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Research in DLT

Project Jasper

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Digital Currencies and Fintech Research Agenda

Digital Currencies:

- Understand benefits, risks and impact on Bank's mandate of private digital currencies
- Understand policy rationale (if any) to a central bank digital currency (CBDC)
- Consider ways in which a CBDC system could be created

Fintech:

- Understand benefits, risks and impact on Bank's mandate of new technologies such as DLT

http://www.bankofcanada.ca/research/digital-currencies-and-fintech/

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Our Approach

RESEARCH

Understanding the benefits and risks of digital currencies and electronic payments is important. That's because they could have an impact on our core central bank functions.

For the past few years, we have researched private and central bank digital currencies. More recently, we've been studying other uses of Distributed Ledger Technology (DLT).

Browse our (Fintech) research

EXPERIMENTS AND PROJECTS

With many possible applications of DLT, we need to look at a range of questions. Test cases between authorities and the private sector can help deepen our understanding.

The Bank works with academics and the private sector to build and test this technology. Learn more about this work, including our flagship DLT experiment – Project Jasper.

Learn more about our projects

COLLABORATION ON THE REGULATORY AGENDA

Managing the benefits and risks of financial technology through a global regulatory framework is essential.

The Bank of Canada contributes to this agenda through the Financial Stability Board, the Committee on Payments and Market Infrastructures, and the Basel Committee on Banking Supervision.

Learn more about this work

Project Jasper Phase I and II

Jasper National Park | Source: Wikipedia

Objectives of Project Jasper

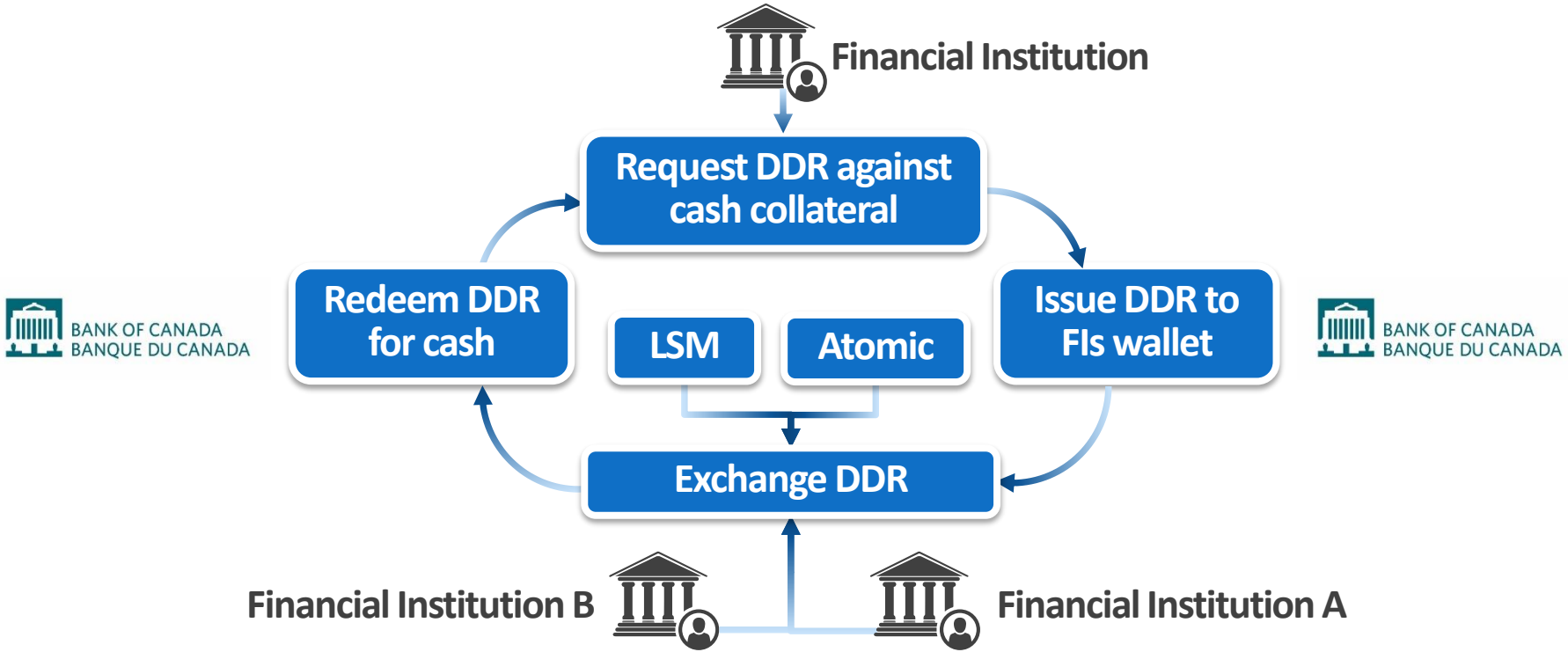
What would a DLT based large value payment system mean for:

