Blockchain and its applications
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Lecture 57: Blockchain in Financial Services

- **Cross-border payments over blockchain**

- **Project Ubin**

- **Steller Protocol and Network**

- **Ripple Protocol and Network**

- **Project Ubin**

Cross-Border Payments

- Classic use case for which Bitcoin was created and perhaps the holy grail of cryptocurrencies
- To date, we have over 6000 cryptocurrencies!
- But, what qualifies as a currency. In economics, the following criteria must be satisfied:
  - Medium of exchange: Are merchants willing to accept the currency in exchange for goods and services
  - Unit of account: Is it a measure of the real value of goods and services (e.g., would a merchant be willing to accept the same value regardless of relative currency fluctuations)
  - Store of value: A mode of investment

Steller Protocol and Network

- Decentralized, hybrid blockchain platform with open membership; launched in 2014; **Lumens** as native asset
- **Federated Byzantine Agreement** (FBA) – quorums formed based on participants individual trust decisions, followed by agreement within quorums (Steller Consensus Protocol)
- 2-5 second transaction clearance
- Anchors act as bridges between a given currency and Stellar network
- Has a **distributed exchange**: pay in EUR with INR balance and network will automatically convert it at lowest rate for you

https://www.stellar.org/

Steller Protocol and Network

- The idea got published in a SOSP 2019 Paper --
  - Lokhava, Marta, et al. "Fast and secure global payments with Stellar." *Proceedings of the 27th ACM Symposium on Operating Systems Principles*. 2019.

