographic verification, consensus process and data synchronization lead to performance problems.
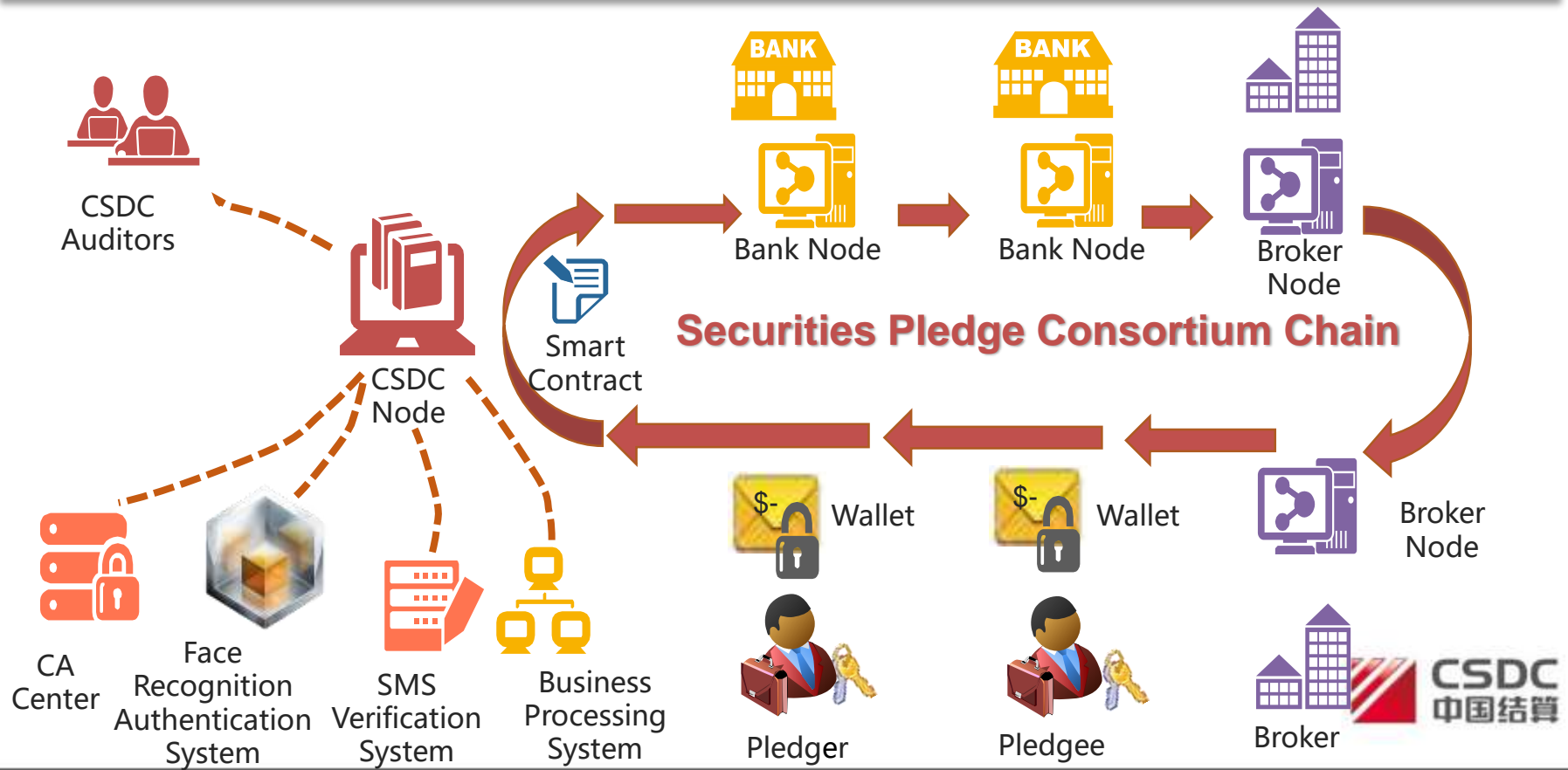
Quota Update Test Results

Single Synchronous

Single Asynchronous

Batch Synchronous

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- Securities Pledge refers to an activity in which the borrower(Pledger) uses securities as a form of collateral to secure the funds from the lender(Pledgee), which is an important financing channel for investors.