- Standing against Principles for Financial Market Infrastructure (PFMI)
- Costs (3 levels: core systems; participants, financial system)
- Transparency of information
- Barriers to direct participation by institutions

Approach

Pose Hypothesis/ Questions → **Design and build proof of concept** → **Conduct analysis**

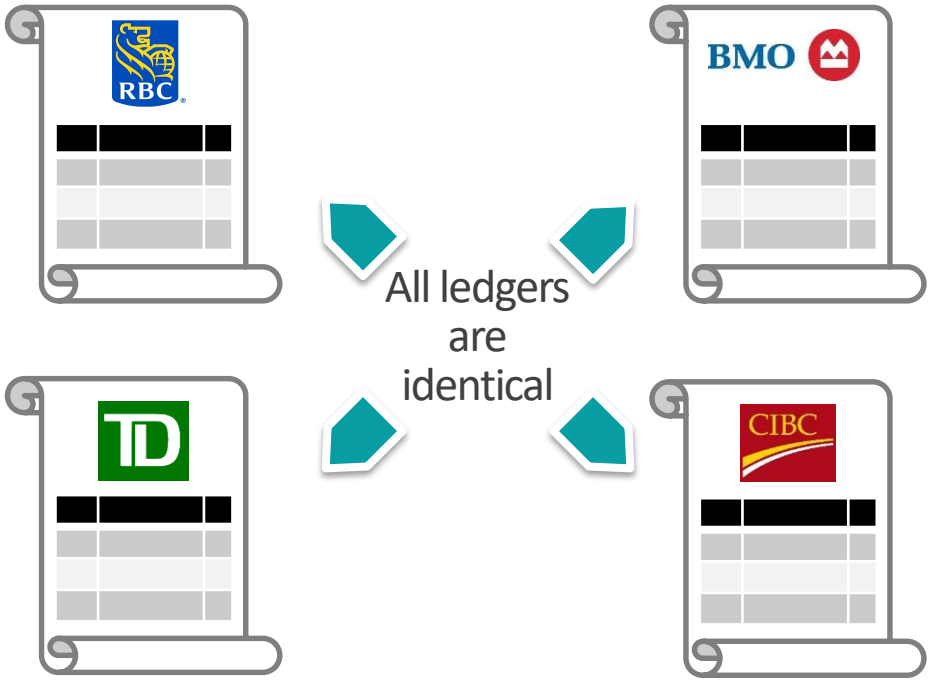
Functional Lifecycle



Architecture – Ethereum Platform

Designed for the internet and pseudonymous access

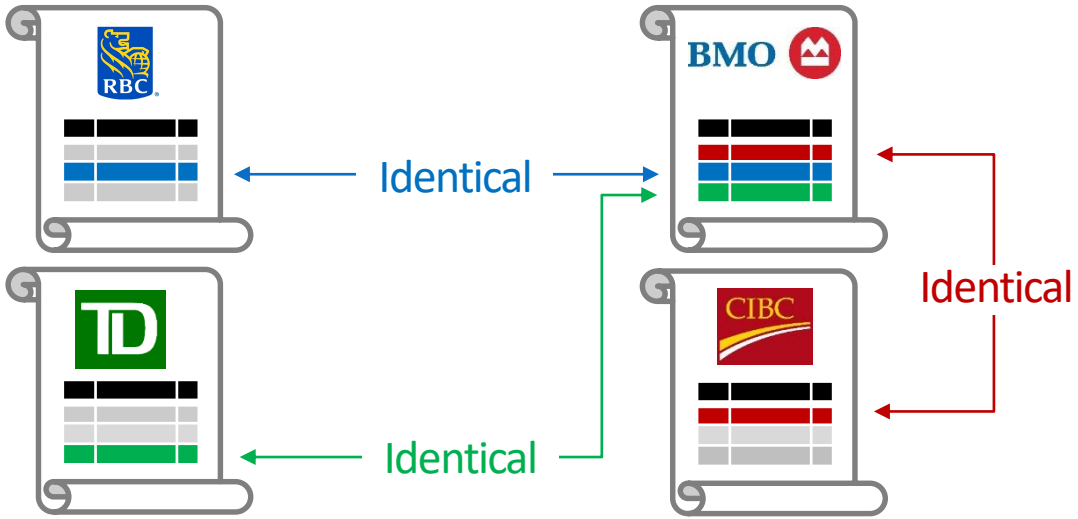
- Data and function replicated everywhere
- Little confidentiality
- High resilience
- Any changes are validated and recorded by a consensus of whole network
- The consensus method (PoW) means changes become more permanent over time



