Digital Currencies Digital Assets Digital Economy and Finance

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Current Academic Positions

- Adjunct or visiting pprofessor teaching for National University of Singapore (NUS), Nanyang Technological University (NTU), Singapore Management University (SMU), Singapore University of Social Sciences (SUSS), Renmin University of China (人民大学) and Tsinghua University (清华大学) in Beijing, and Hong Kong Financial Services Institute
- Co-founder and Director of Lee & Pei Finance Institute （李白金融学院）

Current Professional Positions

- Member of AI Ethics Review Board, Singapore Computer Society
- Board member of Blockchain Association Singapore
- Senior Consultant of RHT Compliance Solutions, RHTLaw Asia, Singapore
- Professional Council member for Chartered FinTech Professional (CFtP), Global Fintech Institute
- Member of Academic Committee for "China's Greater Bay Area – ASEAN Research Centre" of Shenzhen University
- Angel Investor, Adviser and Mentor of several Fintech start-ups

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Statement 声明

The views expressed here are purely the views of the presenter, they do not reflect the official policy or position of any organization

这里表达的纯属讲员的观点,
不反映任何组织的官方政策或立场

Quiz

1. Digital currency is cryptocurrency?

   No, cryptocurrency is just one type of digital currencies

Quiz

2. Digital assets are cryptocurrencies?

    No, cryptocurrencies do not equal to digital assets

Quiz

3. We can use everyday computers to mine cryptocurrencies?

Yes. You can use everyday computer or crypto mining rig to mine cryptocurrencies - solve mathematical puzzles, verify transaction blocks, and mint new coins.

Quiz

4. The "Crypto Winter" shows that the prospect for blockchain is bleak and gloomy?

   No, cryptocurrencies is only one of the many applications of blockchain technology

   Lawrence Wong: *"Early forecasts have proven too optimistic, and it is **<u>still not clear</u>** that blockchain technology will develop beyond limited use cases into a game-changer for a wide range of industries. This is why we are piloting specific use cases to test the possibilities in the financial sector."*

Outline

Part 1: What is digital finance (and economy)?

How did it emerge and rise?

Part 2: Class 101 - some core concepts of blockchain

Part 3: Singapore digital finance ecosystem

Part 4: Governance and Regulations

Part 5: Leveraging on national digital competitiveness for Singapore companies

What is digital finance (and economy)? And, how did it emerge and rise?

GFC exposed problems of existing financial system
全球金融危机暴露现有金融系统存在的问题

- How was "casino finance" (refers to highly risky / leveraged investment, e.g., subprime mortgages, CDO^2 and CDO^3) useful to the real economy?

- Was it ethical to give massive bonuses to senior executives when banks were making massive losses?

  (e.g., Merrill Lynch lost US$15 bn 4Q 2008, but still paid US$ 121 mio to top 4 executives)

- Can you trust your financial advisory services providers anymore?

  (e.g., "mini-bond" saga in Singapore and HK)

- Were financial firms behaving in a socially responsible manner? Were they environmentally responsible?

SUBPRIME MORTGAGES

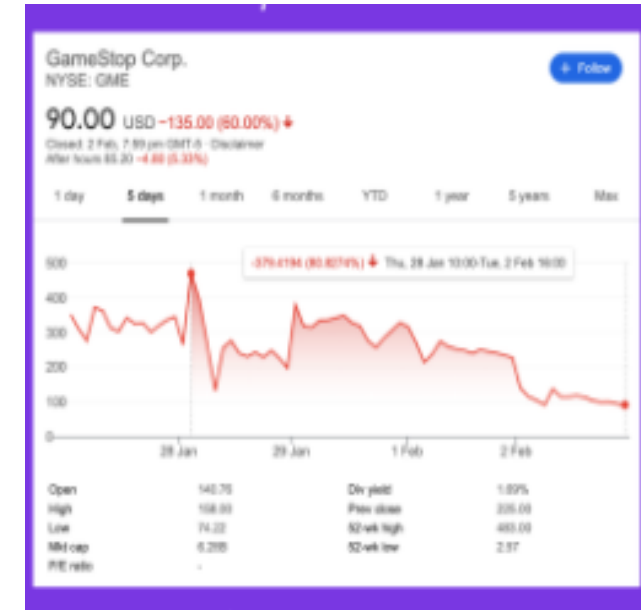"I THOUGHT WE WERE JUST BUYING A HOUSE!"
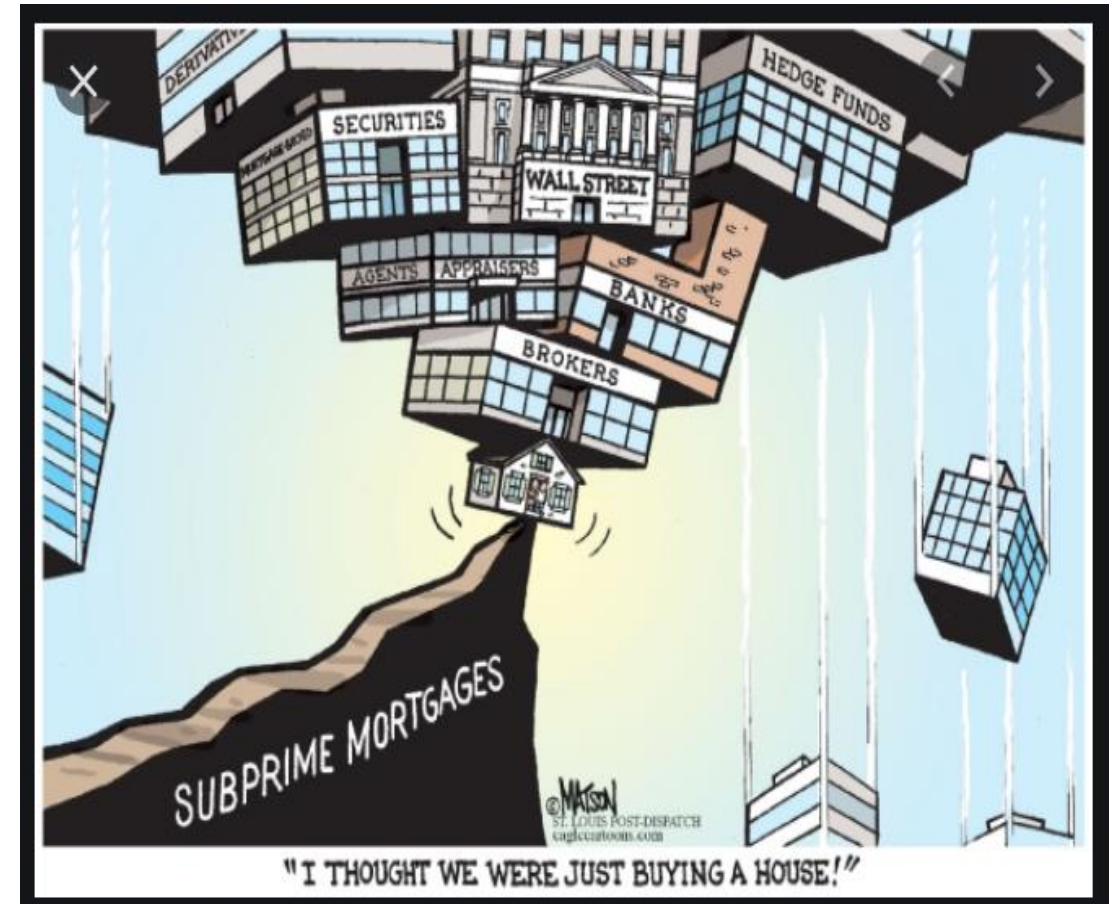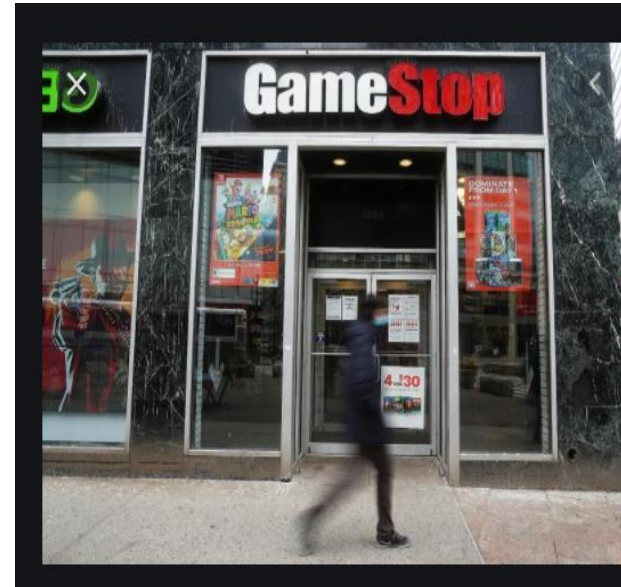
Wall Street vs Main Street 华尔街对峙大(主)街运动

- **Main Street (representing ordinary people) strongly called for: -**

  - financial service industry must truly serve the enterprises (especially SMEs), people and families, and community

  - must serve the under-banked and unbanked

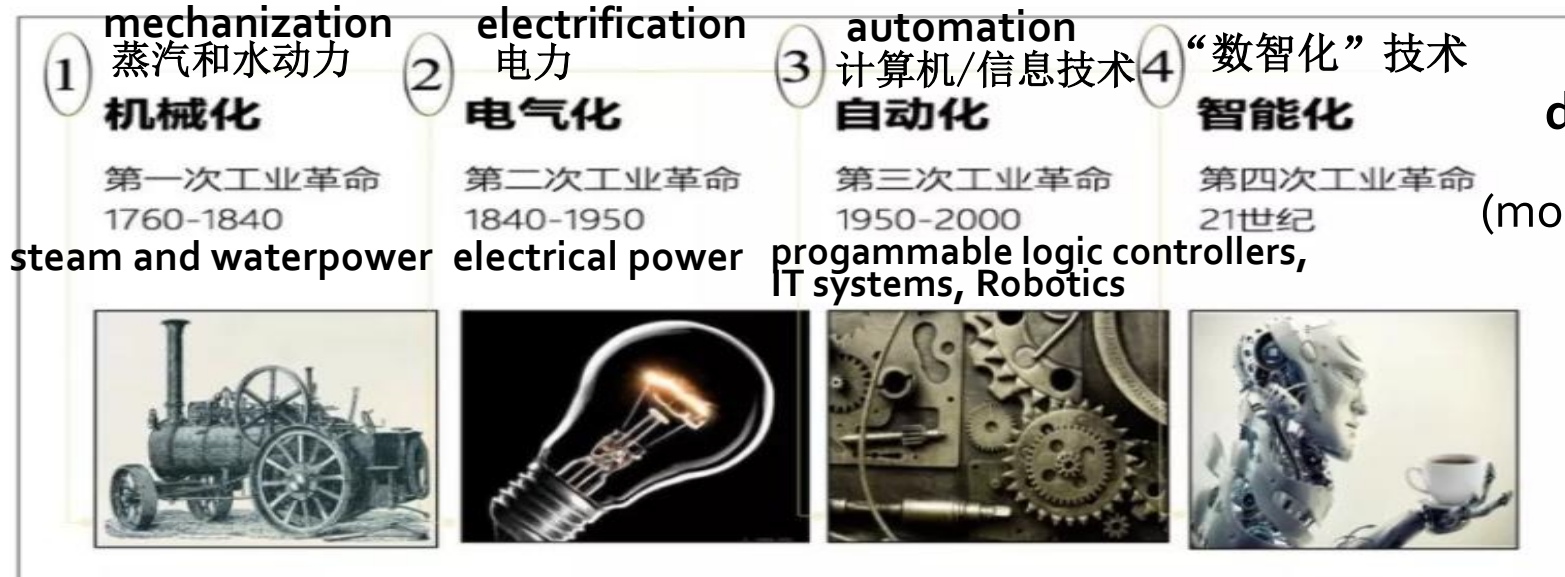- **Strong desire to improve or even transform Wall Street - existing crony capitalist financial system**
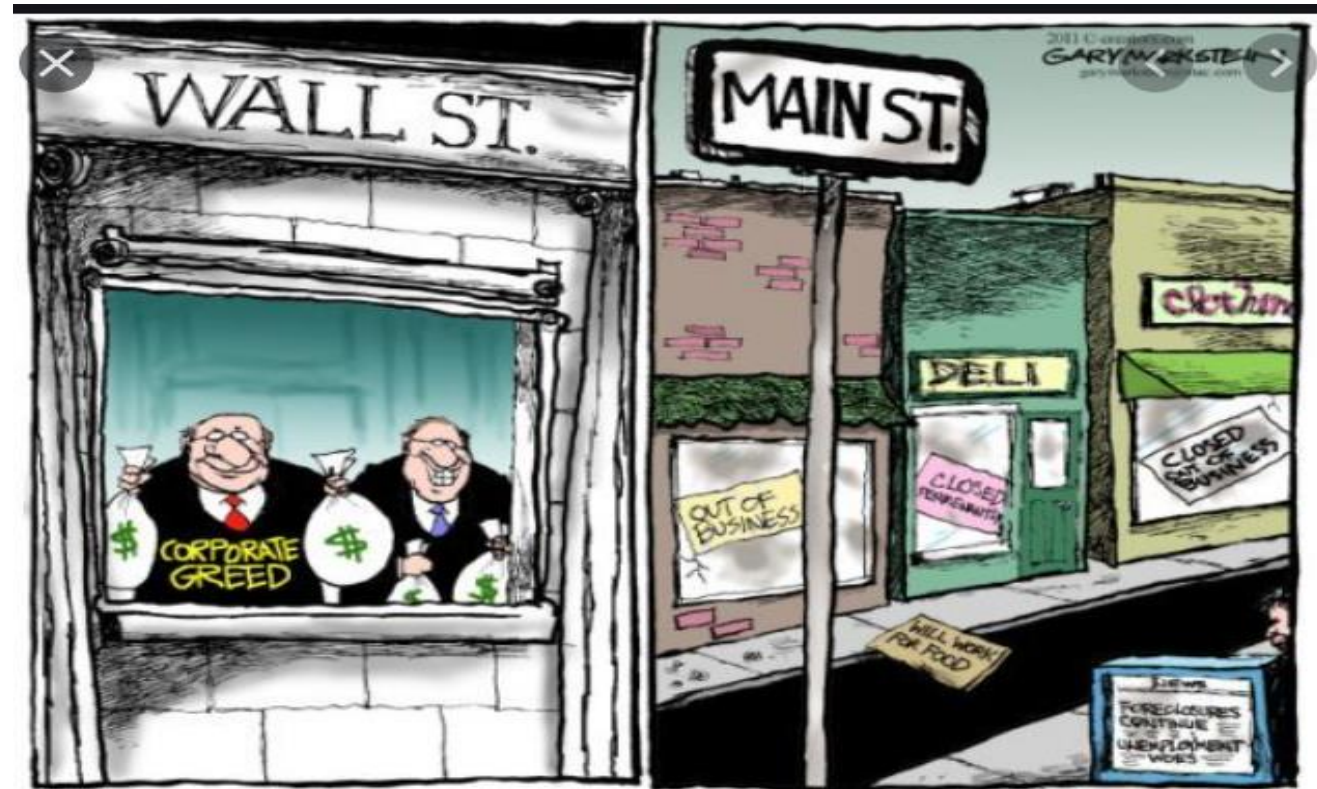
GameStop (游戏驿站) short squeeze 轧空revealed shortcomings of legacy financial infrastructure
（被视为华尔街对峙大(主)街的一场斗争）

- retail investors were blocked from trading during a period of volatility while Wall Street institutional investors could still trade as they have many privileged channels

    （多个证券经纪公司，包括罗宾汉免费交易app 暂停用户购入游戏驿站及其他一些关联股票，但华尔街机构投资者却有特权交易通道）

- retail investors can never win against those favored with information advantage and deep pocket, and well-connected

    (散户永远无法战胜那些拥有信息优势和财力雄厚的投资者)

- shortcomings: slow settlement cycles, inefficient price discovery, entry barriers, manipulation by central parties etc....

GameStop Corp.
NYSE: GME

90.00 USD −135.00 (60.00%)

(Reference: "Democratise finance by decentralizing, not mopping", Pei Sai Fan and Yu YingHui, Business Times, 9 Feb 2021)

At the same time, the advent of Industrial Revolution 4.0 and digital technology....

mechanization
蒸汽和水动力

① 机械化
第一次工业革命
1760-1840
steam and waterpower

electrification
电力

② 电气化
第二次工业革命
1840-1950
electrical power

automation
计算机/信息技术

③ 自动化
第三次工业革命
1950-2000
progammable logic controllers, IT systems, Robotics

④ "数智化" 技术
智能化
第四次工业革命
21世纪

digitization and smart technologies
(mobile devices, processing power - AI, robotics, quantum computing, storage capacity-cloud services and data-IOT etc..)

" This Fourth Industrial Revolution is characterized by **a range of new technologies that are fusing the physical, digital and biological spheres** (一系列融合物理、数字和生物领域的新技术), impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human."

(Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum in his new book "The Fourth Industrial Revolution)

The Fourth Industrial Revolution
Klaus Schwab
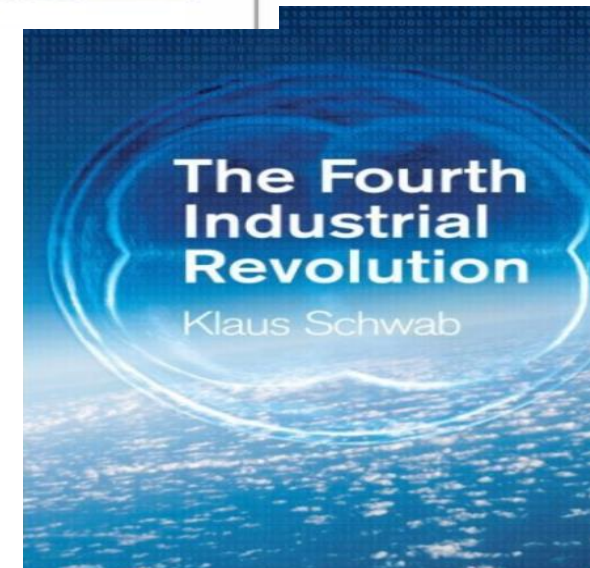
At the same time, the advent of Industrial Revolution 4.0 and digital technologies....

"BASIC"

B: Blockchain 区块链

A: AI/AR 人工智能/虚拟现实
（包括Data Science 大数据）

S: Cyber Security 网络安全

I: IoT 物联网

C: Cloud and Quantum Computing 云运/量子算力

The timely arrival of digital (and mobile) technologies and "fintech" has enabled "**financial inclusion**" and "**sharing economy**"

Integration of new technologies empowers new applications
一系列技新术融合赋能新的应用场景

(Source: Schulte Research Estimates, from the book "AI & Quantum Compting for Finance & Insurance, by Paul Schulte and David Lee Kuo Chuen World Scientific, 2019)
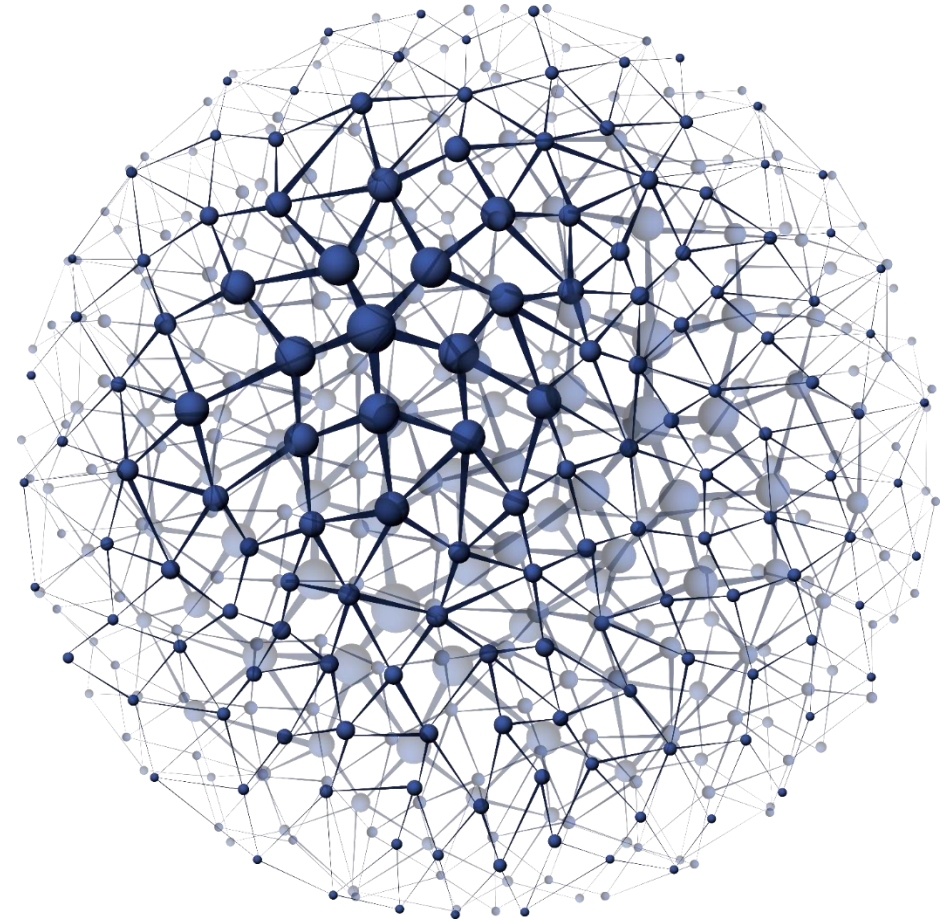
Integration of new technologies empowers new applications
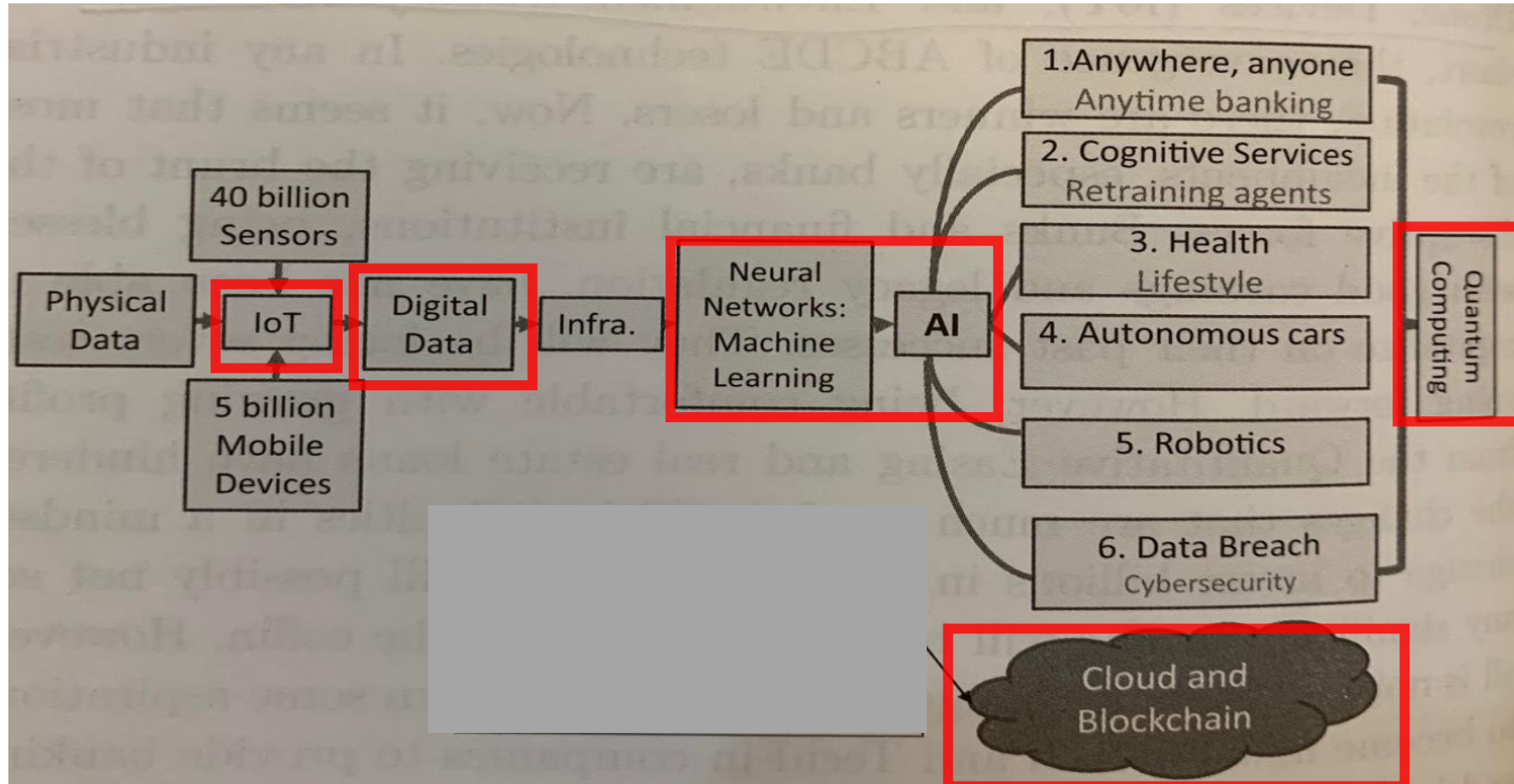## 一系列技新术融合赋能新的应用场景

虚拟现实/扩增实境/非同质化代币 VR / AR/NFT ➡ Metaverse ⬅ 5G / 6 G

40 billion Sensors

Physical Data

IoT

Digital Data

5 billion Mobile Devices

Infra.

Neural Networks: Machine Learning

AI

1. Anywhere, anyone Anytime banking

2. Cognitive Services Retraining agents

3. Health Lifestyle

4. Autonomous cars

5. Robotics

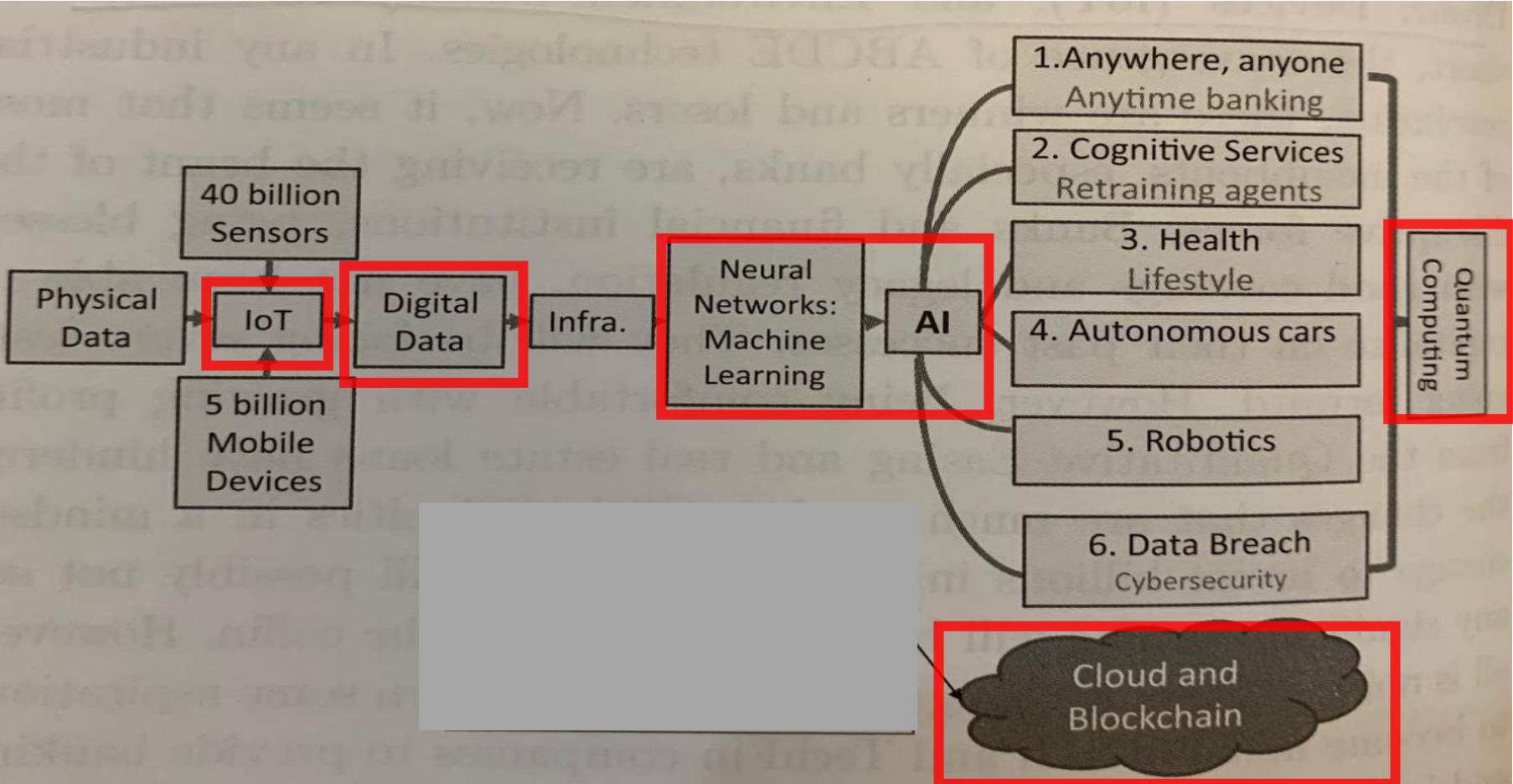6. Data Breach Cybersecurity

Quantum Computing

Cloud and Blockchain

(Source: Schulte Research Estimates, from the book "AI & Quantum Compting for Finance & Insurance, by Paul Schulte and David Lee Kuo Chuen World Scientific, 2019)

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Digitization ➡ Digitalization ➡ Digital Transformation

- **数位化(Digitization)** 将信息从物理格式转换为数字格式的过程, 例如将文本、图片或声音转换为计算机可以处理的数字形式 (如二进制)
  (convert analog data into digital form)

- **数字化 (Digitalization)** 使用数字技术来改变商业模式, 如业务流程数字化, 以提高效率降低成本
  (apply digital technologies to streamline and make processes more efficient)

- **数字化转型** (**Digital transformation**) 战略性地利用数字技术, 改变企业文化, 在根本上改变企业与员工运作方式, 提供更卓越的客户体验, 以提供新的收入和创造新的企业价值。是个长期的目标
  (strategically use digital technologies to create new business models and customer value propositions which requires changes to culture, operating structure and governance)

What is Digital Economy (什么是数字经济)?

"broad range of economic activities that use digitized information and knowledge as __key factors of production__, modern information networks as an __important activity space__, as well as information and communications technology to __drive productivity growth__."

(by World Economic Forum and the Group of Twenty)

"指的是使用数字化的知识和信息作为关键__生产要素__、以现代信息网络作为__重要载体__、以信息通信技术的有效使用作为效率提升和经济结构优化的__重要推动力__的一系列经济活动 "

中国是亚洲数字大国 (China's digital economy surged in 2021 to 45.5 trillion RMB, or 39.8 % of country's GDP)

(Source:中国信息通信研究院发布的《中国数字经济发展报告（2022年）》)

图 2005-2020 年中国数字经济总体规模与 GDP 占比（数据来源：中国信息通信研究院、艾媒数据中心）
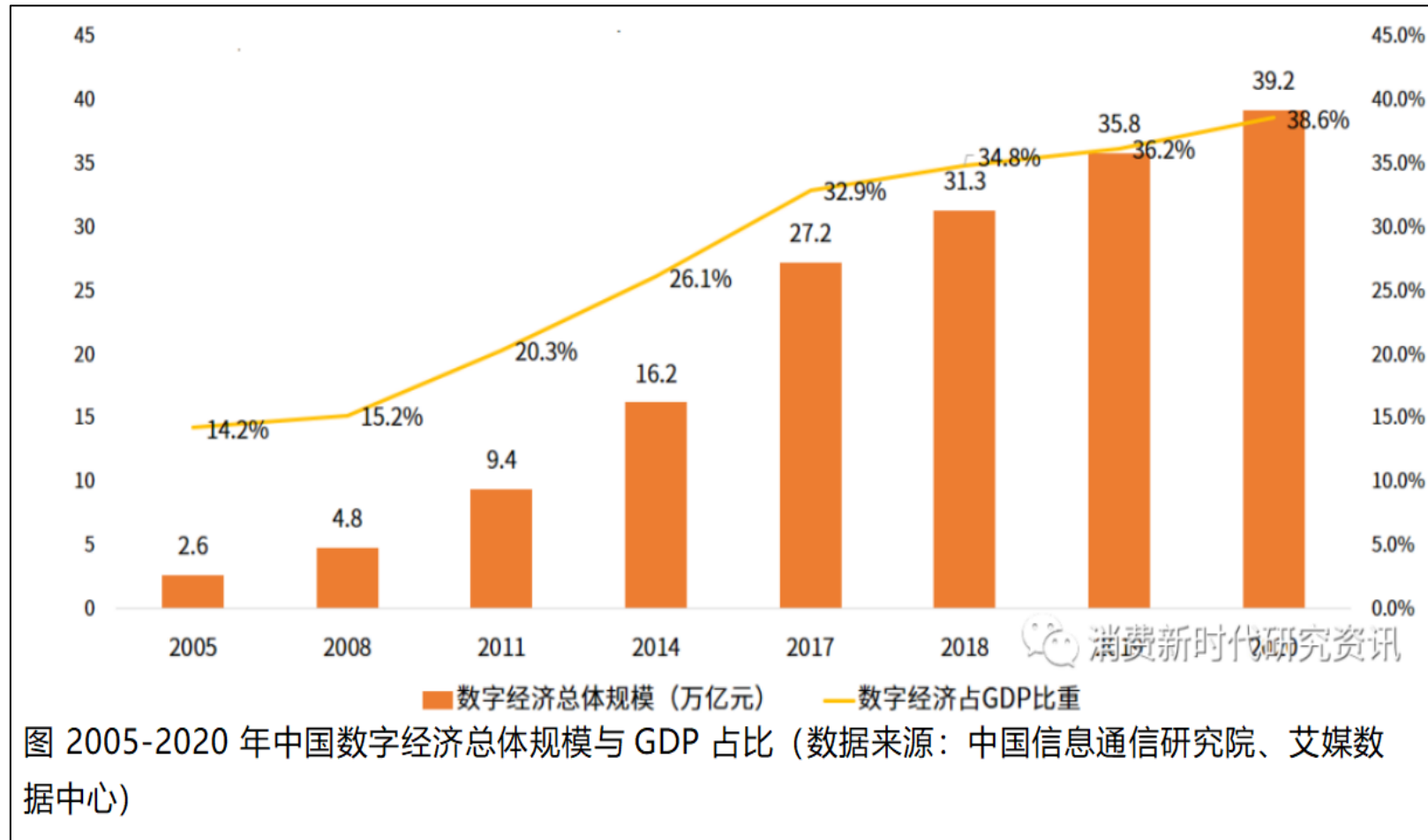
China's 14th Five-Year Plan" Digital Economy Development Plan
中国"十四五"(2021-2025)数字经济发展规划