- The main participants include CSDC, pledgees, pledgers, brokers, etc. These participants can build consortium chain to conduct the pledge business, ensuring the tamper-resistance and traceability.

Securities Pledge Consortium Chain

CSDC Auditors

CSDC Node

Smart Contract

BANK Bank Node

BANK Bank Node

Broker Node

Broker Node

Wallet

Wallet

CA Center

Face Recognition Authentication System

SMS Verification System

Business Processing System

Pledger

Pledgee

Broker

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Characteristics of Securities Pledge Blockchain

- Data processing and identification verification are still implemented in off-chain systems docked with the chain through a safe and isolated **proxy system**.

- **Smart Contract** is used to automate business processes, reducing the risks of human intervention.
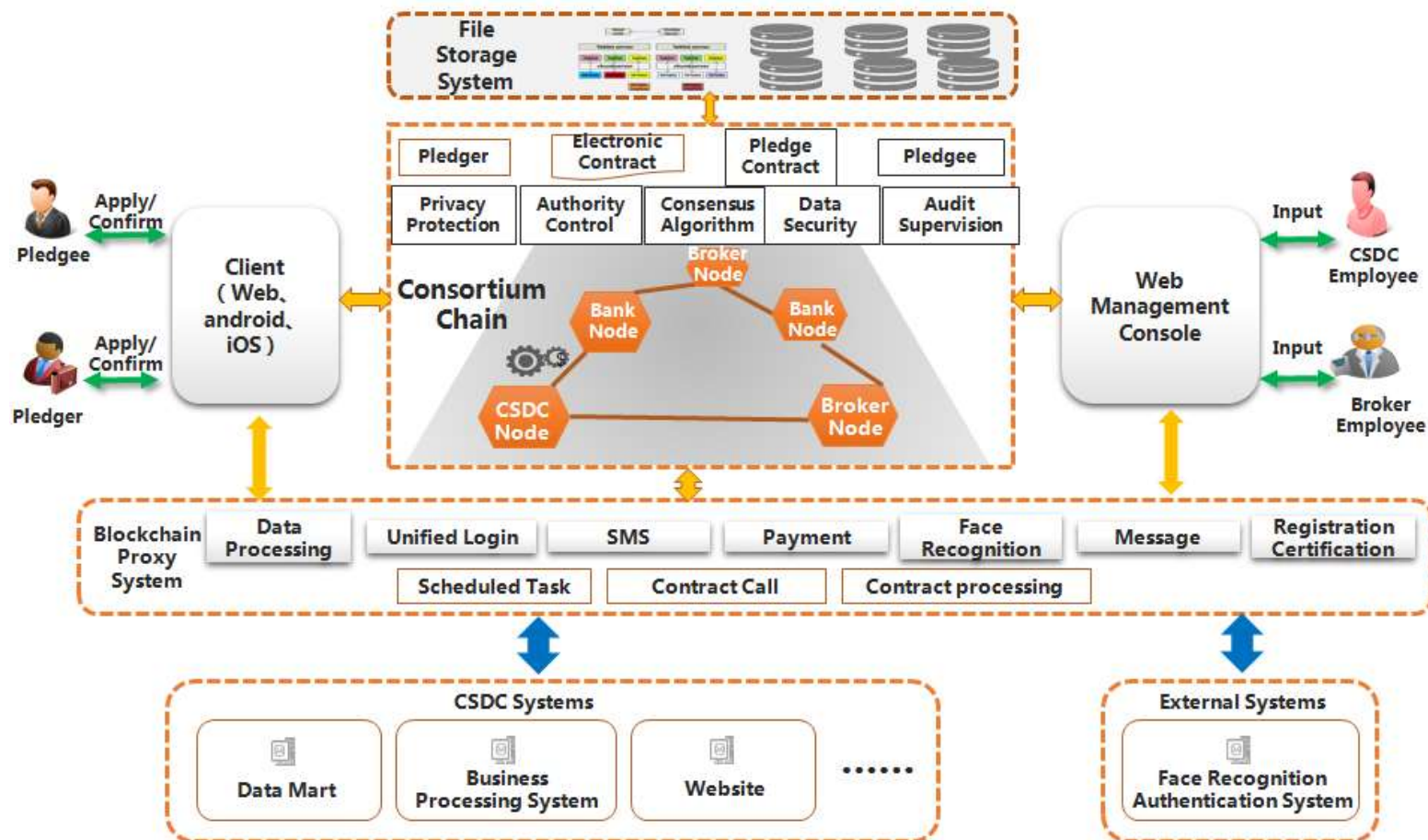
Summary on POC Projects