Architecture – Corda Platform

Designed for Financial Institutions and identified (permitted) access

- Data only shared and replicated on nodes of parties to trade
- Good confidentiality
- More costly resilience
- Changes validated only by parties and trusted notary
- Changes are deterministic
- Some centralised functions



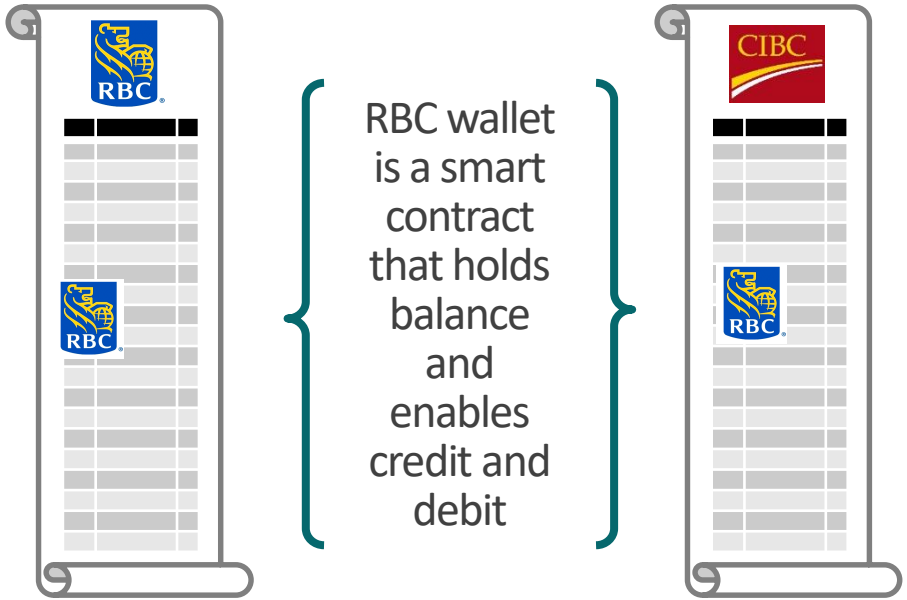
Centralized functions

Notary: Validates and records *all* transactions it receives

Doorman: Identity and authorization service

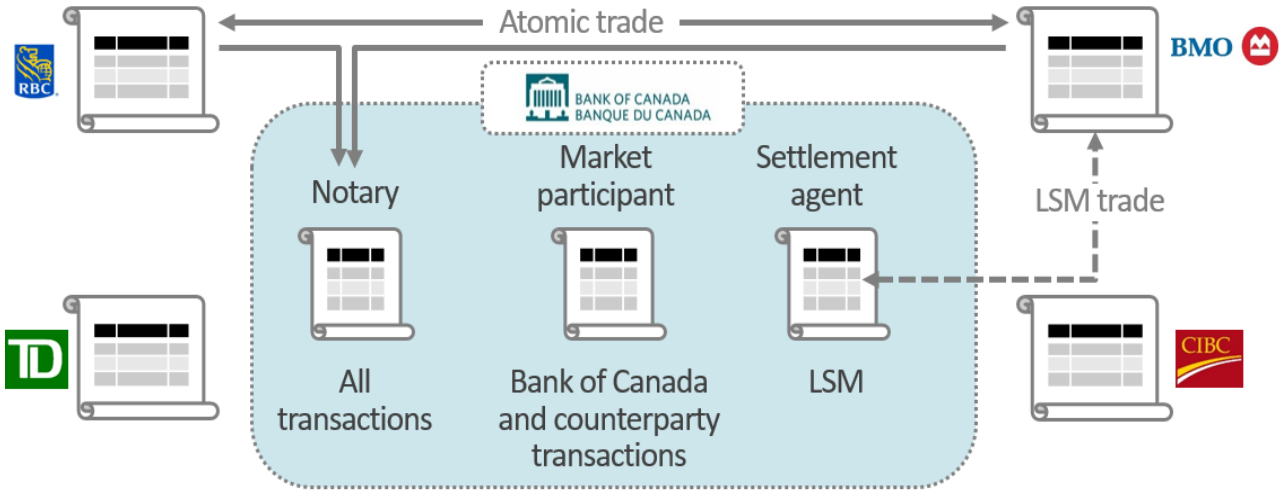
Architecture – Phase 1, Proof-of-Concept on Ethereum