- 数字经济是(继农业经济、工业经济之后的)主要经济形态
  (Digital economy will be main form of economic activities)

- 以数据资源为关键要素
  ("Data" will be the new oil for digital economy)

- 以现代信息网络 (如物联网，第三代互联网Web3)为主要载体
  (Economic activities will be mainly carried out via modern information networks)

- 以信息通信技术融合应用、全要素(用户、数据和资源)数字化转型为重要推动力,促进公平(如消除信息不对称)与效率(如提高生产力)的新经济形态
  (Information and communication technology and all-element, full-scale digital transformation will create a more efficient and equitable new economy)

China Digital Economy full steam ahead…

(Quantum computing, AI, 6G, Beidou (北斗) Satellite Navigation System……..)
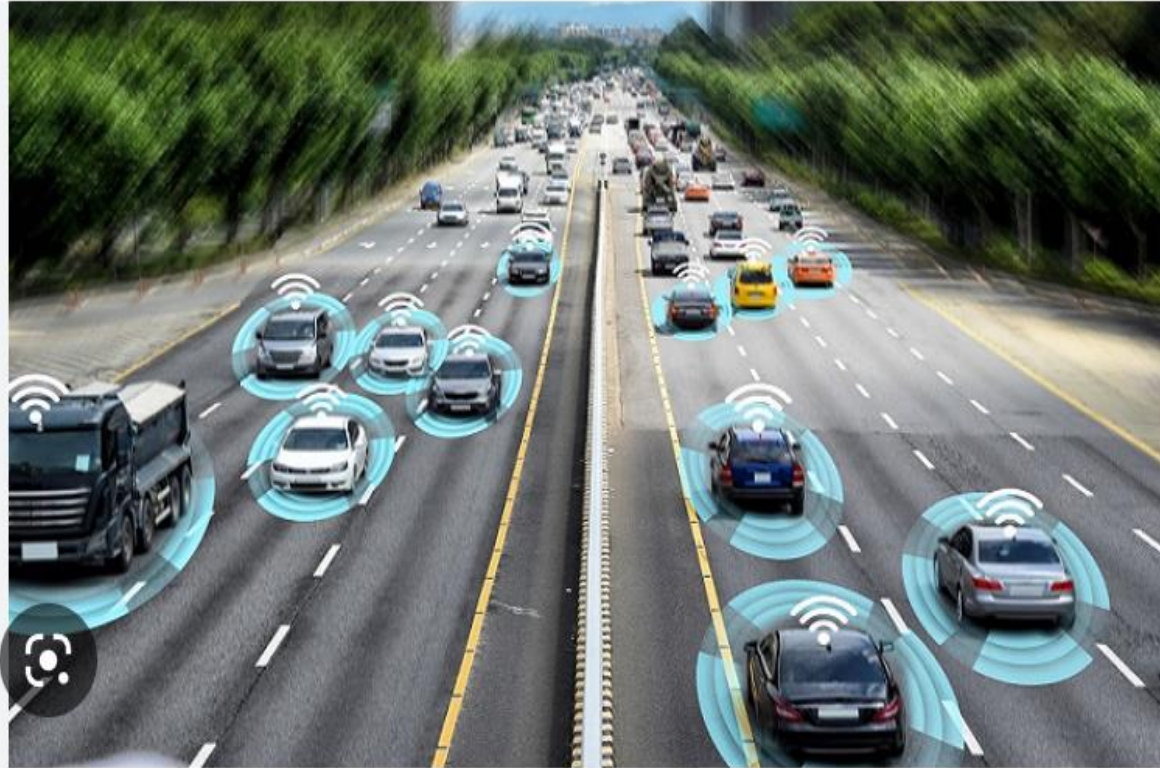
争夺"中国自动驾驶第一城"|界面新闻·

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Visit

What is Digital Finance (什么是数字金融)?

*"a term to describe the impact of **new technologies** on the financial services industry. It includes a variety of products, applications, processes and business models that have **transformed the traditional way** of providing banking and financial services."* (by European Union)

*"the **delivery of** traditional **financial services digitally**, through devices such as computers, tablets and smartphones. Digital finance has the potential to make financial services **accessible to underserved populations** in areas that lacked physical infrastructure for these services."* (by Gartner)

United Nations Secretary-General's Special Advocate for Inclusive Finance for Development

Financial Inclusion

Thirty-one percent of the world's adults—1.7 billion people—struggle to get by without the basic financial services they need to protect themselves against hardship and invest in their futures. Financial inclusion seeks to unlock development opportunity and improve the lives of all, especially the poor, by expanding access to catalytic financial tools. Affordable, effective, and safe financial services—savings, insurance, payments, credit, and more—can play a transformative role by fostering equitable growth and furthering vital development goals such as poverty reduction, job creation, gender equality, and food security.

Mobile internet and fintech promote financial inclusion
移动互联网和金融科技带来促进包容性金融或普惠金融的机会
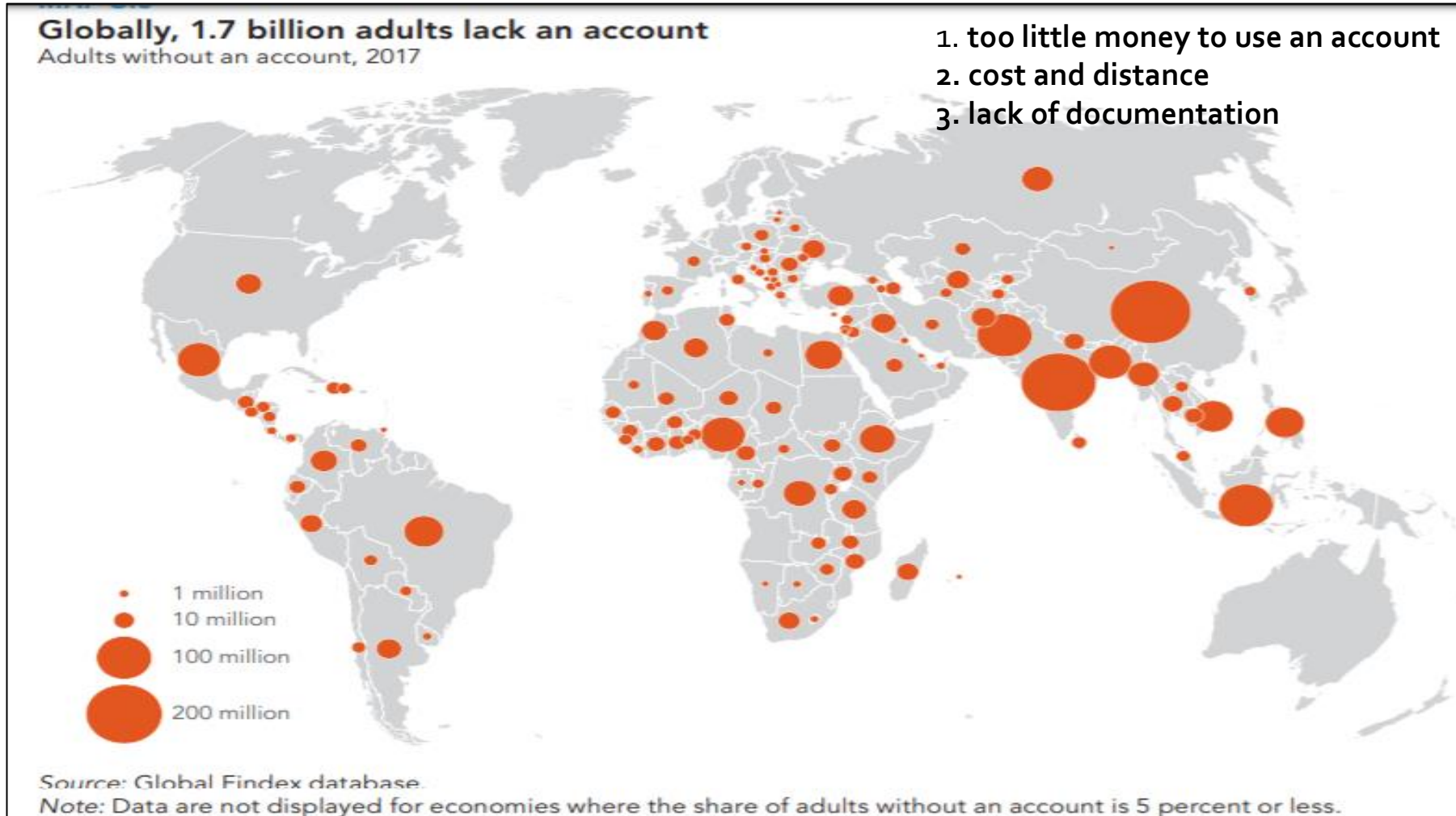
(Source: The Global Findex Database 2017 - Measuring Financial Inclusion and the Fintech Revolution, by World Bank Group)

Mobile internet and fintech promote financial inclusion
移动互联网和金融科技带来促进包容性金融或普惠金融的机会

(Source: The Global Findex Database 2017 - Measuring Financial Inclusion and the Fintech Revolution, by World Bank Group)
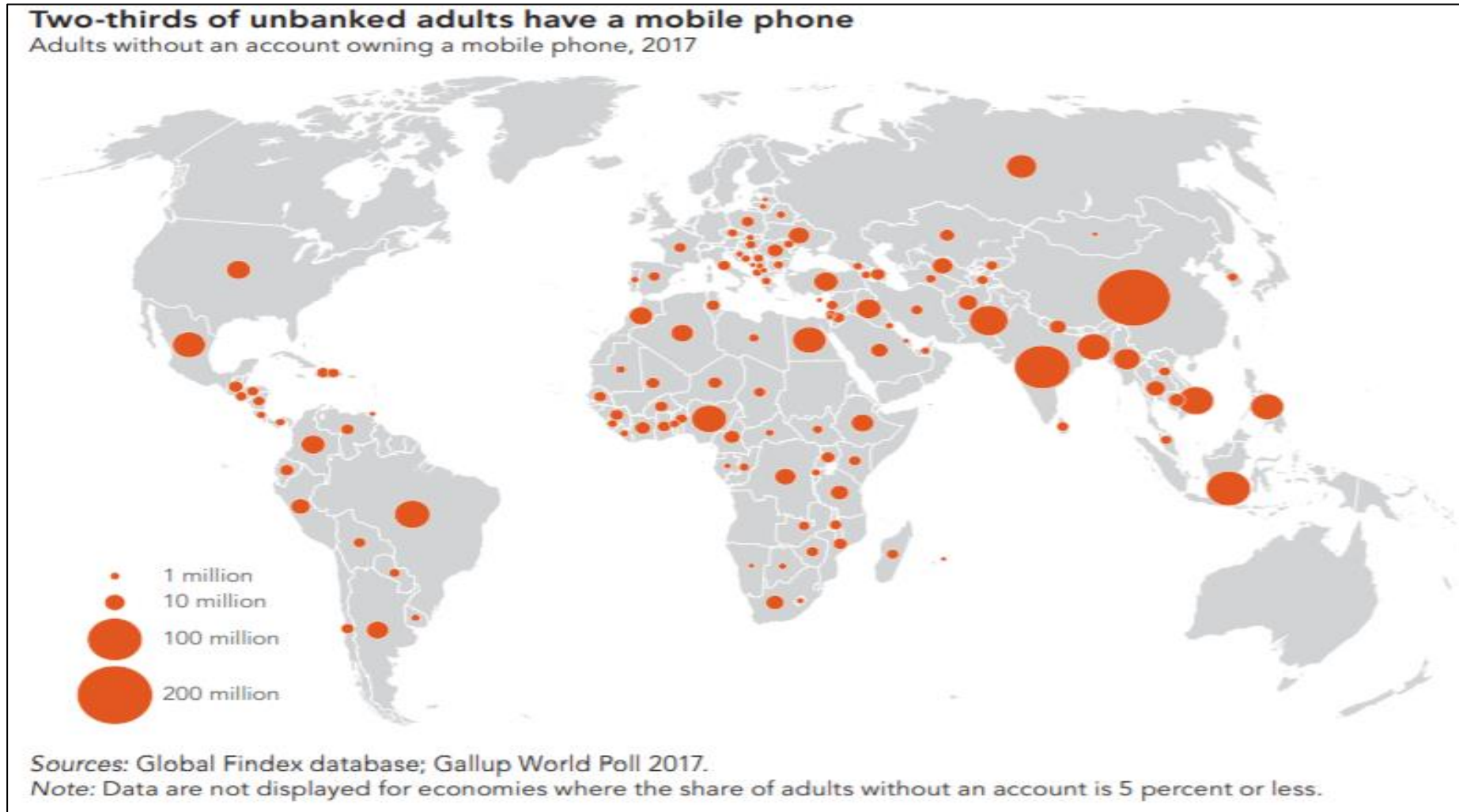
Comes Satoshi Nakamoto (中本聪)...

"中本聪"是何方圣神？日本人, 苏联人, 美国人?
有人说"中国人本来就是聪明的！"

31 Oct 2008, Nakamoto published a white paper
"*Bitcoin: A Peer-to-Peer Electronic Cash System*".
《比特币：一种点对点式的电子现金系统》

Bitcoin will create a decentralized, trustless
digital cash system aimed at eliminating
intermediaries such as banks and credit card
companies that charge high fees and are
prone to fraud and security risks (e.g., single
point of failure)

Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
satoshin@gmx.com
www.bitcoin.org

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing the proof-of-work. The longest chain not only serves as proof of the sequence of events witnessed, but proof that it came from the largest pool of CPU power. As long as a majority of CPU power is controlled by nodes that are not cooperating to attack the network, they'll generate the longest chain and outpace attackers. The network itself requires minimal structure. Messages are broadcast on a best effort basis, and nodes can leave and rejoin the network at will, accepting the longest proof-of-work chain as proof of what happened while they were gone.

1. Introduction

Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model. Completely non-reversible transactions are not really possible, since financial institutions cannot avoid mediating disputes. The cost of mediation increases transaction costs, limiting the minimum practical transaction size and cutting off the possibility for small casual transactions, and there is a broader cost in the loss of ability to make non-reversible payments for non-reversible services. With the possibility of reversal, the need for trust spreads. Merchants must be wary of their customers, hassling them for more information than they would otherwise need. A certain percentage of fraud is accepted as unavoidable. These costs and payment uncertainties can be avoided in person by using physical currency, but no mechanism exists to make payments over a communications channel without a trusted party.
   What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party. Transactions that are computationally impractical to reverse would protect sellers from fraud, and routine escrow mechanisms could easily be implemented to protect buyers. In this paper, we propose a solution to the double-spending problem using a peer-to-peer distributed timestamp server to generate computational proof of the chronological order of transactions. The system is secure as long as honest nodes collectively control more CPU power than any cooperating group of attacker nodes.
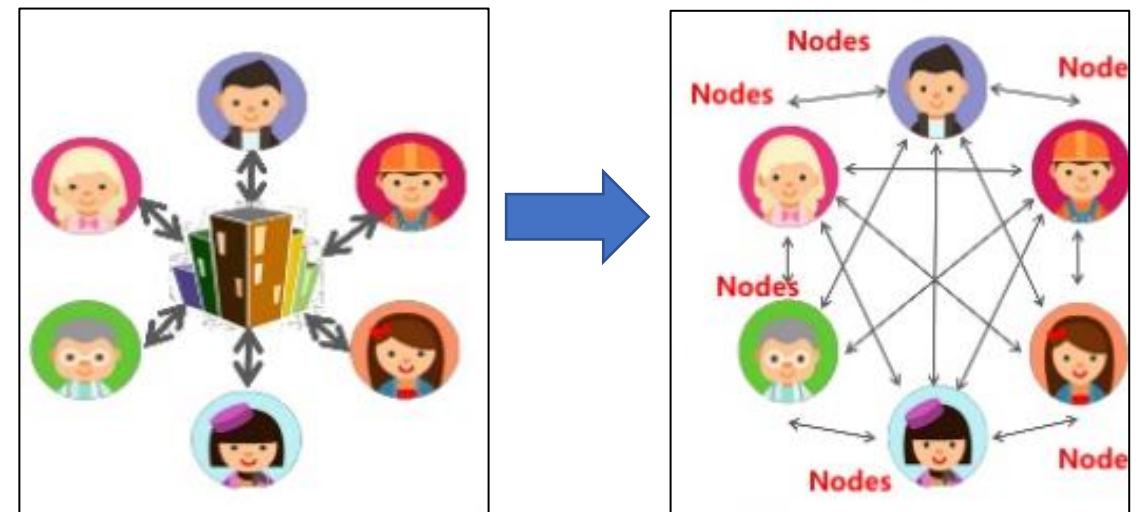
With Cryptocurrencies, Decentralized Finance (DeFi) emerging to democratize finance (Example: Cross-border Payments)