- **Federated voting**: Nodes try to agree on abstract statements by first voting, then accepting, and finally confirming statements.
  - Keep on voting any valid statement
    (that the nodes believe to be valid)
  - Accept when a majority votes (form quorums)
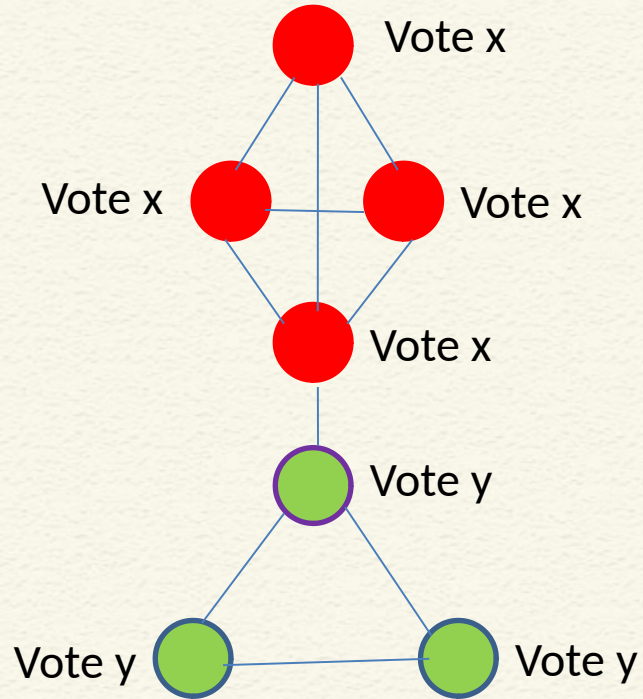 - Confirm when the quorum unanimously accepts a statement
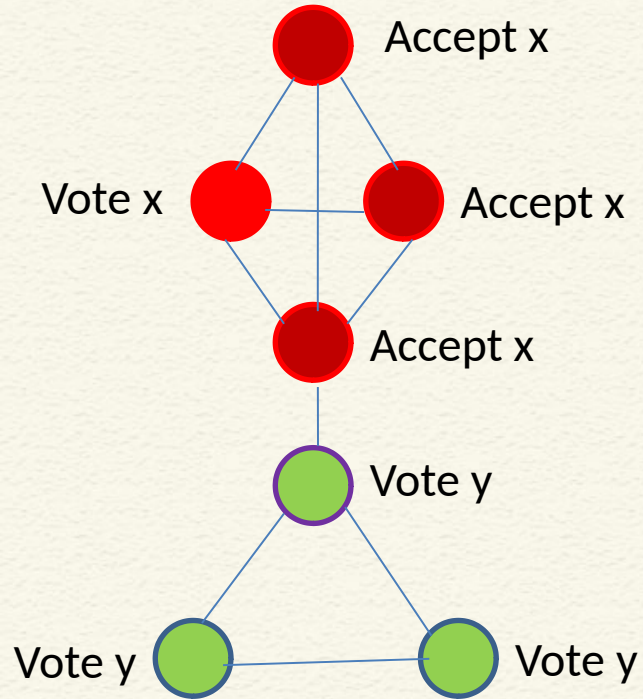
Federated Voting in Steller
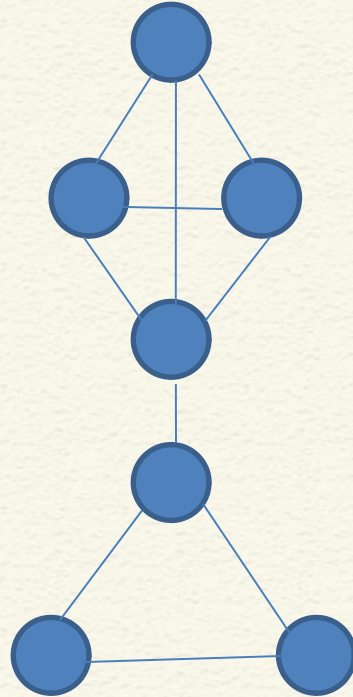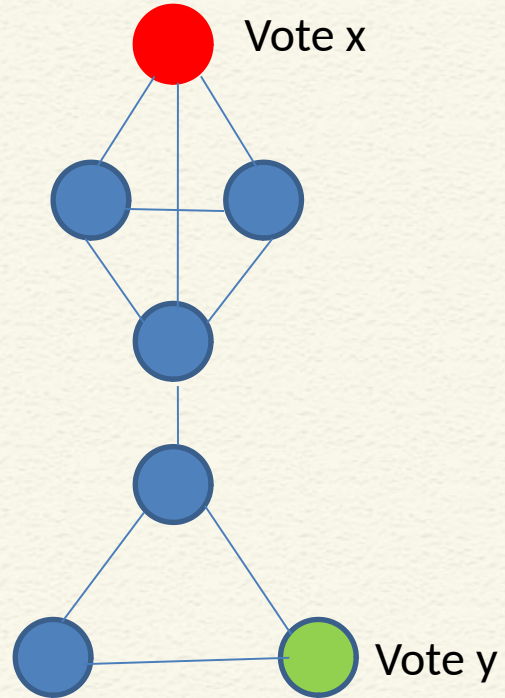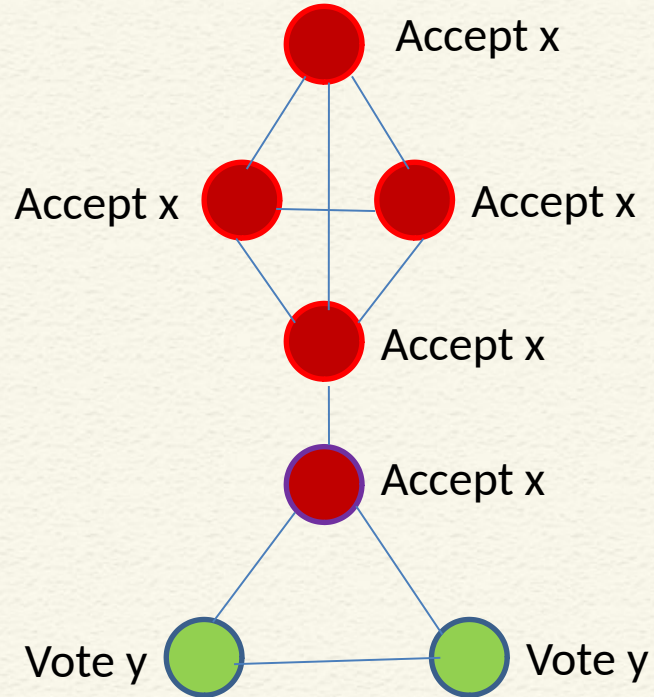
Federated Voting in Steller
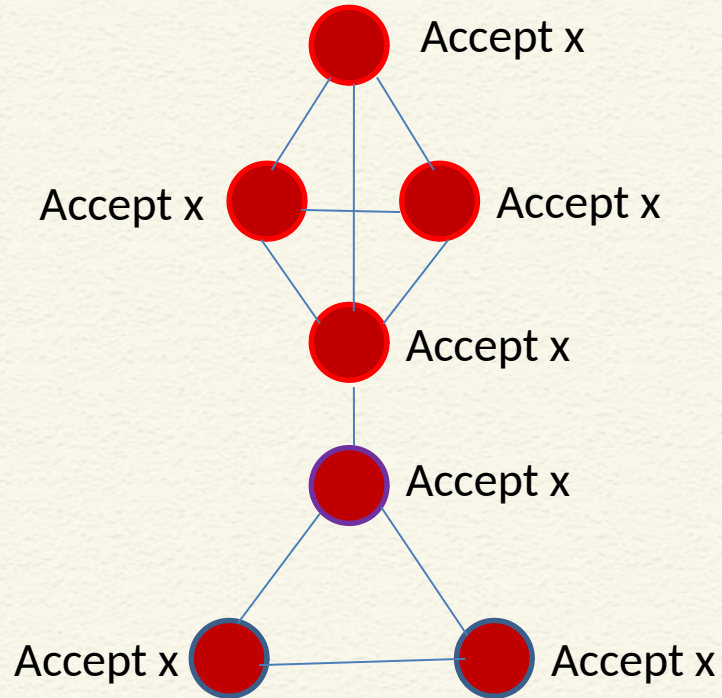
Federated Voting in Steller