- Although the RBC wallet exists on all nodes, only RBC can invoke the function to spend from it (only it has the private key)
- Similarly, although all ledgers have the function to issue new DDR, only Bank of Canada can invoke that function
- If an FI's node fails, they should be able to continue transacting on the network
- Settlement does not have a definite point-in-time finality
- Everyone on the network an see *all* trades

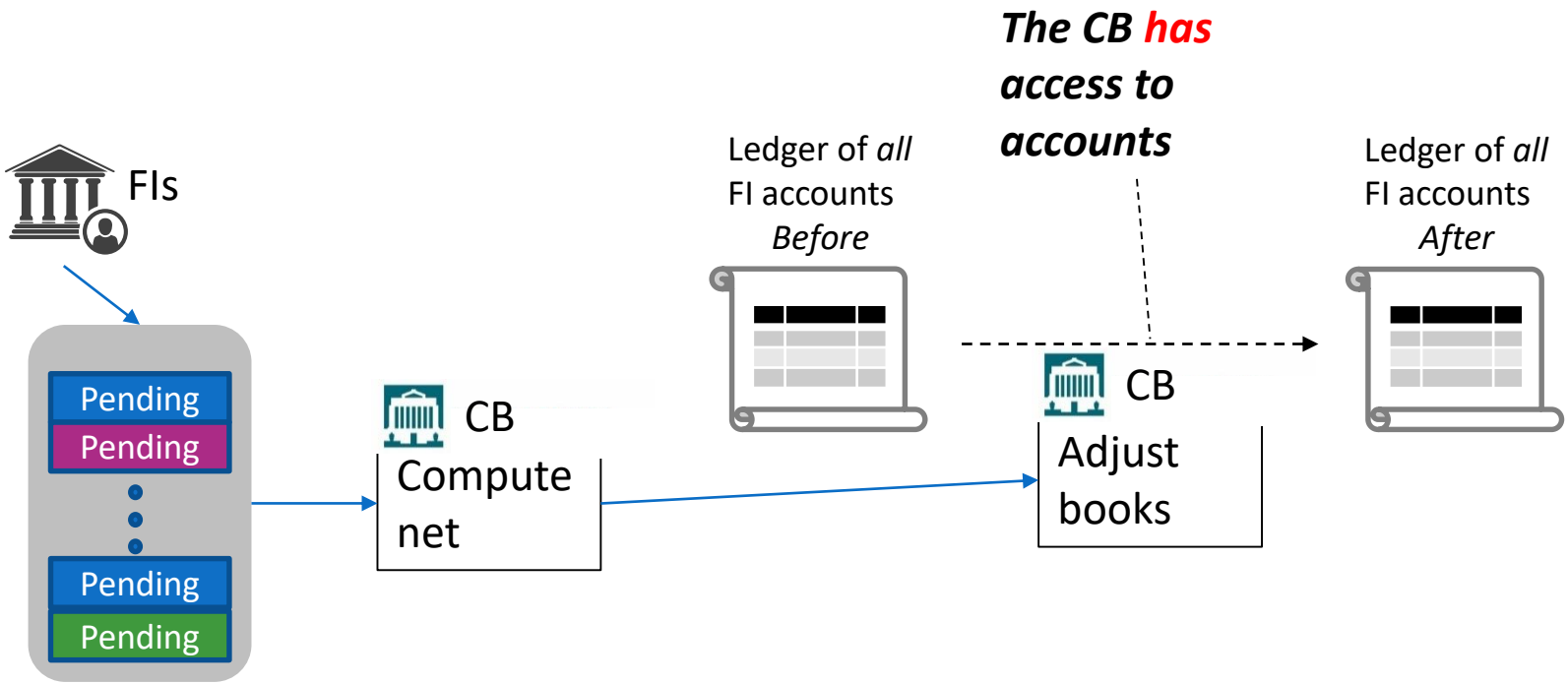