Summary
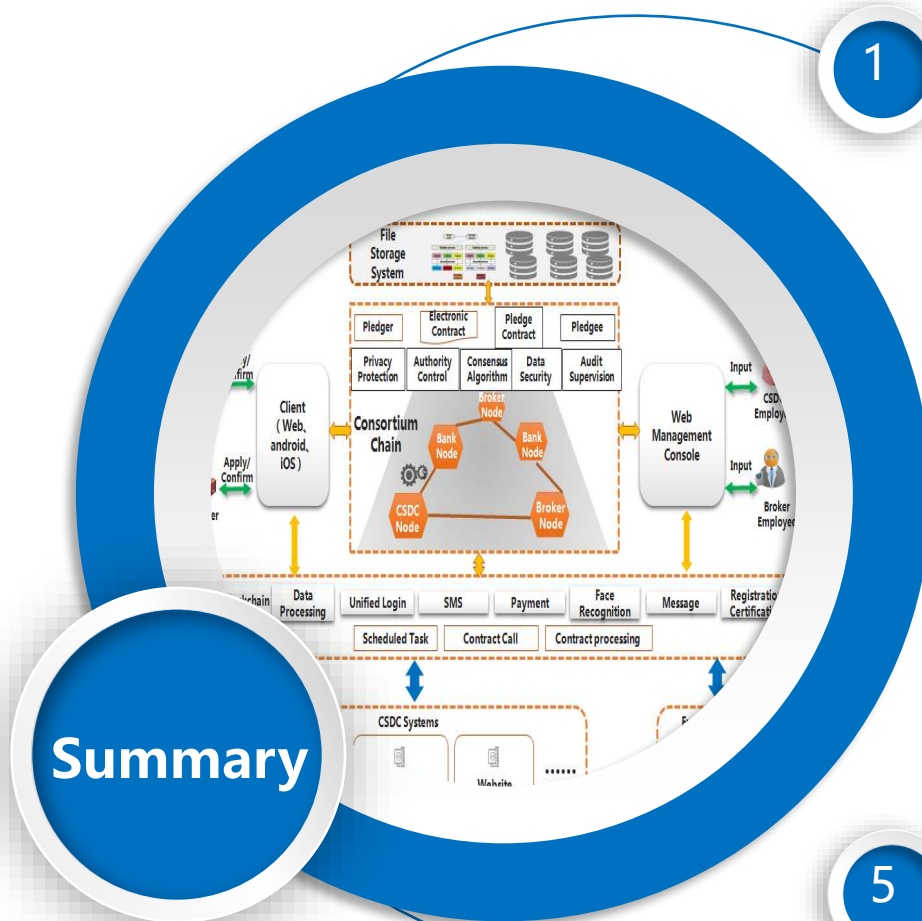
1 **Anonymity**
This characteristic of Blockchain is difficult to meet the real-name regulation.

2 **Distributed storage and consensus mechanism**
Reducing the performance compared with traditional processing methods.

3 **Smart Contract**
Smart Contract can automate the process to ensure the credibility, but it can not guarantee the credibility of the off-chain data, which relies on the provider.