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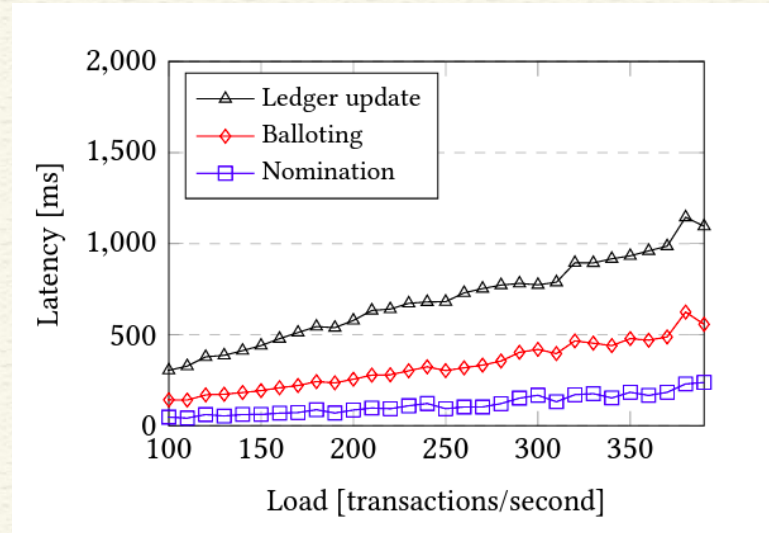
Federated Voting in Steller

Federated Voting in Steller

Steller Protocol and Network

- Partially synchronous protocol
  - Safety under asynchronous assumptions
  - Liveness require a synchronous network

- **Performance**:

Ripple Protocol and Network

- Protocol for banks to clear and settle payments in real time through a distributed network
- Consensus (**XRP Ledger** – **XRPL** -- https://xrpl.org/) allows payment exchanges and remittance to happen without need for a centralized clearing house
- Average 5 second confirmations; no mining, custom protocol that hasn't yet been validated for correctness and fault tolerance
- Gateway nodes convert fiat currencies to **XRP** (currency in Ripple)
- Market-makers convert from one currency to another
- Centralized governance, with Ripple still holding a large fraction of the cryptocurrency
- https://ripple.com

Ripple Protocol and Network

- Unlike Steller, there are open questions on Ripple consensus
  - Chase, Brad, and Ethan MacBrough. "Analysis of the XRP ledger consensus protocol." *arXiv preprint arXiv:1802.07242* (2018).
  - Claims that XRPL violates safety and liveness

Project Ubin: SGD on Distributed Ledger

- A collaborative project with the industry to explore the use of Blockchain and Distributed Ledger Technology (DLT) for clearing and settlement of payments and securities
    - Taken up by the Monetary Authority of Singapore (MAS) in November, 2016
    - Reports available on the MAS website: https://www.mas.gov.sg/schemes-and-initiatives/project-ubin

Project Ubin: SGD on Distributed Ledger

- Five-phase project
  - Phase 1: Tokenized SGD
  - Phase 2: Re-imagining RTGS
  - Phase 3: Delivery versus Payment (DvP)
  - Phase 4: Cross-border Payment versus Payment (PvP)
 - Phase 5: Enabling Broad Ecosystem Collaboration