Architecture – Phase 2, Proof-of-Concept on Corda

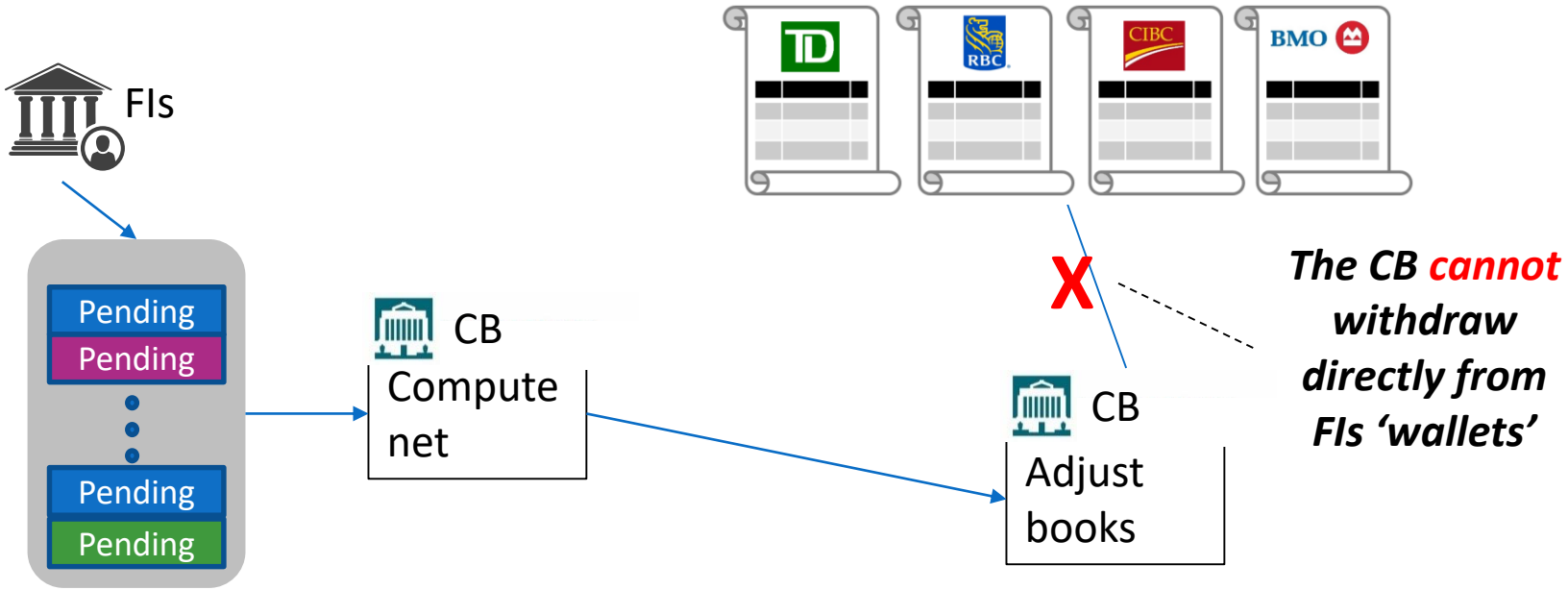
- Hybrid: decentralised / centralised
- FIs do not receive information on trades they are not party to
- Since data and functions are not replicated, an FIs node must be available for it to transact
  - Requires 'traditional' high availability and disaster recovery architecture
  - As with current systems, central function failure => system wide failure
- Settlement has definite finality