4 **Security issues**
Need more emphasis on issues like private key security, data security, etc.
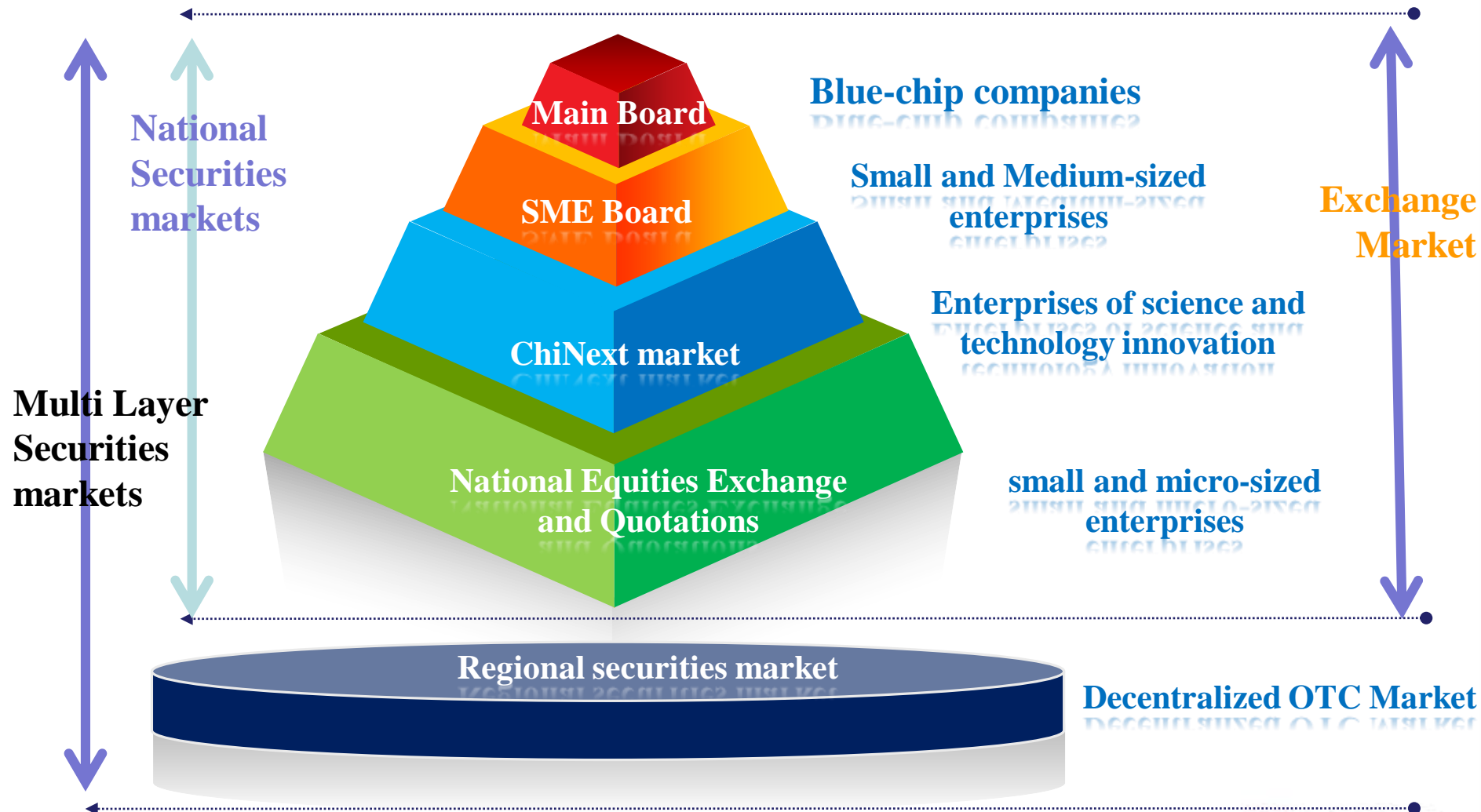
5 **Decentralization**
Absolute decentralization is unnecessary. We still need off-chain application systems in many cases.