Project Ubin: SGD on Distributed Ledger

- Phase 1: Tokenized SGD
  - Consortium of financial institutions to conduct inter-bank payments using blockchain technology
    - Bank of America Merrill Lynch, Credit Suisse, DBS Bank, HSBC, JP Morgan, Mitsubishi UFJ, OCBC, R3, Singapore Exchange (SGX), United Overseas Bank
  - Include DLT-based payment in MEPS+
  - Participant banks pledge cash into a custody account held at MAS. MAS will then create the equivalent value in Digital SGD on the DL and assign them to the respective banks.
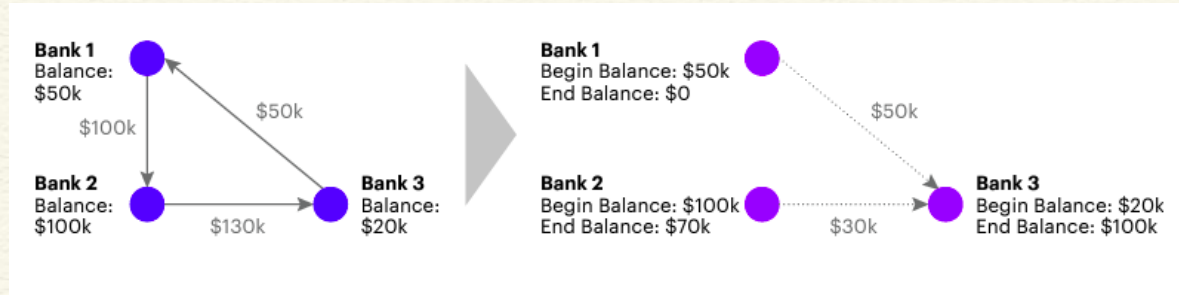
Project Ubin: SGD on Distributed Ledger
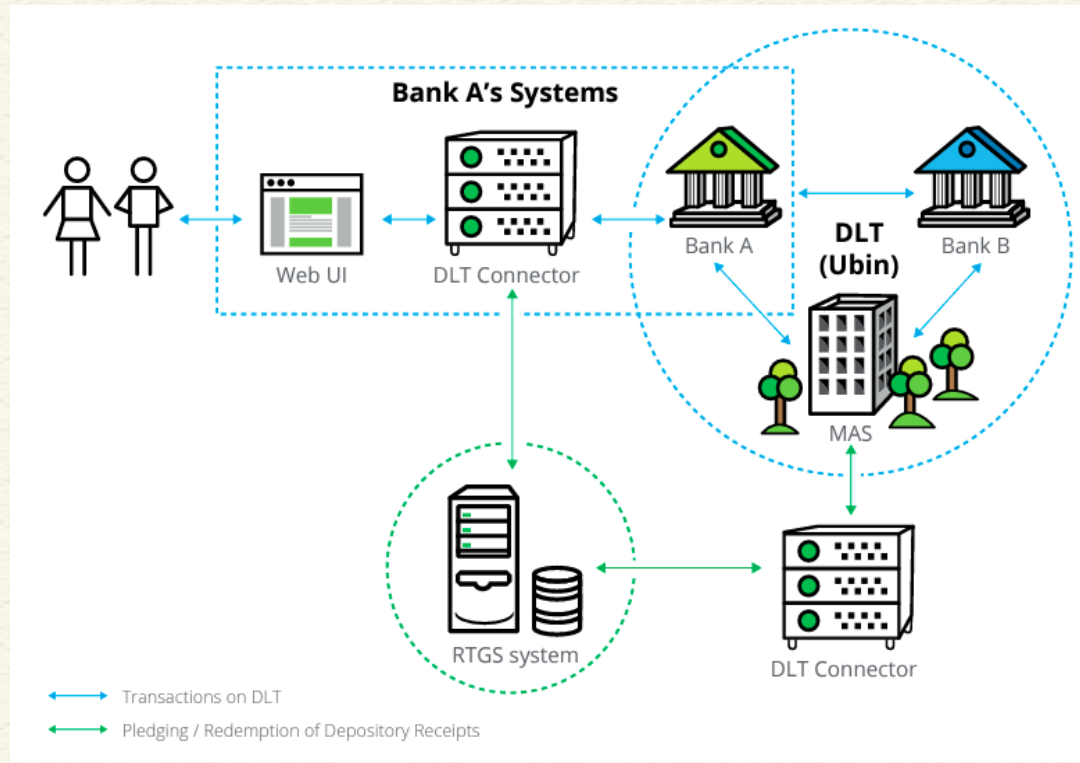
Project Ubin: SGD on Distributed Ledger