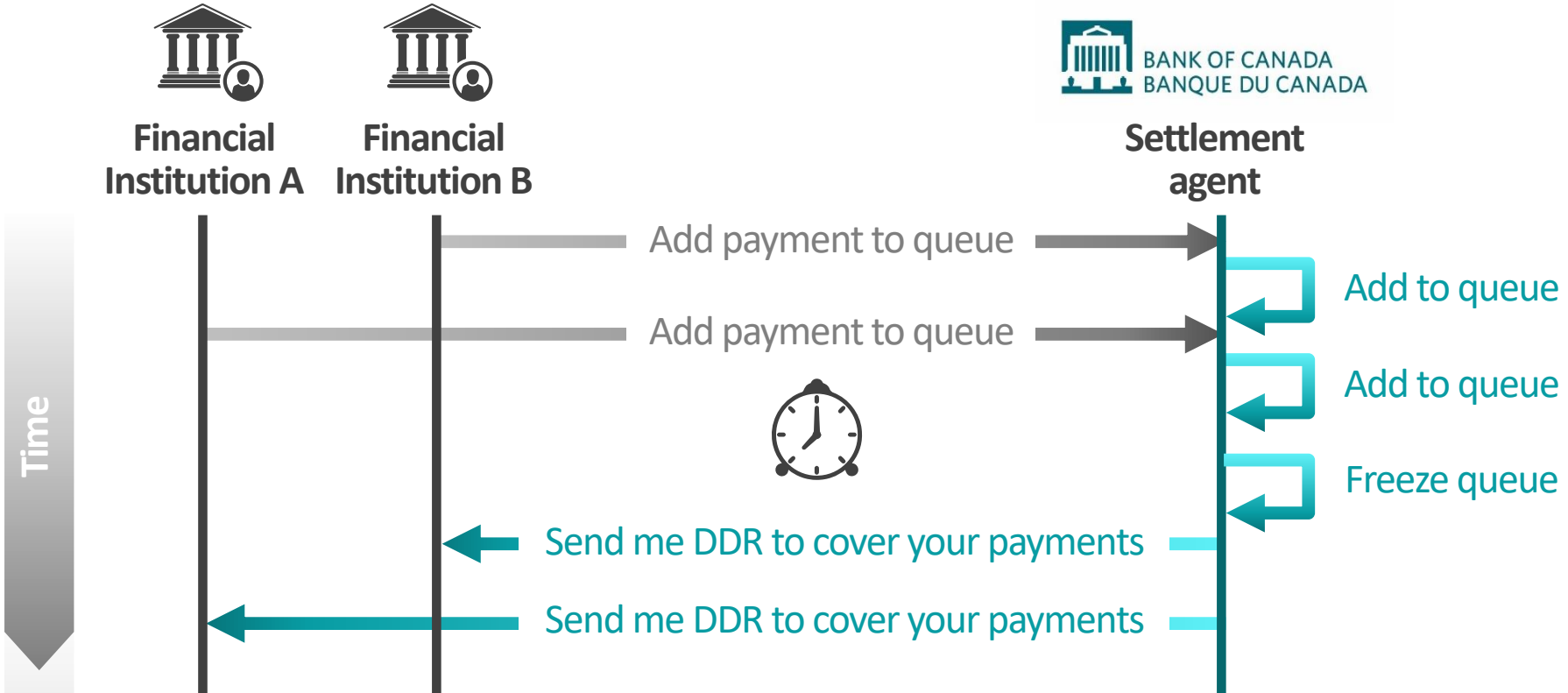
LSM Netting Functions – Privileged Access in Centralised Systems