Centralized Cross-border Payment
中心化跨境支付
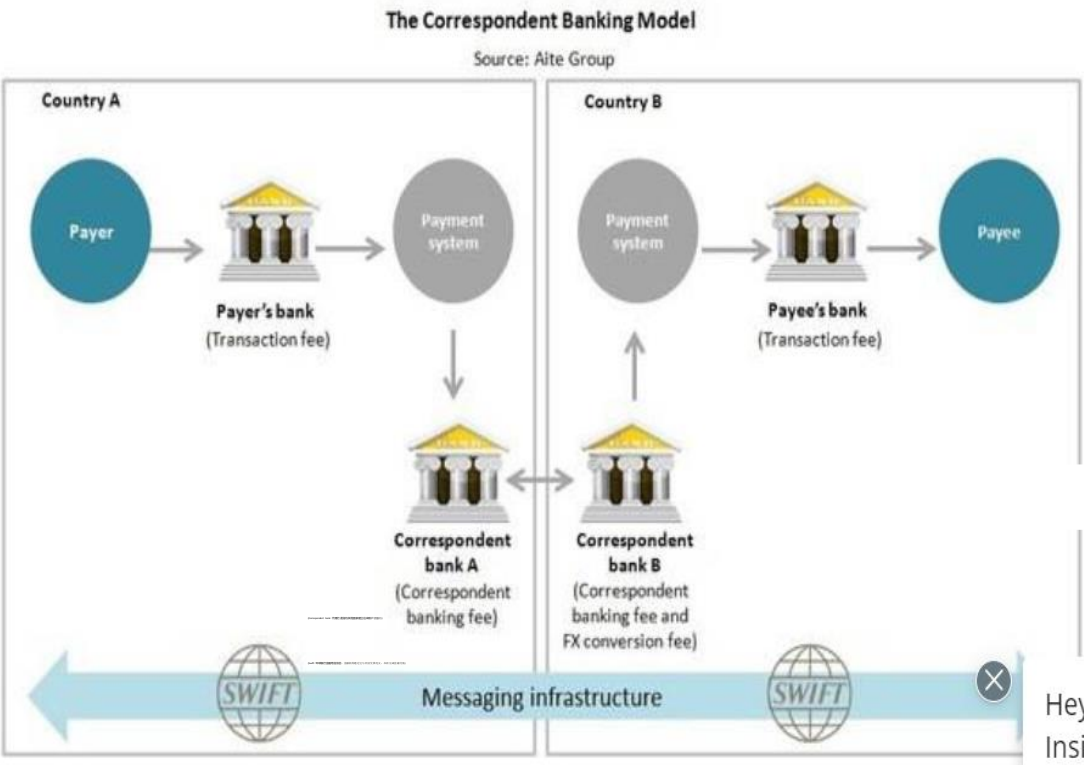
Distributed Cross-border Payment
分布式跨境支付

The Correspondent Banking Model
Source: Aite Group

Country A | Country B

Payer → Payer's bank (Transaction fee) → Payment system

Payment system → Payee's bank (Transaction fee) → Payee

Correspondent bank A (Correspondent banking fee)

Correspondent bank B (Correspondent banking fee and FX conversion fee)

SWIFT — Messaging infrastructure — SWIFT

Source: Aite Group

Stylised process flow of a DLT-based payment system

Node

Node | Consensus | Node

Node | Node

Node

1. Transaction proposed

Send X to B

Entity A

Peer-to-peer distributed network

2. Nodes in network undergo consensus process to validate and agree on updates to the distributed ledger, ensuring that no two nodes have conflicting records

Receive X from A

3. Transaction completed

Entity B

DeFi is intended to democratize finance…..
But does it?

"**….** Decentralisation can be a noble goal…But this principle is not what DeFi applications are delivering. There is a large gulf between vision and reality…. **In practice, there is a lot of centralisation in DeFi**…. efficiency gains for average users have so far failed to materialise…"

"…To date, the DeFi space has been used primarily for **speculative activities**. Users invest, borrow and trade cryptoassets in a largely unregulated environment…."

"…Achieving agreement in a large network takes time and effort and **consumes energy**. The larger the ledger, the harder it becomes to update it quickly….(so) **hard for fully decentralised systems to scale up**…"

"…. DeFi is subject to the same vulnerabilities as are present in traditional financial services. High leverage, liquidity mismatches and connections to the formal financial system mean vulnerabilities in **DeFi could undermine the stability of the broader financial system** (stablecoins could face runs)…"

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DeFi is intended to democratize finance…..
But does it?

(23 Mar 2022)

以太坊创始人Vitalik Buterin

"…Ethereum has made a handful of white men unfathomably rich, pumped **pollutions** into the air, and emerged as a vehicle for **tax evasion, money laundering, and mind-boggling scams**."

"… (Vitalik Buterin) worries about the dangers to overeager investors, the soaring transaction fees, and the **shameless displays of wealth** that have come to dominate public perception of crypto…"

"…Bored Ape Yacht Club, an überpopular NFT collection of garish primate cartoons that has become a digital-age status symbol for millionaires …"

EVOLUTION OF MONEY

| BARTER SYSTEM | GOLD | METAL COINS | PAPER MONEY | PLASTIC CARDS | ELECTRONIC MONEY | CRYPTO CURRENCY |
| 5000 B.C. | 4000 B.C. | 7TH CENTURY B.C. | 812 | 1928 | 1994 | 2009 |

& COMMODITIES
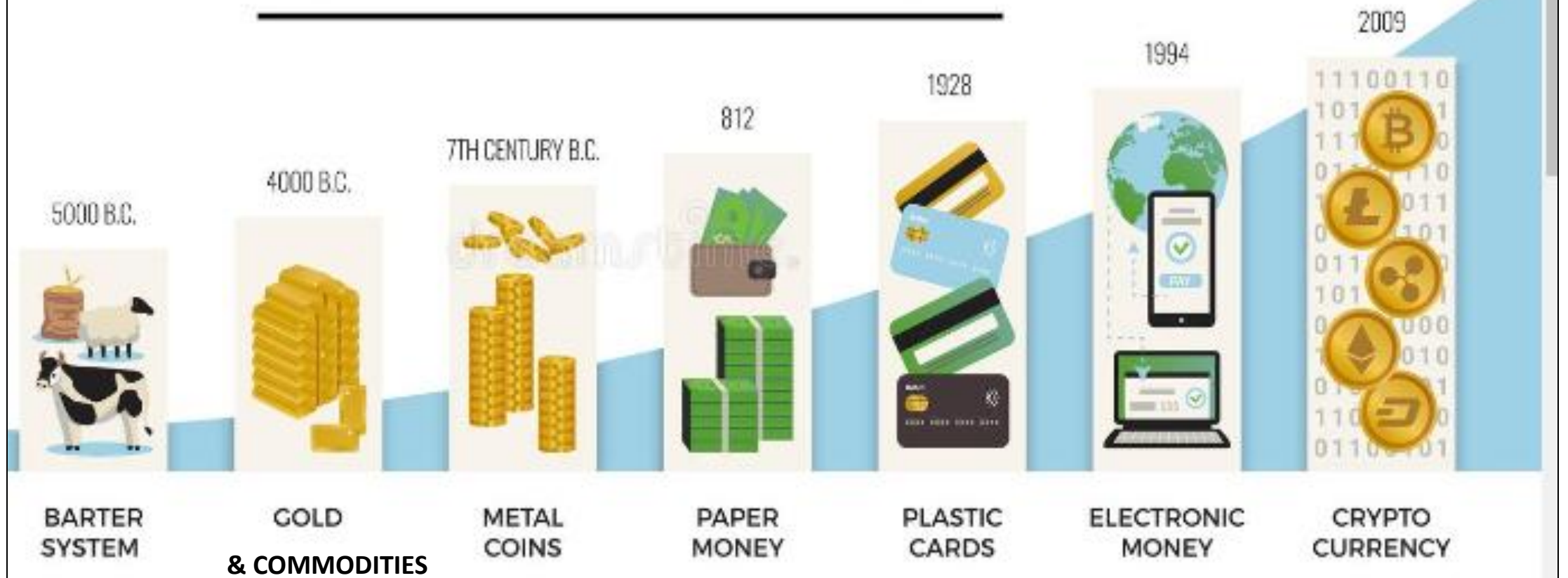
What is Cryptocurrency?

- A **digital currency** is any currency that is primarily managed, stored or exchanged on digital computer systems, especially over the internet (Wikipedia)

  e.g., transfer of bank balances online (FAST), PayNow, AliPay, Wechat Pay

- A **cryptocurrency** is a type of digital currency that allows transactions to be verified and records maintained by a decentralized system (like blockchain) using cryptography

  e.g., Bitcoin (BTC) and Ether (ETH)

- Most jurisdictions view cryptocurrency as digital asset or virtual commodity (虚拟商品)

Class 101
some core concepts of blockchain
浅谈一些区块链的核心概念

Xi Jinping & Party studied blockchain!!!

At a group study session for members of the Politburo Standing Committee of the Chinese Communist Party (CCP) 共产党政治局常务委员会, General secretary of CCP, Xi Jinping said: -

"blockchain would play an important role in the next round of technological innovation and industrial transformation"

"developing blockchain can help China gain an edge in the theoretical, innovative and industrial aspects of this emerging field"

(state media Xinhua on October 25, 2019)

What is blockchain?

(Layman Definition) Blockchain is a **distributed database** where every participant shares and synchronizes information. The data, maintained in chained records called "blocks", is not owned by any single authority. The decentralized design enables it to be **transparent** and **tamper-resistant**. Modifications by one party need to be verified by all others.

区块链是一种基于互联网 (Blockchain is internet-based)，不可篡改 (immutable)，可追溯的 (traceable) 的分布式 (即去中心化) 账本 (decentralized ledger), 用来记录交易, 以无需信任的方式集体维护的一个公共电子资料库 (an electronic database collectively maintained by a community in a trustless manner to record transactions)

区块链是采用分布式网络、加密技术、共识机制、智能合约等多种新一代信息与计算技术集成的新型数据库软件 (Blockchain is a new type of database software integrated with various new-generation information and computing technologies such as distributed network, encryption technology, consensus mechanism, and smart contracts.)

What are the features and advantages of blockchain？

- 分布式/去(非)中心化(decentralized)，点对点(peer to peer)协作

- 无须信任系统 (trustless)/自治性(autonomous), 运用一套基于共识 (based on consensus protocol - a system that users of a blockchain network follow to agree on the legitimacy of transactions) 的数学算法, 在机器之间建立 "信任"网络, 通过技术背书而创造信任

(The Economist 31 Oct 2015: **"The trust machine"** – The technology behind bitcoin could transform how the economy works）
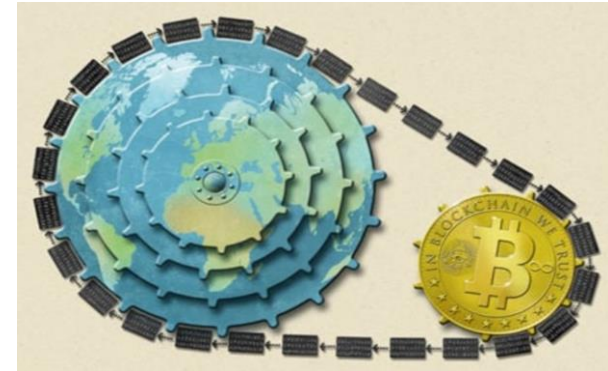
- 不可篡改 (immutable) (信息通过共识并添加至区块链后就被所有的节点共同记录, 靠密码学的哈希函数(Hash Function) 来保证不可篡改或篡改的难度与成本非常高）

- 匿名/隐私性(数据的隐私是靠隐私保护算法保证的. 采用电子住址(公钥私钥)进行交易, 为交易方的身份保密 (pseudonymous）

- 信息透明性,可追溯 (transparent & traceable) (通过开放式区块数据结构存储了所有交易历史数据, 区块链上任一条数据都可以通过链式结构追溯其本源)

Why Decentralize? 为什么要"去中心化"?

- **Unwanted behavior in centralized systems:**

  1. Censorship or banning of users in the system (中心)可任意删除或阻止系统里的用户

  2. Charging high fees for use of the system (中心)可随意提高利用系统(里提供的服务或产品)的费用

  3. Changing the rules of the system (中心)可更改系统里的规则

  4. Intentionally tampering with data (中心)可刻意篡改系统里的数据

  5. Human made mistakes, getting hacked or closing down

  6. Single point of failure (中心) 的单一信息系统遭受黑客攻击以至瘫痪

- **Democratize finance and make it accessible to all**

- **"The trust machine" lowers the cost of trust** (信任的成本)

What is mining (of Bitcoin)?

The technical nuts and bolts of the Bitcoin protocol are very detailed and difficult to explain.

▪ Why called "Mining" (挖矿)?

Under Gold Standard, we need resources to mine the physical gold to be used as reserve to back up the currency notes issued

Similarly for Bitcoin, we need computing resources to maintain consensus among the network members, i.e., lot of electricity to power the computers to "mine" Bitcoin

▪ What is "mining" (of bitcoin) ?

Bitcoin uses a very difficult validation process (PoW, proof of work) to ensure security or prevent double-spending. To validate transactions on Bitcoin blockchain, a complex puzzle for each transaction must be solved. This puzzle is in a hashtag format, which requires a great deal of computing power to find the solution (a 随机值(nonce) that produces the correct hash value).

"Miners" (nodes in network) compete against each other to validate the next transaction block and add the block to the chain of blocks on the distributed ledger. The successful miner earns a reward. It is a highly energy-intensive consensus mechanism but brings a high degree of trust

(SHA-256 is most prominently used hashing algorithms in blockchains like Bitcoin for cryptographic security)

Types of Consensus Mechanisms 共识机制的种类

Consensus can be achieved on a blockchain through mining and other means: -

1**. Proof of Work (PoW, 工作量证明)**： 也就是所谓的挖矿。 依赖机器进行数学运算来获取记账权, 任何人都可以加入挖矿, 越多矿工参与, 区块链的内容越无法窜改, 但资源消耗相比其他 共识机制高, 区块同步时间长, 扩展性弱, 交易量(TPS)低。如比特币

2**. Proof of Stake (PoS 权益证明)**： 依然是基于哈希运算竞争获取记账权的方式, 根据每个节点 所占代币的比例和时间, 等比例的降低挖矿难度, 从而加快找随机数的速度, 避免大量消耗 能源挖矿

3**. Others: DPOS (Delegated Proof of Share), BFT (Practical Byzantine Fault Tolerance), DBFT （Delegated Byzantine Fault Tolerant）** 以及多种机制混合而成的共识机制等

What are Crypto Wallet, Public Key and Private Key
加密钱包、公钥、私钥？

- **Crypto wallets** are computer apps (电脑软件或者简单的数据库)

  A normal wallet holds actual cash, crypto wallets technically don't store your cryptocurrencies. Your crypto holdings live on the blockchain, and can only be accessed using a private key.

- Just like with doors, keys are used to lock (encrypt) and unlock (decrypt) information to keep it safe. But instead of a physical key, an encryption key is an long string of random characters.

- There is a pair of private key and a public key. You give out the **public key** to anyone you want to receive messages from but keep the matching **private key** entirely to yourself (in crypto wallet). !

- For example: -

  - 用户的钱包地址就是由私钥通过加密生成公钥, 进而生成以0x开头的42位地址, 例如: -
    Public key (42 characters): 0x1C0e374cA09E2c3C3BfaD2e5aE955654e06FA617

  - 私钥的样式为64 位哈希值字符串, 例如:
    Private key (64 characters): 4b92caefffa43005b2d228d4e6aa37c56dacbec421e66b95192a0d08e4be7dd5

Types of Crypto Wallets

Hot wallet (热钱包, 在线钱包)

a crypto wallet that **connects to the internet**. These wallets are generally software you could find on a mobile device, a cloud server, or a laptop, e.g., MetaMask, Dash QT wallet, imTOKEN, they are also available on online digital exchange platforms

Cold or Hardware wallet (冷钱包,离线钱包)

a crypto wallet that is responsible for storing private keys in an **offline** environment. E.g., Ledger Nanos, Trezor and KeepKey

Because it is offline, cold wallets are much more secured than hot wallets which are vulnerable to hackers

Blockchain Demo

(about 17 minutes)

https://andersbrownworth.com/blockchain/

Major Limitations of Blockchain Technology
区块链技术目前的局限性

- **High Input of Energy Needed** (能源的消耗)

  Bitcoin currently consumes about 150 terawatt-hours of electricity annually — more than the entire country of Argentina, population 45 million (Columbia Climate School, May 2022)

- **Transaction Speed** (处理交易速度)

  如比特币目前每秒只能处理大约7笔交易, 而Visa每秒可处理超过几万笔交易 (下图)

- **Scalability** (可扩展(容)性)

  - 区块链"分布式"账本的权力下放/共识机制提供了相对安全保障, 去中立, 去信任等等好处, 但代价是可扩展性, 即分权限制了区块链的交易量与网络中完全参与节点的限制

  - 随着区块链规模的增长, 参与节点对存储, 带宽和计算能力的要求会增加. 逐渐会造成只有少数节点能负担得起处理数据块的成本, 从而导致中心化的风险. 因此, 公共链不得不在低交易量和中心化程度之间进行权衡 (或"不可能三角": 去中心化、安全和扩展性三方面,我们只能取两个) (Blockchain impossible triangle : decentralization, security, and scalability)

- **Security** (安全性)

  如挖矿企业一旦形成联盟并拥有超过50％的算力, 他们就能对比特币网络进行攻击, 破坏比特币的安全性

Transactions Per Second (TPS) 每秒可处理几笔交易?