- Phase 2: Re-imagining RTGS
    - Led by MAS and The Association of Banks in Singapore (ABS)
    - Developed PoC using three DLT platforms – Ethereum, Fabric, and R3 Corda; open-sourced https://github.com/project-ubin
   - Solves the problem of gridlock

Project Ubin: SGD on Distributed Ledger

- Phase 3: Delivery versus Payment (DvP)
    - The cash payment for a purchased security occurs prior to, or upon, its delivery
        - Two counterparties (traders) meets at an agreed time to exchange the agreed assets.
    - In this phase, MAS and SGX collaborated to realise domestic DvP settlement on two separate blockchain platforms

Project Ubin: SGD on Distributed Ledger

- Phase 3: Delivery versus Payment (DvP)
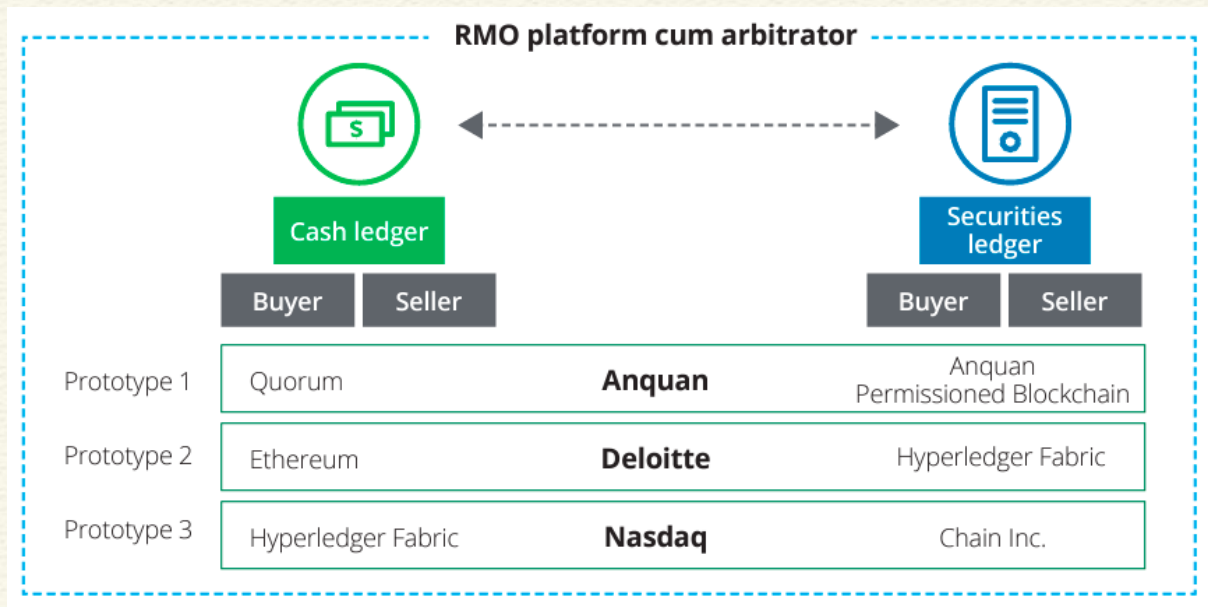
Project Ubin: SGD on Distributed Ledger

- Phase 4: Cross-border Payment versus Payment (PvP)
  - Joint initiative by Bank of Canada (BoC), Bank of England (BoE) and MAS; initiated in November, 2018
  - Transparency in payment status, availability of cross-border payment services, reduced time for payment processing, reduced costs
  - Considers three different payment models and analyzes their respective impact and scale