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III. Impact on China's Securities Market and Application Analysis

China's Securities Market Overview

National Securities markets

Multi Layer Securities markets

Exchange Market

Main Board

SME Board

ChiNext market

National Equities Exchange and Quotations

Regional securities market

Blue-chip companies

Small and Medium-sized enterprises

Enterprises of science and technology innovation

small and micro-sized enterprises

Decentralized OTC Market

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Features of China's Securities Exchange Market

- Over 100 million investors and 300 million securities accounts
- More than 50 million daily transfer
- High demand on trading efficiencies and data storage

Account Management

➢ Real-name requirement
➢ Centralized account opening
➢ Open and maintain account according to the Securities Law
➢ Licensed broker as account opening agent

Registration & Depository

➢ Direct-holding
➢ Fully dematerialized
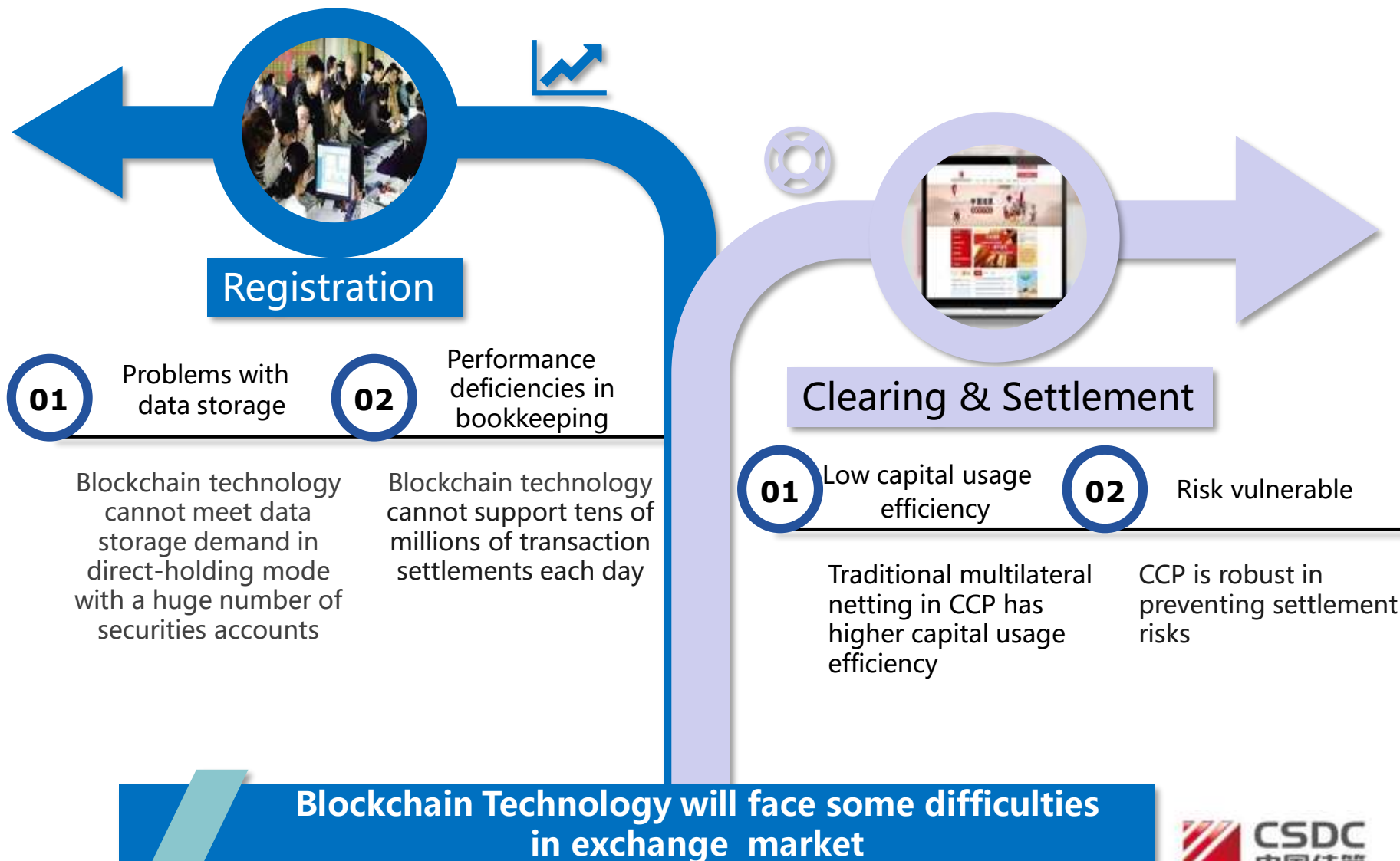➢ Centralized registration & depository