Cryptocurrencies Transaction Speeds Compared to Visa & Paypal

VISA — 24,000
ripple — 1,500
PayPal — 193
BitcoinCash — 60
litecoin — 56
DASH — 48
ethereum — 20
bitcoin — 7

1000 transactions
100 transactions
20 transactions
Company Transactions per second

Article & Sources:
https://howmuch.net/articles/crypto-transaction-speeds-compared
https://howmuch.net/sources/crypto-transaction-speeds-compared

howmuch net

Smart Contract (智能合约)

- It is an automated or self-executing contract that uses computer codes and runs on blockchain technology
  (它是区块链数据库上运行的计算机程序。交易双方不需要彼此信任, 合约由代码进行定义的, 在满足其代码中写入的条件时也是由代码强制自动执行,无法干预)

- Automation
  1. keep expenses low to maximize profit
  2. remove human error, enables smooth process
  3. no need to trust counterparty

- Example (**insurance claim**): If the smart contract is set up with the right policy, documents, and ways to capture data, it can execute itself shortly after the accident and remove administrative barriers, predetermine all insurance payout scenarios, and automatically execute contract terms, leaving no space for manipulation on either side.
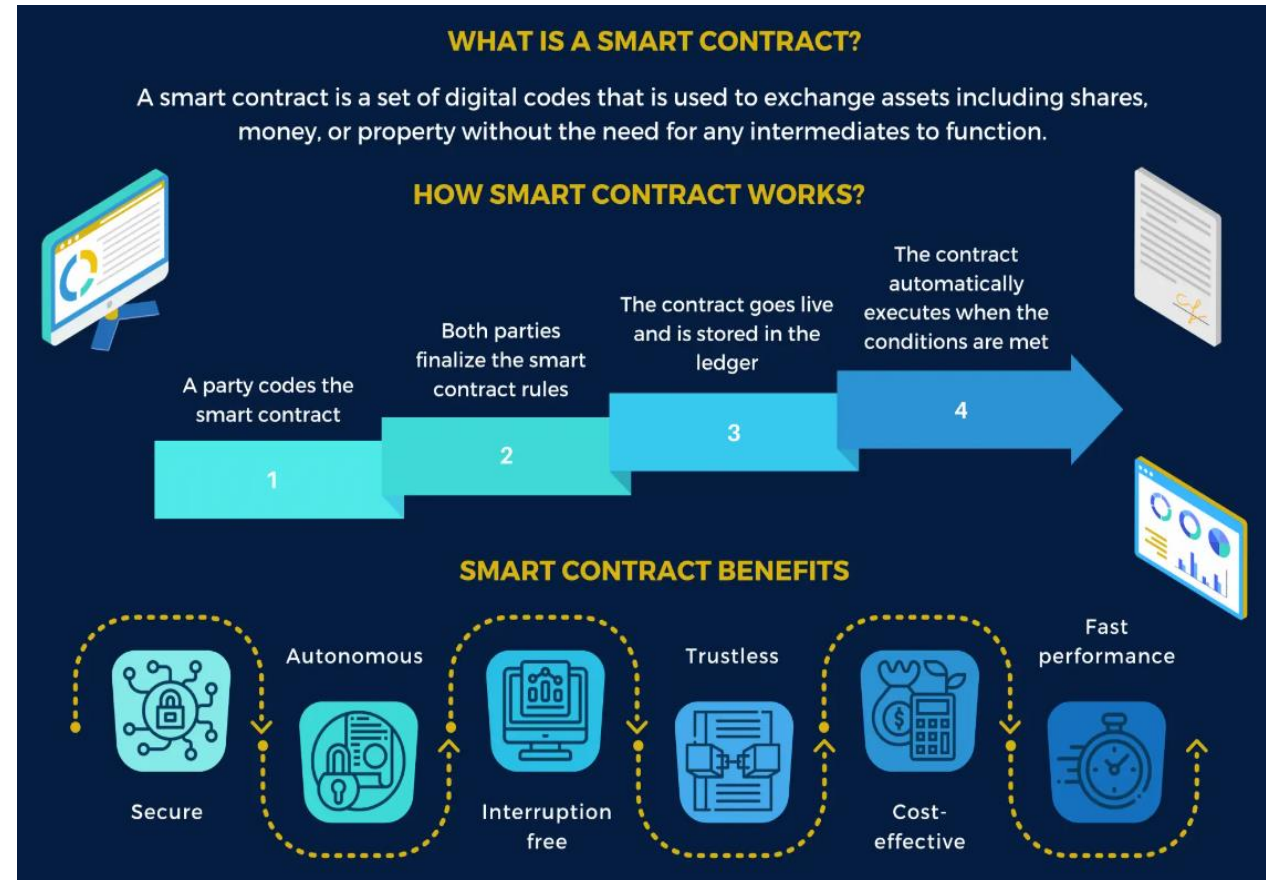
Example: smart contract for asset transfer

```
contract AssetTransfer
{
    enum StateType { Active, OfferPlaced, PendingInspection,
    Inspected, Appraised, NotionalAcceptance, BuyerAccepted, SellerAccepted, Accepted, Terminated }
    address public InstanceOwner;
    string public Description;
    uint public AskingPrice;
    StateType public State;

    address public InstanceBuyer;
    uint public OfferPrice;
    address public InstanceInspector;
    address public InstanceAppraiser;

    constructor(string memory description, uint256 price) public
    {
        InstanceOwner = msg.sender;
        AskingPrice = price;
        Description = description;
        State = StateType.Active;
    }
```

The above 23 lines of code are the beginning code for the AssetTransfer Contract. It initiates the key variables within the contract and then also puts in the constructor for initializing the variables.

(Source: 101 Blockchains)

Ethereum (以太坊)

- Put simply, Ethereum = (Public) Blockchain + Smart Contract

  (以太坊= 区块链+ 智能合约)

- Ethereum was conceived in 2013 by programmer Vitalik Buterin

- It is a decentralized, open-source blockchain with smart contract functionality.

- Smart contracts, an essential tool behind decentralized applications (dApps). Many decentralized finance (DeFi) and other applications use smart contracts in conjunction with blockchain technology.

- Smart contracts allow participants to transact with each other (p-to-p) without a trusted central authority.

- Transactions are sent from and received by user-created Ethereum accounts. A sender must sign transactions and spend Ether, Ethereum's native cryptocurrency, as a cost of processing transactions on the network

- On 15 September 2022, Ethereum transitioned its consensus mechanism from proof-of-work (PoW) to proof-of-stake (PoS) in an upgrade process known as "the Merge"

  (see: https://etherscan.io/ , etherscan is a website through which you can view and analyse all assets, transactions and balances on the Ethereum network.)

What is Web 3.0?

- **Web 1.0 (1991-2004)** "资讯网络"
  - <u>read-only</u> internet, e.g., AOL , MySpace
  - static web pages
  - owned by big companies

- **Web 2.0 (2004-current day)** "数据网络"
  - <u>read and write</u> internet; "social web"
  - thrives on user-generated content
  - centralized internet owned by Big Tech cos - Google and Meta who own and monetise data

- **Web 3.0 (not yet well-defined)** "数字资产网络" - 自主、开放和智能的互联网
  - future internet, a collaborative medium where we meet and <u>read and write and own</u> our data
  - built on blockchain with core concepts of decentralization, openness, and greater user utility
  - websites and apps will be able to process information through artificial intelligence (AI), machine learning (ML), big data and more.

Differences between Web2.0 and Web 3.0

	Web 2.0	Web 3.0
交互	读+写	读+写+拥有
所有权	公司	用户
隐私	用户为了服务放弃隐私	需要获得用户授权
组织	平台	协议
存储	中心化	去中心化
控制	需要平台许可	无须许可
数据	可篡改	不可篡改
信任	可信任第三方	无需信任
互操性	封闭	可互操
利益相关	股票	通证
好处	公司拥有	和用户共享

Source: @sussblochain

Metaverse (元宇宙)

- a virtual world, a 3D version of the Internet and **digital representation of the real world**

- provides immersive experience that will increasingly converge our physical and digital lives, creating a unified, virtual community where we can work, play, relax, transact and socialize

- still early in its evolution; not one but many virtual worlds

- the degree of interoperability among virtual worlds, data portability, governance and user interfaces will depend on how the metaverse pans out

- Metaverse powered by Web 3.0 will be fully open to anyone, decentralized, interoperable and open-source

Horizon Workrooms (Credit: Meta)

Singapore Digital Finance Ecosystem
新加坡数字金融的生态系统

Cryptocurrencies, Stable-coins & CBDC

- **Cryptocurrencies** 加密货币

a type of digital currency that allows transactions to be verified and records maintained by a decentralized system (like blockchain) using cryptography.

(是私人机构/民间以数字或虚拟方式生成并使用加密技术来保护交易的的货币。例: 比特币、以太币、莱特币等。加密货币不是央行发行或监管, 而是使用去中心化系统来发行并记录交易。由于没有实物价值支撑, 所以其价格大幅度波动！)

- **Stable-coins** 稳定币

cryptocurrencies pegged (or linked) to real-world assets such as fiat like (USD, EUR, CNY or JPY) , gold or oil, or uses algorithm to control or regulate its supply, to keep their value stable unlike the price of BTC or ETH

加密货币的一种, 为了保持其价格稳定, 要有资产抵押发行的代币 。到目前为止, 大多数稳定币都与美元挂钩, 如泰达币 (USDT), 或与黄金或欧元挂钩, 或其他加密货币挂钩。还有通过算法调整供应以保持其价格稳定的稳定币

- **CBDC** 央行法定数字货币

digital form of a country's fiat currency, which is issued and regulated by its central bank.

由一国货币当局/央行基于国家信用发行, 是法定货币在数字经济时代的延伸, 具有法偿性, 可替代现金的支付工具

MAS Policy on Digital Currencies

Digital Currencies		
1. CBDC (digital fiat money) 央行数字货币	**2. Stable-coins 稳定币**	**3. Cryptocurrencies 加密货币**
a. More emphasis on **wholesale CBDC** (involve only FIs)	**a.** payment tool for distributed ledgers, may be important for development of DeFi and Web3	**a.** basic posture – open and inclusive
(1) both domestic and cross-border interbank settlement	**b.** establishing regulatory framework for its issuance and intermediaries	**b.** note the speculative nature of cryptocurrencies, and warn against retail investors dealing in it
(2) utilize DLT to develop Delivery versus Payment (DvP) for the settlement of tokenized assets		**c.** strengthening regulations to ensure integrity of intermediaries and to protect investors, e.g., test to determine suitability of retail investors in dealing in cryptocurrencies, against use of leverage for trading
b. No plan for **retail CBDC** now, but develop technical & policy capabilities for future possible issuance; study Purpose Bound Money		

零售: 新金管局探索可编程的数字新元 - "意向货币"
(Programmable Digital Singapore Dollar)

▪ **可以具备不同的形式**
- 央行: 零售央行数字货币(CBDC)
- 私人: 代币化的银行存款或稳定币

▪ **可编程的"意向货币(Purpose Bound Money)**
- 即允许发行者设定货币的使用条件, 如有效期和只能在特定的商家消费, 如政府发放款项和礼券, 如邻里物券, 协助国人应付通胀和生活费

(这是**可编程"智能化货币政策工具"**的雏形)

"意向货币" 的使用说明

央行数码货币　　金融机构　　商家

代币化存款

意向货币　　零售用户

稳定币

资料来源／金管局　　早报图表／李利群
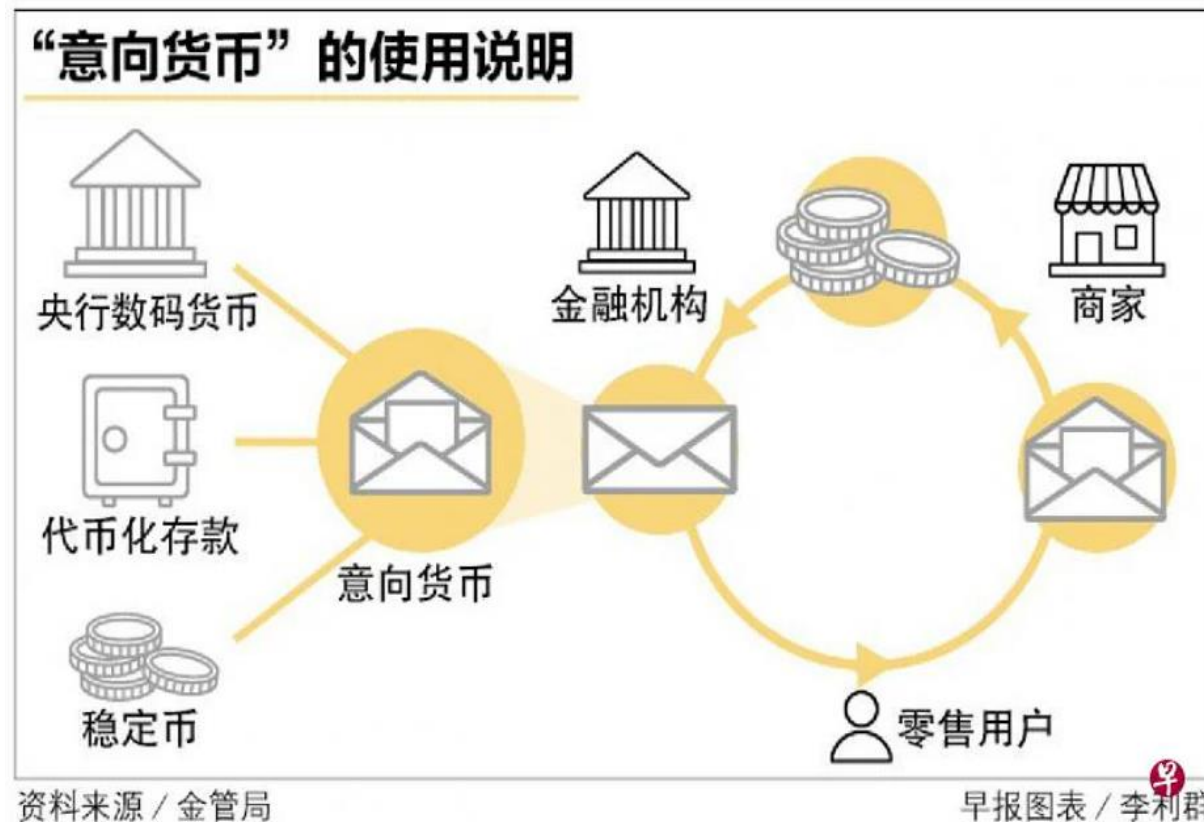
Digital Payment Token Market
数字支付代币服务市场

- 提供数字支付代币或加密货币 (digital payment token, DPT or cryptocurrencies) 服务必须持有新金管局在《2019年支付服务法令》(Payment Services Act 2019）下发给的牌照

- 196 份申请书 (2022年5月止）
  74份申请过后收回; 17份申请获准；3份申请拒绝
  108份申请MAS 还在审核

- 至今, DBS Vickers (星展银行属下的证券经纪商），澳大利亚的 cryptocurrency exchange - Independent Reserve, FOMO Pay, TripleA, Paxos, Sygnum, Digital Treasures Center (DTC), Hodlnaut (撤退), Revolut, Luno, Coinhako, Crypto.com, Genesis, Sparrowtech, Coinbase 和 Circle Internet Financial 已成功拿到牌照

- MAS 严格审查商业模式, 确保真正能为新加坡金融科技和数字资产生态环境做出贡献,并强调风险管理的重要性
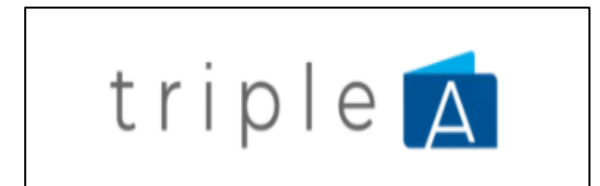
（部分成功申请者）

Digital Assets 数字资产

- **Digital asset** is anything of value whose ownership is represented in a digital or computerized form

  It is done through a process called **tokenisation** – which involves using a software programme to convert ownership rights over an asset into a digital token

  (数字资产是任何有价值的东西,其所有权通过通证化(tokenization) – 计算机使用软件程序以数字化形式产生可流通的加密数字权益凭证 (digital token,代币或通证) 并存储在计算机设备中)

- When deployed on distributed ledgers, digital assets are referred to as **crypto assets**
  (当分布式账本(如区块链) 用于记录这些数字资产的所有权时, 它也被称为加密资产)

- Many items in real-world can potentially be tokenised

  1. financial assets like cash and bonds (金融资产)
  2. real assets like artwork and property (实体经济里的实物资产)
  3. artwork and other creative works 艺术品和创意作品等
  4. even intangible items like carbon credits and computing resources (碳信用和计算资源等无形资产)

Note：cryptocurrency is only one of the many types of digital assets
加密货币只是其中一种数字资产!!!