Project Ubin: SGD on Distributed Ledger

- Phase 4: Cross-border Payment versus Payment (PvP)
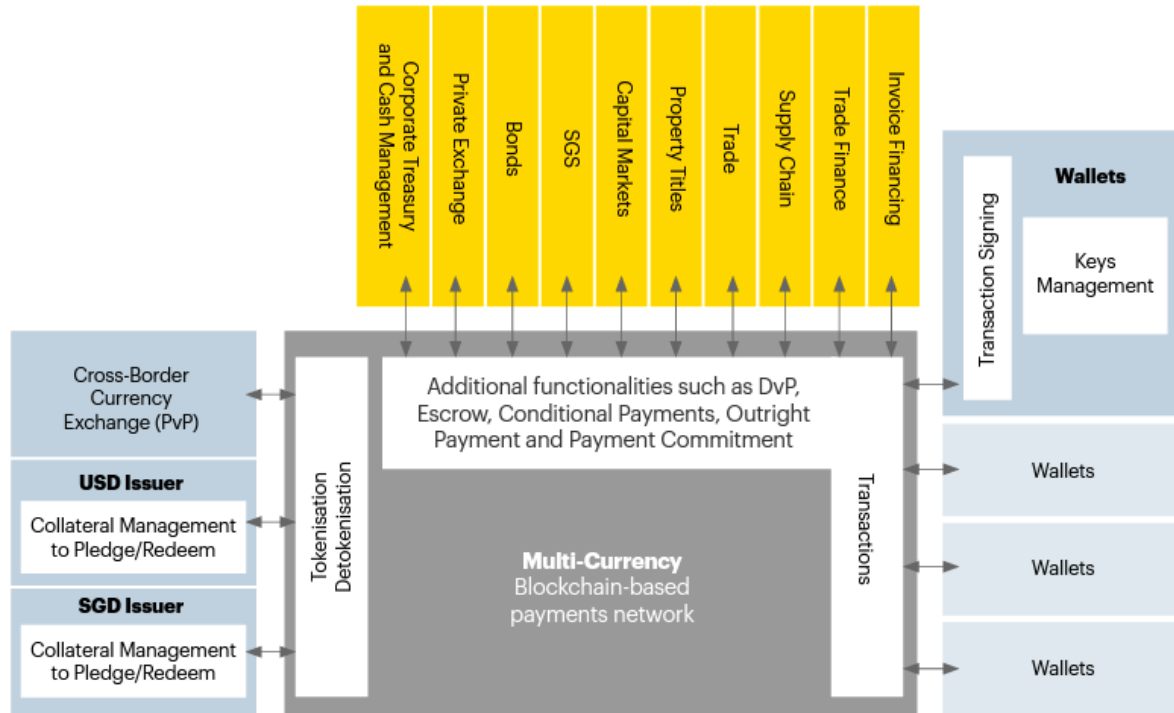 - **Model 2**
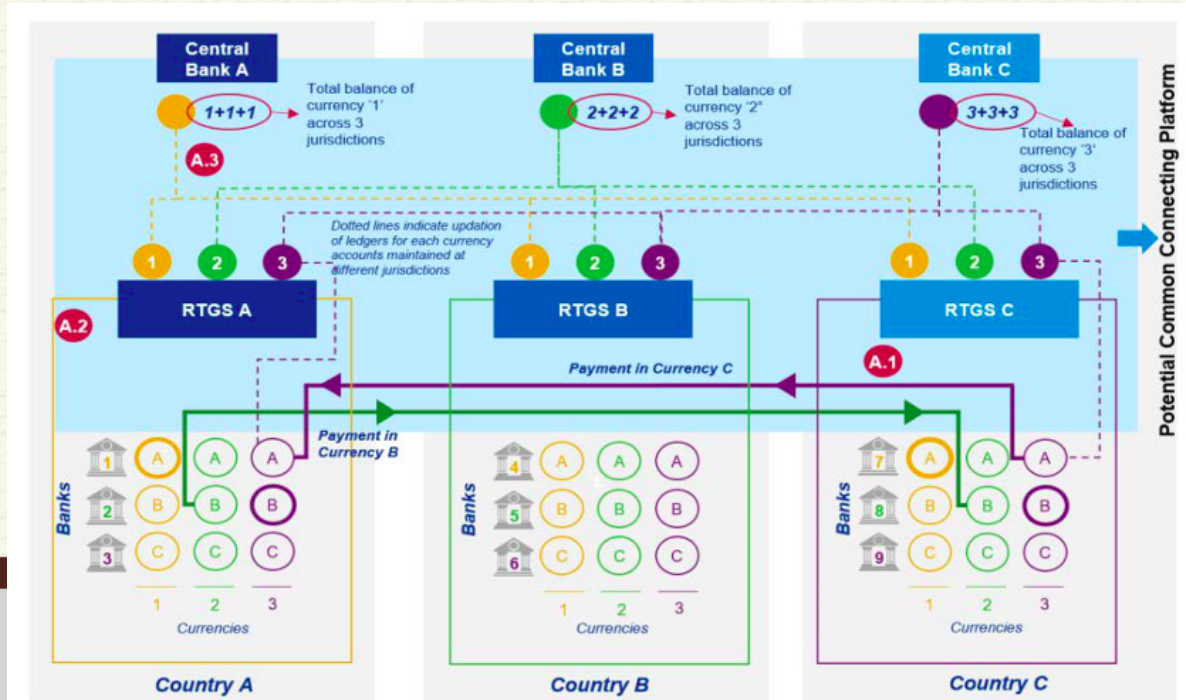
Project Ubin: SGD on Distributed Ledger