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Clearing & Settlement

➢ Diverse Settlement Model
（CCP netting settlement, RTGS）
➢ Cross-border settlement for certain products

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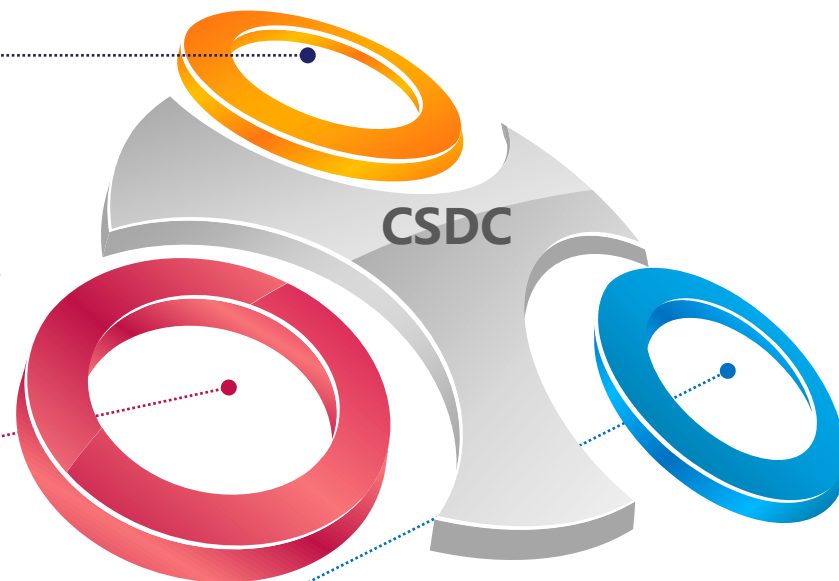
Application Analysis of Blockchain Technology in Exchange Market

Registration

01 Problems with data storage

02 Performance deficiencies in bookkeeping

Blockchain technology cannot meet data storage demand in direct-holding mode with a huge number of securities accounts

Blockchain technology cannot support tens of millions of transaction settlements each day

Clearing & Settlement

01 Low capital usage efficiency

02 Risk vulnerable

Traditional multilateral netting in CCP has higher capital usage efficiency

CCP is robust in preventing settlement risks

Blockchain Technology will face some difficulties in exchange market

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Features of China's Securities Decentralized OTC Market

- Loose regulations and segmented markets
- Lower volume and lower demand on performance
- Decentralized trading, transfer mainly by agreement

Summary

Blockchain technology has limited impact on exchange market due to deficiencies in performance and data storage. However, it may be utilized in low frequency business such as Securities Pledge .

1 **Exchange Market**

Decentralized OTC Market **2**

Blockchain technology as distributed ledger technology is a good match for settlement in decentralized trading market. We could further explore the application of Blockchain technology in regional OTC market .

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IV. Considerations & Recommendations

Considerations

How to prevent attacks on Blockchain platform?

How to maintain and upgrade the system collaborated with Consortium Blockchain ?

How to manage private key using technical means?

How to solve real-name problems to meet regulatory requirements of KYC(Know Your Customer) ?

How to protect privacy as information of clients is shared by all the nodes on Blockchain?

How to improve performance of Blockchain platforms to satisfy higher business requirements?

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Recommendations

- Tracing and exploring new technologies to improve performance and privacy protection in Blockchain

- Strengthening collaboration in the industry and making a tentative work to establish industry union to explore Consortium Blockchain

- Setting up central custodian for private keys and exploring unified account and authentication system as market infrastructures

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Thank you!

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