Digital Assets 数字资产

- **Advantages 数字/加密资产的优势：-**

  1. **Better Liquidity (较好流动性):** 资产分割/碎片化 (fractional ownership), 降低投资门槛；可以24/7 全天候交易

  2. **Better Security (安全性):** 所有权在区块链上记录无法被篡改

  3. **Enhanced Compliance (增强合规性):** 智能合约自动执行特定操作, 让上市企业行为自动化, 增强合规性。如自动指示在预定的支付日期进行股息分配等

  4. **Lower Settlement Risk (降低结算风险)**：智能合约自动执行的方式 – 原子交换 (atomic swap) 实现"券款对付" (DvP)，可以有效避免合同的违约风险。

ADDX

ValueMax
Commercial Paper Series 004

Invest in commercial paper at an interest rate of 3.8% p.a. issued by a SGX Listco from SGD 20K

Asset Class	Target Returns
Cash Alternatives	<5%

Investment Horizon	Min. Investment
<1 year	SGD 20,000

Partners Group
Global Value SICAV

Investing in a globally diversified, open-ended private equity fund.

Asset Class	Target Returns
Private Equity	11-15%

Region	Min. Investment
Global	USD 5,000

iQuant Fund
(Series 1)

A feeder fund into top-ranked macro hedge fund Quantedge Global Fund.

Asset Class	Target Returns
Hedge Funds	>15%

Investment Horizon	Min. Investment
6-10 years	USD 50,000

Digital Assets 数字资产

- 提供数字资产市场交易设施与服务必须持有新金管局 **"认可市场运营商(RMO)"**的牌照

  如DDEx, ADDX (iSTOX), Zipmex, ecxx, 1exchange, HGX, SDAX, PhillipCapital 等。目前未获准处理散户投资者交易业务

- 目前涉及的数字资产包括商业票据，私募股权, 信贷基金, 风险债务基金(venture debt fund), 房地产，红酒等

- 文化与创意作品的NFT目前不受监管

资产代币化市场日益扩大

市场价值（万亿美元）

图例	
其他代币化资产	投资基金
上市股权	债券
非上市股权	房屋净值
其他股权	其他金融资产

○ 代币化市场在全球国内生产总值占比

年份 2022 2023 2024 2025 2026 2027 2028 2029 2030
0.31 0.6 1.5 3.1 5.2 7.6 10.2 13.0 16.1
(0.4) (0.6) (1.3) (2.5) (4.0) (5.5) (7.0) (8.5) (10.0)

2030年分项: 4.8 / 0.8 / 0.7 / 2.6 / 0.4 / 0.8 / 3.2 / 3.0

资料来源／ADDX

早报图表／张进培
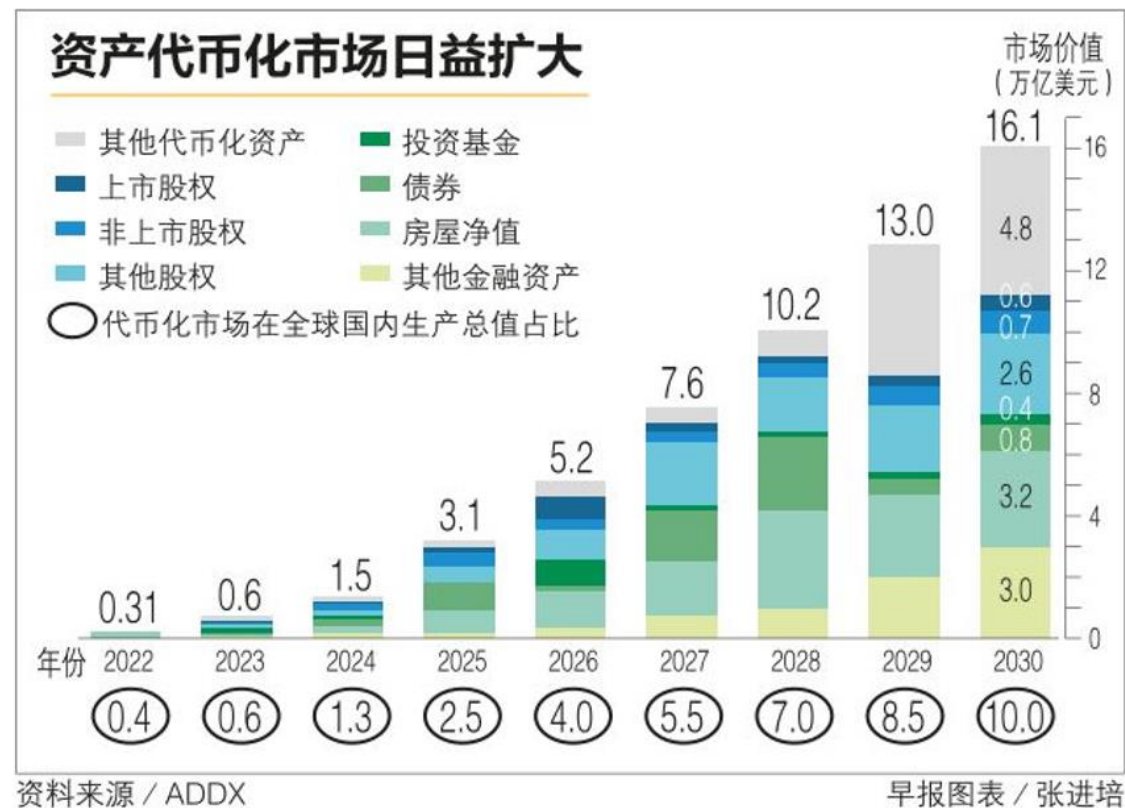
"……在2022年至2030年期间, 资产代币化 (asset tokenization) 市场将从3100亿美元暴增至16.1万亿美元, 到了2030年估计占全球GDP的10％……"

(美国波士顿咨询集团和新加坡数码证券平台ADDX (2022年9月12日) 发表的报告预测)

数字资本市场 – 债券交易平台
(Digital Bond Trading Platform)

- 金融科技公司BondEvalue在新金管局的"监管沙盒"毕业后, 获得认可市场运营商 (RMO) 执照, 于2020年8月成立了**全球首家基于区块链的债券交易所** BondbloX Bond Exchange（BBX）

- BBX的目标是将债券碎片化（如1,000美元），引入整个区域的大众市场。 结算以T+0为基础，而不是一般两天结算周期

- 世界各地的投资者可以通过网络和移动设备在BBX进行交易，但须遵守各国债券交易限制规定。 在新加坡, BBX目前只对合格投资者和机构投资者开放

数字资本市场 – 债券发行,存管和服务平台
(Bond Issuance, Custody and Service Platform)

- 2020年9月, 新加坡交易所 (SGX) 的**数字资产发行、存管和服务平台**为新加坡奥兰国际有限公司发行亚洲首笔, 基于区块链, 规模为4亿新加坡元的5.5年期的数字债券 (STO)
(https://www.sgx.com/media-centre/20200901-sgx-collaboration-hsbc-and-temasek-completes-pilot-digital-bond-olam)

- 2021年5月新加坡星展银行通过DBS Digital Exchange(DDEx)**数字资产交易平台**首次发行1500万新元数字债券。6个月期, 年利率0.60%

- 2021年6月DBS推出亚洲首个自动化**数字发债平台FIX Marketplace**, 让投资者直接在平台认购,旨在让企业更快和更低成本发债。吉宝企业（Keppel Corp）是首家在该平台发行数字债券 (通过10亿美元的欧元商业票据计划) 的公司,

数字资本市场 – 加密货币/资产基金
(Crypto Funds)

- In Nov 2021, Fintonia Group, a MAS-registered fund manager, has launched two open-ended institutional-grade 比特币基金 **Bitcoin funds**. The two funds do not require approval from the regulator, and not allowed to be offered to retail investors

- 更好的专业化管理 – 第三方专业保管加密钱包(third-party licensed custodian storing clients' cryptocurrencies on cold wallets), 为网络安全/黑客攻击买保险，并进行价格风险管理等

  (Reference: https://cointelegraph.com/news/two-mas-regulated-bitcoin-funds-launch-in-singapore)

数字资本市场 – 加密货币/资产基金
(Crypto Funds)

- In Nov 2021, the private digital exchange ADDX launched the listing of a digital asset fund by investment manager Australia-based Trovio Capital Management (TCM)

- In addition to its core positions in **Bitcoin and Ethereum**, the fund invests in **seven other top-performing cryptocurrencies** that have been identified and reviewed on a regular basis

- Investors on the ADDX platform can subscribe to or redeem units each month with the fund manager. The fund's minimum investment size is USD10,000

- TCM provides institutional-grade safeguards: - TCM基金提供

  - independent administrator 独立行政管理

  - custody and trading services provided by the Nasdaq-listed Coinbase
   独立专业托管

  - KPMG as auditor 独立专业审计

(Reference: https://www.hedgeweek.com/2021/11/03/308670/tcm-launches-first-crypto-fund-addx)

数字资本市场 – 加密期货(crypto futures)合约

- In Dec 2019, Intercontinental Exchange 洲际交易所集团 (ICE, owner of NYSE) launched **a bitcoin USD futures contract 美元比特币期货合约.** It is listed on ICE Futures Singapore and cleared by ICE Clear Singapore, which are regulated by MAS

- It is the first of the four MAS-approved exchanges to announce the launch of a regulated futures contract for payment tokens such as bitcoin

- To meet increasing demand from institutional investors for a regulated product to gain and hedge their exposure to these payment tokens 提供比特币价格波动的对冲工具

(https://www.straitstimes.com/business/banking/ice-to-launch-bitcoin-futures-contract-in-singapore-on-dec-9)

财富管理 - 智能投顾 (Robo Advisors)

Providing online account opening, attentive customer support, as well as risk assessment to **customised investment advice**.

Some extend services to offer **cash management** accounts to boost returns on cash savings, **brokerage account** that allows investors to buy and sell U.S. stocks, and comprehensive **insurance and wills writing** solutions to clients.

https://dollarsandsense.sg/robo-advisors-in-singapore-what-you-need-to-know-before-investing/

数字银行 (Digital Banks)

(1) 全数字银行牌照 (Full Digital Banks)

Grab-Singtel; 科技巨头Sea

(2) 数字批发银行牌照 (Wholesale Digital Banks）
(针对企业尤其中小企业）
- 蚂蚁集团 (Ants Group)
- 绿地金融投资控股集团有限公司, 香港联易融有限公司 (Linklogis Hong Kong Ltd), 北京协同股权投资基金管理有限公司组成的财团

▪ 2022年开始营业

FULL BANK LICENSE	FULL BANK LICENSE	WHOLESALE BANK LICENSE	WHOLESALE BANK LICENSE
Grab Singtel	sea	蚂蚁集团 ANT GROUP	绿地集团 GREENLAND GROUP / Linklogis LIS / Beijing Co-operative Equity Investment Fund Management

"我们希望这些银行能与现有银行并驾齐驱, 提高该行业优质金融服务交付的门槛, **尤其是为目前得不到金融服务的企业和个人 (underbanked and unbanked)** 提供优质金融服务, 同时进一步加强新加坡未来数字经济在金融领域的发展"

（金管局局长 Ravi Menon）

基于生态系统的贸易融资平台
(Ecosystem-based Trade Finance Platform)

- **OneSME** [由新加坡OneConnect金融科技公司开发运营, 并得到新加坡信息通信媒体发展管理局 (IMDA) 的支持]

  跨境平台到平台的数字贸易连接, 便利本地中小企业 (在本地B2B采购平台Eezee.sg上) 与中国企业开展贸易（OneConnect壹企业400万中小企业的买家库）联系

- **商业无国界计划**（一项由MAS和资讯通信媒体发展局 IMDA主导的公共计划, 简称BSB)

  一个商业与数字服务的全球混合元枢纽。该枢纽具备以下功能：

  （1）为中小企业创造更多的国内外贸易机会

  　　利用人工智能让中小企业能够在一个更大的全球市场中发现价格和销售机会。

  （2）中小企业生态系统间的互操作

  　　连接世界各地不同平台/市场, 帮助中小企业进入更大的供应商及买家生态系统, 例如新加坡B2B平台SourceSage上的中小家具制造商能够收购印度B2B平台GlobalLinker上的买家

  （3）无缝集成式数字服务的快速直观接入

  　　例如，连通企业与物流和金融服务提供商

  （4）沙盒环境加快中小企业新服务的测试和交付

基于生态系统的贸易融资平台
(Ecosystem-based Trade Finance Platform)

▪ **普华永道 去中心化借贷平台**

中小企业只需**提出一次就可以向多家银行申请贷款**。平台可以代表银行评估 (具固定标准) 的政府担保贷款申请的资格。平台 让中小企业知道他们没有达到哪些标准，以及他们可以获得其他哪些贷款。平台可连接到金融科技公司，实施信用建模、电子KYC（了解您的客户）甚至电子签署，进而实现整个贷款管理的无纸化

▪ **TradeTrust** （由IMDA和环球银行金融电信协会(SWIFT)开发）

利用区块链技术, **实现不同国家的数字贸易平台之间可信电子贸易单证**(trade documents)**交换和互操作性,** 有望为全球200多个国家和地区的11000个SWIFT信息技术用户提供更便捷、更具成本效益的跨境数字贸易服务

(Working with various agencies and industry partners both locally and overseas, Singapore seeks to use public blockchain to develop an interoperability framework, "TradeTrust", for the exchange of digital trade documentation.)

新加坡个人财务数据共享平台 (SGFinDex)

- 全球首个公共数字基础设施, 使用国家设立的个人数字身份 (SingPass) 登录或授权他方获取其财务信息

- 平台上汇集来自个人的银行财务信息 (如存款、信用卡、贷款和投资), 以及来自政府和其他机构提供的信息, 如新加坡建屋发展局 (HDB) 住房贷款, 公积金 (CPF) 余额和税收, 中央托管公司持有的股票, 人寿与健康保单等

- 帮助**了解个人整体财务情况, 以便理财师应用软件做全面财务规划**

SGFinDex 如何操作 ？

MyInfo Financial Data

SingPass
User consent

Bank Financial Data

sgfindex

Encrypted Data Package

Financial Planning App

1 Access www.mymoneysense.gov.sg or your bank's financial planning platform to connect your banks to SGFinDex
- You may disconnect any bank anytime

2 Retrieve your financial information from banks and MyInfo securely
- Provide consent to retrieve your personal data through SGFinDex
- SGFinDex passes encrypted data to the financial planning platform
- Financial planning platform decrypts and displays the data for you

World's first public digital infrastructure to use a national digital identity and centrally managed online consent system to enable individual to retrieve your financial data such as your savings, insurance and investments - all in one consolidated view.

（参考文献：https://www.mas.gov.sg/development/fintech/sgfindex）

新加坡贸易数据共享平台(SGTraDex)

- 新加坡资讯通信媒体发展局联同金融机构、贸易商、港口、航运/物流公司等推出

- 一个**共同采用** – 以数据驱动有利于**协调供应链中相关各方运作**的数据基础设施

- 更准确地实时监控、核实和分享货物流动数据，进而提高工作效率与生产力, 以及提升各方对贸易融资的信心 (可避免包括青岛港贸易融资骗贷案-仓单重复质押之类的问题)
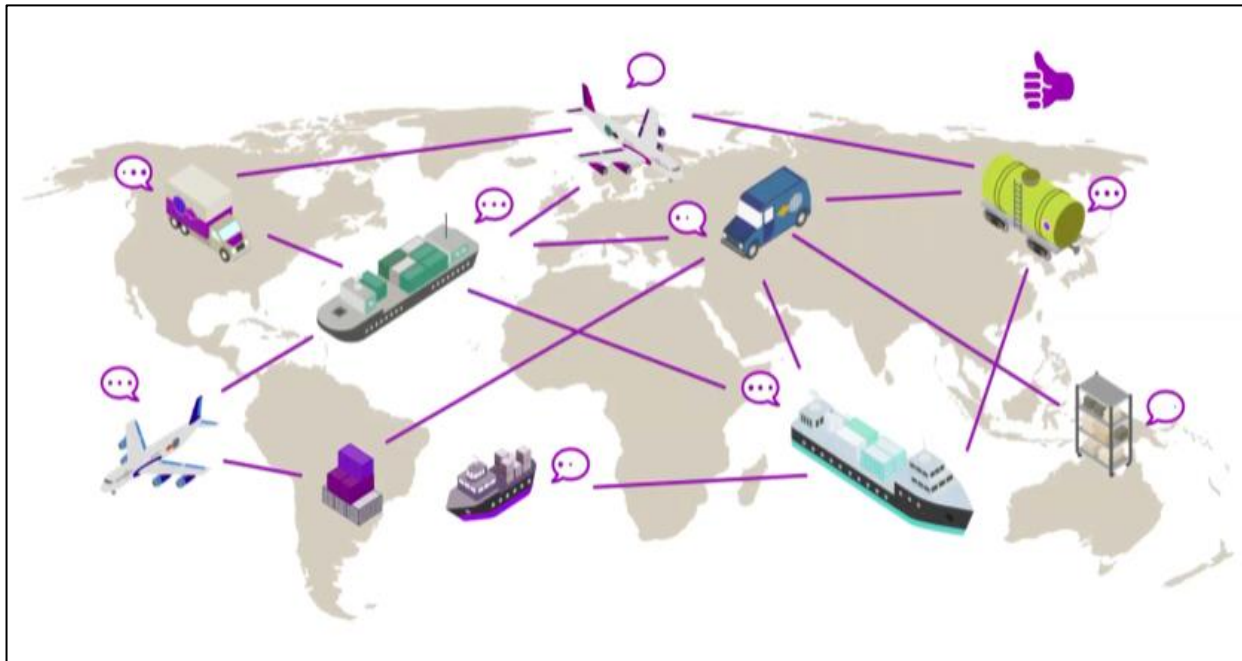
A digital infrastructure that facilitates trusted and secure sharing of data between supply chain ecosystem partners

(Source: https://sgtradex.com/)

新加坡对数字金融未来发展的期待 (Outlook)

- 利用数字货币进行跨境支付链接 (using digital currency for cross-border payments)

- 数字市场 (digital marketplaces)

- 数字资产应用案例 (digital asset use cases)

  MAS' Project Guardian探索利用资产代币化(asset tokenisation)创建具有经济价值的实用场景。首个试点计划下，代币化日元和新元存款的跨货币真实交易，和买卖代币化政府债券的模拟活动都顺利完成

- **Web 3 – 去中心化金融 (DeFi)**

  试点项目包括利用公链通过执行智能合约进行更具包容性的担保借贷
  （MAS' Project Guardian）

- 绿色金融 (green finance)

  利用科技和数据支持绿色金融生态系统，如衡量投资对环境的影响

[MAS' Project Guardian 守护者计划: 新金管局与与金融业者展开合作计划探索去中心化金融的潜在应用。将由星展银行（DBS）、摩根大通（JP Morgan）和数码资产合资公司Marketnode牵头]

全球科技加速器 Global FinTech Hackcelerator 2022

新金管局收集, 组织并优先列举金融服务行业急需解决的57问题(Problem Statements), 然后征求金融科技业者的数码解决方案

新金管局从而发挥其**金融发展**职能, 指导创新方向!