- Phase 5: Enabling Broad Ecosystem Collaboration
  - Provides technical insights into the blockchain-based multi-currency payments network prototype that was built
    - Describes how the network could benefit the financial industry and blockchain ecosystem.
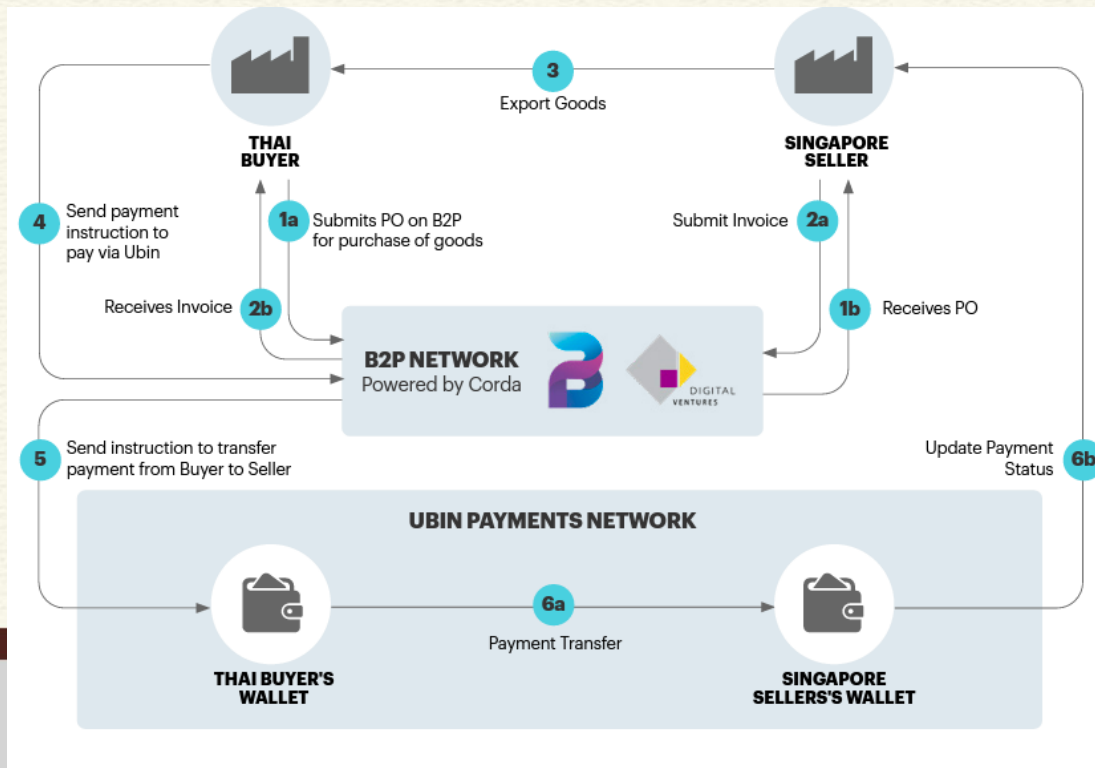
Project Ubin: SGD on Distributed Ledger

- Phase 5: Enabling Broad Ecosystem Collaboration

Project Ubin: SGD on Distributed Ledger

- Phase 5: Enabling Broad Ecosystem Collaboration

Blockchain for Procure-to-Pay (B2P)
Automated document verification and payment processing

Conclusion

- Financial services have been one of the key use-cases for Blockchain

- Project Ubin develops a payment network prototype for multi-currency payments; the project has been open-sourced

- Check the project reports for Ubin: https://www.mas.gov.sg/schemes-and-initiatives/project-ubin

Thank you