Web 3.0 :

(A) 嵌入区块链技术 - 探索有助于克服可扩展性和实施面对挑战的领域

(B) 扩展去中心化金融 DeFi - 探索有关识别和开发实际应用场景的问题

绿色金融 :

(C) 监控承诺 (monitor commitment) **-** 让投资者和金融机构更容易监控发行人对可持续发展的承诺

(D) 衡量影响 (measure impact) **-** 提高衡量贷款和投资对达到其定下可持续性目标的能力

(https://hackolosseum.apixplatform.com/h1/gfh2022#preview)

Governance and Regulations
治理与监管条例

Which two are the extremes?

CRYPTOCURRENCY REGULATIONS AROUND THE WORLD

United States

- Despite having a high number of cryptocurrency investors and blockchain companies, the US has yet to create a clear regulatory framework for the asset class.

European Union

- Cryptocurrency is legal throughout most of the EU, although exchange governance depends on individual member states.

China

- China's central bank said all cryptocurrency-related transactions are illegal and must be banned.

Singapore

- Cryptocurrency classified as property but not legal tender.

- Digital payment token licences granted to local fintech firm Fomo Pay, DBS Vickers and Australian crypto exchange Independent Reserve.

El Salvador

- It is the world's first country to accept Bitcoin as legal tender. **in 2021**

Sources: THE NEW YORK TIMES, INVESTOPEDIA, AFP, COINMARKETCAP, BANK OF AMERICA   STRAITS TIMES GRAPHICS: CHNG CHOON HIONG

(Straits Times 14 Oct 2021)

Miss El Salvador dons golden bitcoin outfit at beauty pageant

(Reuters January 14, 2023)

The currency-themed national costume representing "the evolution of the Salvadoran currency," from cacao beans, colón, U.S. dollar to Bitcoin

(Reference: **"萨尔瓦多追捧比特币的现实思考"**, 白士泮, 联合早报, 30-6-2021)

Singapore:
REGULATORY POSITION on CRYPTO- CURRENCIES

Tharman Shanmugaratnam, Deputy Prime Minister and Minister in charge of MAS:

"1. Cryptocurrencies are an **experiment**. The number and different forms of cryptocurrencies is growing internationally. It is too early to say if they will succeed. If some do succeed, their **full implications** will also **not be known** for some time.

2. The Monetary Authority of Singapore (MAS) has been closely studying these developments and the potential risks they pose. **As of now, there is no strong case to ban cryptocurrency trading here**. **But** we will be **subjecting those involved as intermediaries to our anti-money laundering regulations**. And we will **keep highlighting to Singaporeans that they could lose their shirts** when they invest money in cryptocurrencies....

We will continue to **encourage experiments** in the blockchain space that may involve the use of cryptocurrencies, because some of these innovations could turn out to be **economically or socially useful**. But equally, we will stay **alert to new risks**."

MAS' View on Digital Token Categories

MAS believes digital tokens are evolving, but currently view digital tokens in following categories: -

(a) **Payment Token** – also known as cryptocurrencies or virtual currencies, as a means to purchase goods or services, e.g., Bitcoin (BTC) and Ether (ETH)

(b) **Utility Token** - digital representation of future access right to a token seller's product or service. They are not bought for return on investment.

(e.g., a company developing a block-chain based online game could issue utility tokens to fund the development of the game. Once the game is developed, the token owners could use the tokens for in-game purchases.)

(c) **Security Token** - digital representation of ownership or a security interest over the token seller's assets or property, or a debt owed by the seller. They are bought for return on investment

Are these digital tokens regulated by MAS?

(Reference: **"A GUIDE TO DIGITAL TOKEN OFFERINGS"** issued by MAS, last updated on 23 December 2019)
(Reference: Blockchain & Cryptocurrency Laws and Regulations | Singapore | GLI (globallegalinsights.com)

MAS' Regulatory Approach on Security Tokens

❑ "A Guide to Digital Token Offerings" by MAS provides guidance

- If the digital token has the attributes of a **capital markets product**, it will be regulated under the Securities and Futures Act (SFA)

  e.g., issuers must observe the prospectus requirements for the offer of securities under the SFA; persons dealing in or providing corporate finance advice on these tokens must hold a capital markets services licence

- Capital markets products include any securities, units in a collective investment scheme, derivatives contracts and spot foreign exchange contracts for purposes of leveraged foreign exchange trading

❑ Trading of security tokens are currently offered by " Recognised Market Operators (RMOs) " which are regulated by MAS under SFA

(Reference: "A GUIDE TO DIGITAL TOKEN OFFERINGS" issued by MAS, last updated on 30 Dec 2019)
(https://www.mas.gov.sg/regulation/capital-markets/approved-exchange-ae-or-recognised-market-operator-rmo-licence)
(2022-Cryptoassets-Blockchain-Singapore (Chng Li-Ling).pdf (Chng Li-Ling, RHT))

MAS' Regulatory Approach on Payment Tokens (1)

❖ under **"Payment Services Act 2019"** (wef 28 Jan 2020): -

- the issuing digital payment tokens **(DPTs, aka cryptocurrencies)**
- issuing or operating of payment account including e-wallets
- providing services of dealing in DPTs
- facilitating or providing platform to allow persons to exchange DPTs (i.e., cryptocurrencies exchanges)

in Singapore will be licensable and regulated activity.

❖ Under **"Guidelines on Provision of Digital Payment Token Services to the Public"**

DPT service providers (include payment institutions, banks and other FIs, as well as applicants under PSA Act 2019) should not promote DPT or its derivatives services in public areas or social media to the general public in Singapore

❖ under **SFA**, approved exchanges in Singapore are allowed and regulated to trade **payment token derivatives**

Intercontinental Exchange (ICE) launched Bitcoin futures contract in Singapore on Dec 9, 2019

MAS Regulation - Payment Services Act 2019 (2)

PAYMENT SERVICES ACT
2019

One Licensing Framework, Seven Payment Activities

Omnibus framework that covers both new and traditional payment activities, and fosters synergies between activity types
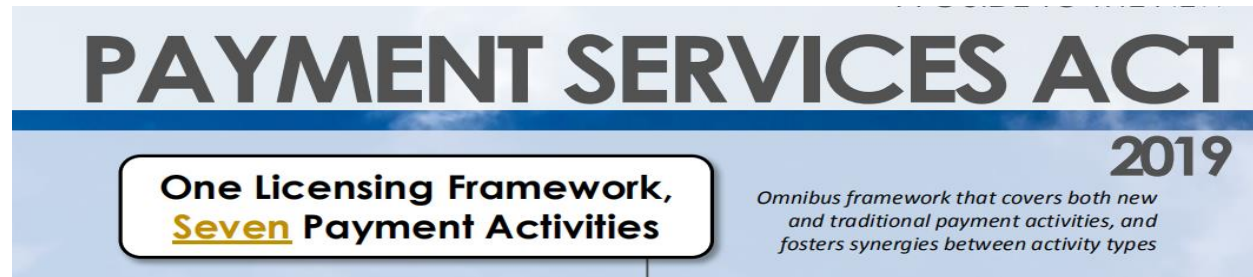
- **7 regulated retail payment activities are: -**

  (a) an (payment) account issuance service, e.g., e-wallets and non-bank issued credit cards

  (b) a domestic money transfer service, e.g. payment kiosks and payment gateway services

  (c) a cross border money transfer service

  (d) a merchant acquisition service, e.g., online payment gateways and the provision of point-of-sale terminals

  (e) an e money issuance service, e.g., e-money includes money stored in e-wallets

  (f) a DPT service - buying or selling DPTs or providing a platform to allow persons to exchange DPTs

  (g) a money changing service

" …narrows the gap with Japan, currently a major Asian centre for cryptocurrency trading after 22 exchanges received licences there since 2017…"
(Bloomberg)

MAS Regulation - Payment Services Act 2019 (3)

Modular approach enables calibration of regulations to account for the specific risks and context of each activity type

Activity-Based, Risk-Focused Regulation

Three Licence Classes

Four Key Risks

Money-Changing Licensee
- Conducts money-changing service only

Standard Payment Institution
- ≤ S$3m monthly transactions for any activity type
- ≤ S$6m monthly transactions for two or more activity types
- ≤ S$5m of daily outstanding e-money

Major Payment Institution
- > S$3m monthly transactions for any activity type
- > S$6m monthly transactions for two or more activity types
- > S$5m of daily outstanding e-money

MONEY LAUNDERING & TERRORISM FINANCING

USER PROTECTION
Safeguarding of funds in transit and e-money float

INTER-OPERABILITY
Access Regime
Common Platform
Common Standards

TECHNOLOGY RISKS
Governance
Authentication
Cyber Hygiene
Encryption
Anti-Fraud

MAS Regulation - Payment Services (Amendment) Bill (4)

- The Act is amended on 4 Jan 2021, demonstrating that regulations ought to keep pace with fast technological advances and changes to international standards

- Main amendments: -

  (1) expand the scope of DPT services to minimise laundering illicit proceeds or hide illicit assets: -

   (a) facilitating the transmission of cryptocurrencies from one account to another
   (b) custodial services for cryptocurrencies
   (c) facilitating the exchange of cryptocurrencies where the service provider does not come into
     possession of the moneys or cryptocurrencies involved

  (2) broaden the definition of cross-border money transfer service to include facilitating transfers of money between persons in different jurisdictions, where money is not accepted or received by the service provider in Singapore

  (3) MAS can impose measures **to ensure better consumer protection**, e.g., requiring a DPT service provider to segregate customer assets from its own assets; and **to maintain financial stability and safeguard the efficacy of monetary policy**

  (MAS will consult public when drafting specific measures)

MAS Discourages Cryptocurrency Trading by General Public

新金管局限制加密货币服务向公众/散户推广

"MAS strongly encourages the development of blockchain technology and innovative application of crypto tokens in value-adding use cases. But the trading of cryptocurrencies is highly risky and not suitable for the general public. DPT service providers should therefore not portray the trading of DPTs in a manner that trivialises the high risks of trading in DPTs, nor engage in marketing activities that target the general public."

"…MAS强烈鼓励区块链技术的发展，以及**加密代币** (crypto token) 在增值用例中的创新应用。但**加密货币** (cryptocurrencies 或DPT) 的交易风险很高，**不适合普通公众**。因此，DPT服务提供者不应以淡化DPT交易高风险的方式来描述DPT交易，也不应从事针对公众的营销活动…"

(MAS Assistant Managing Director (Policy, Payments and Financial Crime),
Ms Loo Siew Yee)

(指导方针 https://www.mas.gov.sg/-/media/MAS-Media-Library/regulation/guidelines/PSO/ps-g02-guidelines-on-provision-of-digital-payment-token-services-to-the-public/Guidelines-on-Provision-of-Digital-Payment-Token-Services-to-the-Public-PS-G02.pdf)

MAS Position on Cryptocurrency (Payment Token)

- Cryptocurrencies is just one of the digital assets

- Cryptocurrencies are actively traded and heavily speculated upon. MAS has been strongly warnings against retail investments in cryptocurrencies due to their extreme price volatility and market manipulation

<div style="color:red; text-align:center">

**"Yes: Digital Asset Innovation,
No: Cryptocurrency Speculation"**

</div>

Is NFT regulated in Singapore?

- NFTs are unique (non-fungible, not mutually interchangeable) digital items that have digital certificates of ownership ("tokenised") stored and traded on the blockchain

- Currently, creating and buying/selling NFTs are **not specifically regulated** under the Singapore laws (considered a grey zone?)

- Should an NFT have the characteristics of a capital markets product under the Securities and Futures Act (SFA), it will be subject to MAS' regulatory requirements, in line with the guidance provided in "A Guide to Digital Token Offerings" (updated 26 May 2020)

- Although it appears that the definition of a "digital payment token" (DPT) mainly applies to fungible tokens, it may be possible for certain types of NFTs, **depending on the relevant factual circumstances (such as its usage and attributes)** and underlying digital file, to fall within the definition of a "digital payment token". Correspondingly, the relevant provisions within the PS Act may be applicable to NFTs which constitute DPT

Bored ape yacht club - The computer-generated 10,000 NFTs (cartoonist apes) were launched as a collection on 30 Apr 2021. Each avatar was priced at US$200 (in ETH), and the collection was sold out in a day.

A symbol of wealth for the billionaires and as member of exclusive club with privileges

https://www.cnplaw.com/non-fungible-tokens-and-their-legal-implications-cnpupdate-may2021

Risk Areas of Digital Assets MAS Focuses on

1. combat money laundering and terrorist financing risks (legislated)

2. manage technology and cyber related risks (legislated)

3. safeguard against harm to retail investors (to be further enhanced by legislation)

4. uphold the promise of stability in stable coins (studying)

5. mitigate potential financial stability risks (studying)

[Total assets of global financial institution 2021: USD 487 trillion (Statista)
Total market capitalization of cryptocurrencies 2021: USD 0.98 trillion (CoinGecko)]

Singapore - Asia's Crypto and Blockchain Hub

- Singapore actively **promotes blockchain** development

- Singapore making **good progress** to build the regulatory framework for digital assets (with Financial Services and Markets Act 2022, Payment Services Act 2019 and existing Securities and Futures Act)

- **legal clarity** put Singapore in a good position in promoting digital finance (that is so closely associated with the digital tokens)

- The conducive regulatory environment , plus the open, sound and prudent supervision by MAS, Singapore has become Asia's crypto and blockchain hub

Regulating Web 3.0 and Metaverse?

- Who regulate the borderless? International regulatory cooperation will be key

  无国界，谁来管？国际监管合作将是关键

- Since May 2022, WEF is looking into Metaverse governance and policy framework to ensure an interoperable, secure, and inclusive Metaverse ecosystem under **"Defining and Building the Metaverse" project.**

- In Jun 2022, Meta, Huawei, and Microsoft and other tech giants set up **Metaverse Standards Forum** to explore where the lack of interoperability is holding back metaverse deployment, and because metaverse will bring together diverse technologies, the Forum will foster interoperability standards that will be essential to an open and inclusive metaverse.

- We can't regulate what doesn't yet exist, and we need for real use-cases to emerge out of Web3.0. Regulatory response will be gradual. Market players must continually collaborate with regulators to shape the regulatory framework.

Leveraging on national digital competitiveness for Singapore companies

新加坡企业的宏观数码(字)优势

"连接器" (Connectivity)

新加坡是地理世界里渺小的 "小红点" (little red dot)，
但却是数字世界里重要的 "全球节点" (critical global node)！

"世界多国筑起了保护主义的**高墙**(high walls)，新加坡筑起多边合作的**桥梁**" (briges)！

- 政治立场中立, 体制开放包容 (politically neutral; open & inclusive)

- 过去到现在是物理自由港; 将来是数字与科技自由港

- 提倡新型数字经济伙伴关系协定 (Digital Economy Partnership Agreement) 领军者 (新加坡, 智利, 新西兰于2020年6月12日签署)

  - 加强国与国之间数字连结性, 促进电子贸易, 数字系统兼容性以及数据跨境自由流通等领域的合作 (digital connectivity, electronic trade, digital system interoperability & cross-border free flow of data)

  - （积极谈判）中国, 韩国, 加拿大

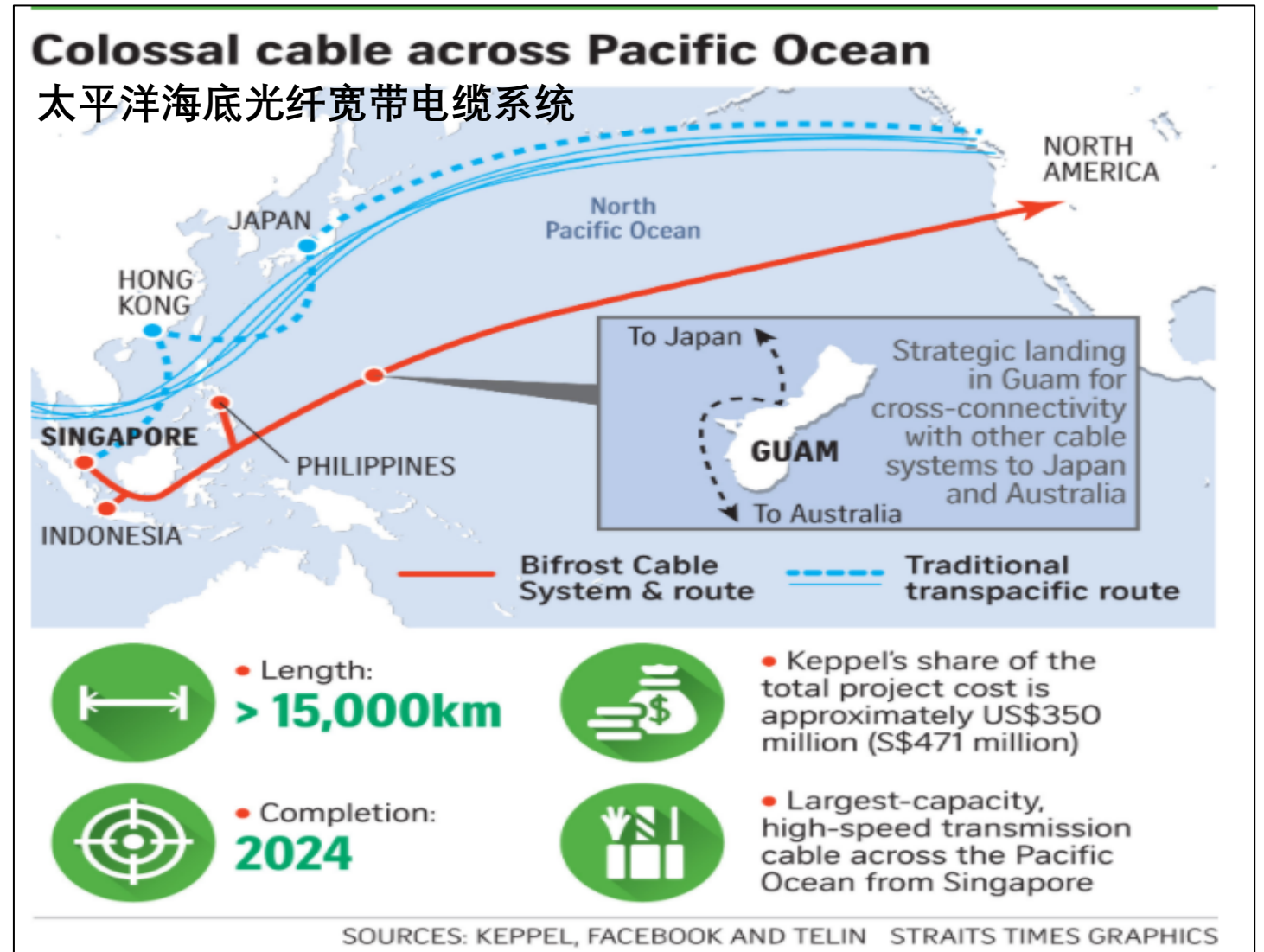- 新加坡也同澳大利亚、智利、韩国、新西兰和英国达成双边数码经济协议

> 数码经济伙伴关系协定 开始处理中国加入申请
>
> 订户
>
> 来自 / 联合早报
> 发布 / 2022年8月20日 5:00 AM
>
> 数码经济伙伴关系协定（Digital Economy Partnership Agreement，简称DEPA）联合委员会正式开始处理中国加入协定的申请。

"连接器"- 实例 (1) 太平洋海底光纤宽带电缆系统

- 横跨太平洋，连接新加坡与北美西岸的Bifrost海底光纤宽带电缆系统

- 连接**新加坡、印度尼西亚、菲律宾、日本、澳大利亚**和**北美**西海岸

- 全长超过1万5000公里，预计在2024年完工

- 将更好地满足云计算、移动设备和 5G 部署对数据带宽指数级增长的需求
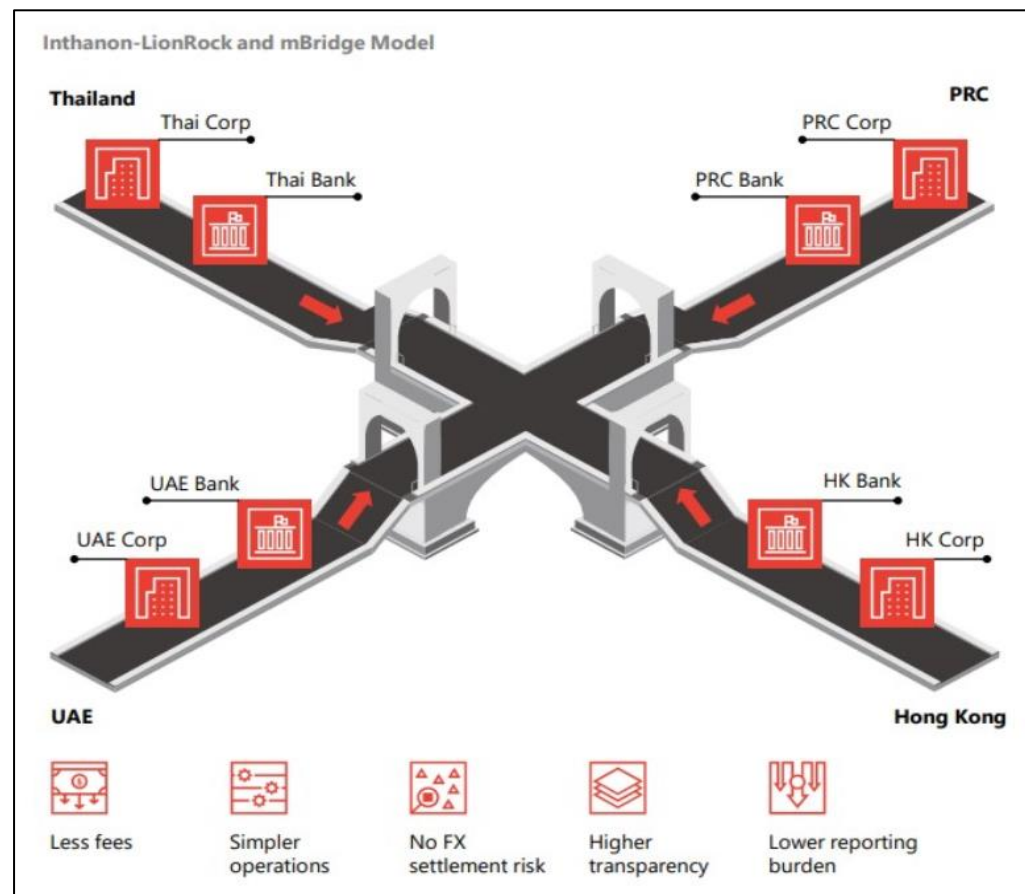
- 加强新加坡数字中心的地位 (Int'l Digital Hub)

Colossal cable across Pacific Ocean

太平洋海底光纤宽带电缆系统

NORTH AMERICA

JAPAN

North Pacific Ocean

HONG KONG

To Japan

Strategic landing in Guam for cross-connectivity with other cable systems to Japan and Australia

GUAM

SINGAPORE

PHILIPPINES

To Australia

INDONESIA

━━ Bifrost Cable System & route

- - - Traditional transpacific route

- Length: > 15,000km
- Keppel's share of the total project cost is approximately US$350 million (S$471 million)
- Completion: 2024
- Largest-capacity, high-speed transmission cable across the Pacific Ocean from Singapore

SOURCES: KEPPEL, FACEBOOK AND TELIN   STRAITS TIMES GRAPHICS

(Source:"New subsea cable to link S-E Asia, North America", ST, 30 Mar 2021)

"连接器" - 实例 (2) 创造东盟支付系统

- 2021年4日, 新加坡的移动支付平台 PayNow和**泰国**的移动支付平台–PromptPay连通。只要有对方的手机号, 就能够安全且随时随地汇款过账 **(全球首创）**

- 2022年第四季起, PayNow将分阶段同**马来西亚**的移动支付平台DuitNow接通, 完成实时的新马跨境转账交易。用户也能在两地的商店消费时, 用手机扫描NETS或DuitNow的QR码付费

- 最终创造**东盟(零售)支付系统 (Asean retail payment system)**

- 新加坡PayNow计划2022年7月也和**印度**的 Unified Payments Interface (UPI)连通

机遇: 多边央行数字货币桥 (m-CBDC Bridge)

- 旨在支持点对点(不用代理行)跨境数字支付。允许各参与国或地区的金融机构使用本国或地区的CBDC , 在基于分布式账本技术的共享平台上, 直接相互交易 (allowing FIs to use CBDCs issued by participating central banks to transact directly with each other on a distributed ledger technology (DLT)-based shared platform. This has the potential to reduce dependence on (i) the inefficient traditional network of correspondent banks, and (ii) also the use of US dollar for cross-border payments)

- **"Project Inthanon-LionRock"** 多边央行数字货币桥项目 (中国,中国香港, 泰国, 阿联酋)

  "Project Dunbar" 多边央行数字货币桥项目 (新加坡, 澳大利亚, 南非, 马来西亚）

- 这两个项目可以结合或协同发展, 推动它们之间的互操作性, 为区域创造覆盖地更广效率更高的"泛亚" (pan-Asia) 跨境支付系统

Inthanon-LionRock and mBridge Model

Thailand — Thai Corp — Thai Bank

PRC — PRC Corp — PRC Bank

UAE — UAE Bank — UAE Corp

Hong Kong — HK Bank — HK Corp

Less fees | Simpler operations | No FX settlement risk | Higher transparency | Lower reporting burden

机遇: 中国与东盟智慧城市联合发展的机会

"……..东盟应利用数字革命的优势, 以确保**数字系统的互操作性** – 也就是说, 在一国开发的数字系统也可以在其他国家使用……。

……我们可以跨越国界开展业务, 并拥有更加**一体化的东盟经济**。"

(新加坡总理**李显龙**在2018年11月15日东盟闭幕式媒体发布会上的发言)

"..新中（**深圳**）智慧城市倡议下，成功让深圳的企业试用电子提单，也正在合作建立两国都认可的数码身份认证系统，以让跨境旅游和付款更加便利。

中新**广州**知识城也是智慧城市方案及数码化技术的试验田。此外, 两国正在合作,把贸易通关程序数码化,让区域内的跨境货物流动变得更加顺畅…"

(新加坡总理**王瑞杰**在2022年10月31日新中双边合作联合委员会第18届会议前媒体发布会)

ASCN：共同致力于智慧和可持续的城市发展

东盟
智慧城市网络
---试点城市---

Below is a list of the 26 Pilot Cities that have been nominated by the respective ASEAN Member States.

- Brunei- Bandar Seri Begawan
- Cambodia- Battambang
- Cambodia- Phnom Penh
- Cambodia- Siem Reap
- Indonesia- Makassar
- Indonesia- Banyuwangi
- Indonesia- DKI Jakarta
- Laos- Luang Prabang
- Laos- Vientiane
- Malaysia- Johor Bahru
- Malaysia- Kuala Lumpur
- Malaysia- Kota Kinabalu
- Malaysia- Kuching
- Myanmar- Nay Pyi Taw
- Myanmar- Mandalay
- Myanmar- Yangon
- Philippines- Cebu City
- Philippines- Davao City
- Philippines- Manila
- Singapore- Singapore
- Thailand- Bangkok
- Thailand- Chonburi
- Thailand- Phuket
- Vietnam- Da Nang
- Vietnam- Ha Noi
- Vietnam- Ho Chi Minh City

"催化器" (Catalyst)

- 开放与包容的经济, 世界级金融中心, 风投基金活跃 (open and inclusive economy, a world-class financial center, and active venture capital market)

- 监管体制战略优势 – 积极发展数字金融, 鼓励创新。例: 数字货币与资产监管条规完整明确, 减少对业者的不确定性 (competitive advantage in regulatory system)

- 全球化DNA, 优良商业环境

- 东西方的文化智慧交汇

- 深厚的商业与人脉网络 - 对西方、东盟、中国和印度的企业文化有比较充分的了解
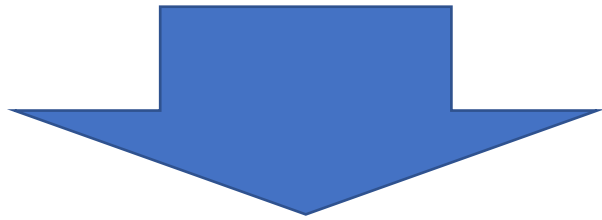
- 新加坡已吸引很多国家的科技巨头和初创企业来新落户

- 新加坡领先区域**数字创新**的经济体

- 利用新加坡设立的各种平台, 如东盟金融创新网络, 新加坡是进军东盟与亚太市场的 **"实验室" "跳板" "桥头堡" (Lab, Springboard, Bridgehead)**

新加坡 "实验室" – 创新, 测试科技, 市场可行性研究等

"….发挥本地规范与监管体系完善的优势, 让这里成为人们验证新想法与发明的重地…."

(Singapore) remaining open to global talent, as well as investment in the innovation economy where new ideas and inventions can be tested

ASEAN Financial Innovation Network ("AFIN")
"催化器"- 实例:东盟金融创新网络

- **(是什么)** 新金管局、东盟银行家协会和世界银行的国际金融公司共同成立了东盟金融创新网络

- **(为什么)** 目标是帮助东盟的银行与金融科技公司合作，以拓宽和加深整个东盟的数字金融服务的使用范围，向东盟资金不足的人郡提供金融服务

  (毕马威（KPMG）：**在6.8亿多人口中，只有27%拥有银行帐户**)

- **(怎么样)** 东盟金融创新网络推出了API Exchange（APIX），这是世界上第一个跨境开放体系平台, 金融机构和金融科技公司可以相互连接（"金融科技市场"）(Fintech Market), 在沙盒中进行协作实验（"金融科技沙盒" Fintech Sandbox), 以推动整个亚太地区的数字化转型和金融包容性

"公信器" (Credibility)

▪ 具有完善国际水平的法律与司法制度, 例: 新加坡国际商事法庭有条件成为加密货币平台破产重组司法管辖区 (jurisdiction for cryptocurrencies resolution and restructuring)

▪ 数字制度与标准的建设得到国际社会认可

  - 新加坡2019年制定的人工智能治理框架模式 (Model AI Governance Framework)赢得联合国 World Summit on the Information Society (WSIS) 奖
  - 新加坡, 联合澳大利亚和日本作为召集人, 为WTO电子商务联合声明倡议制定数字贸易规则

▪ 全球信任的知识产权中心; 积极打造数码信任中心 (intellectual property centre; digital trust centre)

▪ 可助力他国参与推动全球数字经济治理体系, 以及数字经济规则与技术标准的制定

▪ 他国和新加坡企业合作, 创建科技赋能高效又具有公信力的产品, 打入东盟与亚太区域市场

Opportunity: Building the public infrastructure for global 2nd-generation smart Internet
机遇: 构建全球性第二代智能互联网的公共基础设施

(1) 由中国国家信息中心 (China State Information Center) 信息化和产业发展部领军开发的区块链服务网络 (Blockchain-based Service （BSN）Network）在新加坡设立BSN基金会, 为了更好的开发与管理国际数字业务, 利用区块链技术构建连通全球的科技基础设施

"当前的国际规则和政策的确没有完全解决

(数字技术)带来新机遇的新问题....

新加坡是建立前瞻性标准项目的理想地点"

(Singapore is the ideal place to build a forward-looking standard project**)**

BSN 区块链服务网络
BLOCKCHAIN-BASED SERVICE NETWORK

基于区块链运行环境的第二代互联网

机遇: 构建科技基础架构, 联通东盟数字城市

(2) 中国**上海万向区块链**和新加坡贸易与工业部下属官方机构裕廊集团（JTC）达成战略合作, 落户新加坡榜鹅数码园区, 探索以区块链为基础, 深度整合隐私计算、物联网、人工智能、5G等数字化技术, 为数字城市构建**安全可信**的"基础架构", 以便更好联通东盟数字城市

(Building safe and trustworthy infrastructures for Asean Digital Cities)

机遇: 区域数据中心

(3) 新加坡是亚太最具竞争力容量最高的数据中心的国家 (Cushman and Wakefield 报告)。70+ 数据中心正在运营（2021末）

没有自然灾害, 高效基础设施(如全球主要托管和云计算供应商都在新加坡)和广泛光纤网络高容量快速连接外

政府关注 "数据中心运营的**关键标准注重于环保、安全和(能源)效率**问题"

Top data centre markets

GLOBAL		ASIA-PACIFIC
2021	**2022**	**2022**
1. Northern Virginia	1. Northern Virginia	1. **Singapore**
2. Chicago	2. Silicon Valley (tie)	2. Hong Kong
3. Sydney	2. **Singapore** (tie)	3. Sydney
4. Silicon Valley	4. Chicago (tie)	4. Seoul
5. **Singapore**	4. Atlanta (tie)	5. Tokyo
6. Dallas	6. Hong Kong	6. Osaka
7. London	7. Phoenix	7. Mumbai
8. Seattle	8. Sydney	8. Shanghai
9. New York/New Jersey	9. Dallas	9. Melbourne (tie)
10. Amsterdam	10. Seattle (tie)	9. Beijing (tie)
	10. Portland (tie)	11. Jakarta

Source: CUSHMAN & WAKEFIELD   STRAITS TIMES GRAPHICS

(Singapore scored highly on key criteria such as market size, fibre connectivity, availability of cloud services and pro-business policies)

谢谢 Thank You