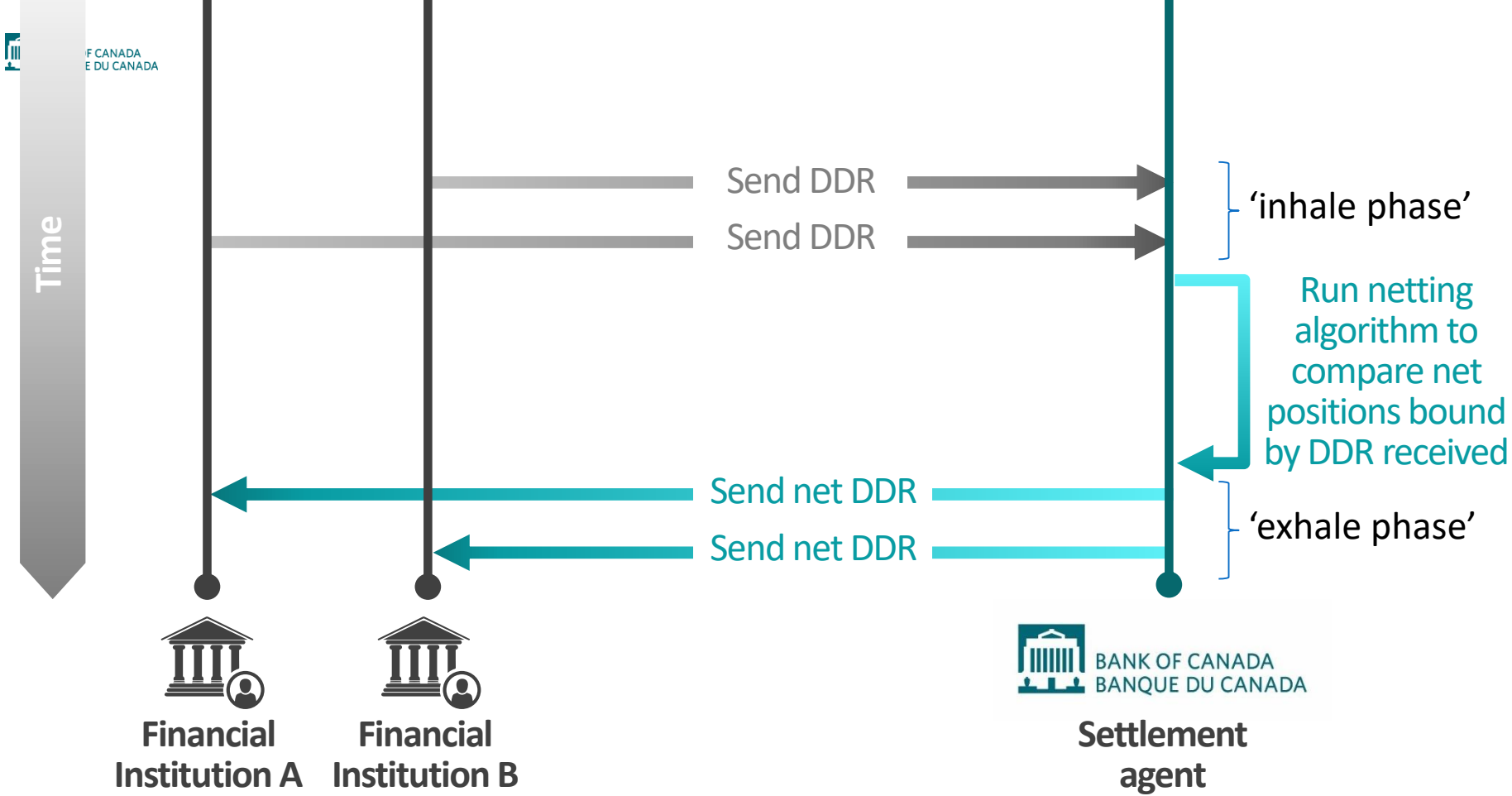


LSM Netting Functions – A Challenge in DLT



LSM Netting Functions – A Solution in DLT




Time
Send DDR
Send DDR
'inhale phase'
Run netting algorithm to compare net positions bound by DDR received
Send net DDR
Send net DDR
'exhale phase'
Financial Institution A
Financial Institution B
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Settlement agent

Findings – Against PFMIs

Principle	LVTS	Phase 1 (Ethereum)	Phase 2 (Corda)
Credit & Liquidity risk	Satisfied	DDR backed 1:1 with cash collateral on LVTS	
Settlement Finality	Satisfied	Probabilistic finality	Satisfied (requires further investigation)
Operational Risk – resilience	Central system engineered for HA and DR. Minimal participant work.	Tolerant to partial failure – rely on network, not individual nodes. High redundancy.	Requires engineering for HA and DR at central node *and* participant's nodes
Operational Risk – scalability	high throughput	Ethereum limited to about 12 tx/sec	No inherent limitation. Central functions can cause bottlenecks (e.g. notary)

Other Lessons

- Unlikely to be net benefits using DLT over a centralised system for the *sole* purpose of interbank payments
  - Focus of phase 3 is multiple-asset DLT PoC
- Benefits more likely to come from enabling efficiencies in the broader FIs and FMIs via simplified processes (e.g. back office reconciliation)
- LSM implementation is complex – inherently centralised functions in decentralised systems is tricky

Project Jasper Phase III

Jasper National Park | Source: Wikipedia

JASPER III – REIMAGINING POST TRADE SETTLEMENT ON DLT

- This phase of Project Jasper aimed to reimagine post trade settlement on Distributed Ledger Technology.

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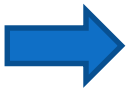
Motivations

End-to-End Post Trade Settlement Lifecycle On-Ledger



Liquidity Efficiency

Improving Collateral Management

Reduced Reconciliation Cost

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Solution Overview: Phase 3

Tokenisation

Cash is tokenised on-ledger as Digital Depository Receipts (DDR) similar to Phase II of Jasper

Equities are tokenised on-ledger as asset tokens in an analogous manner

Participants

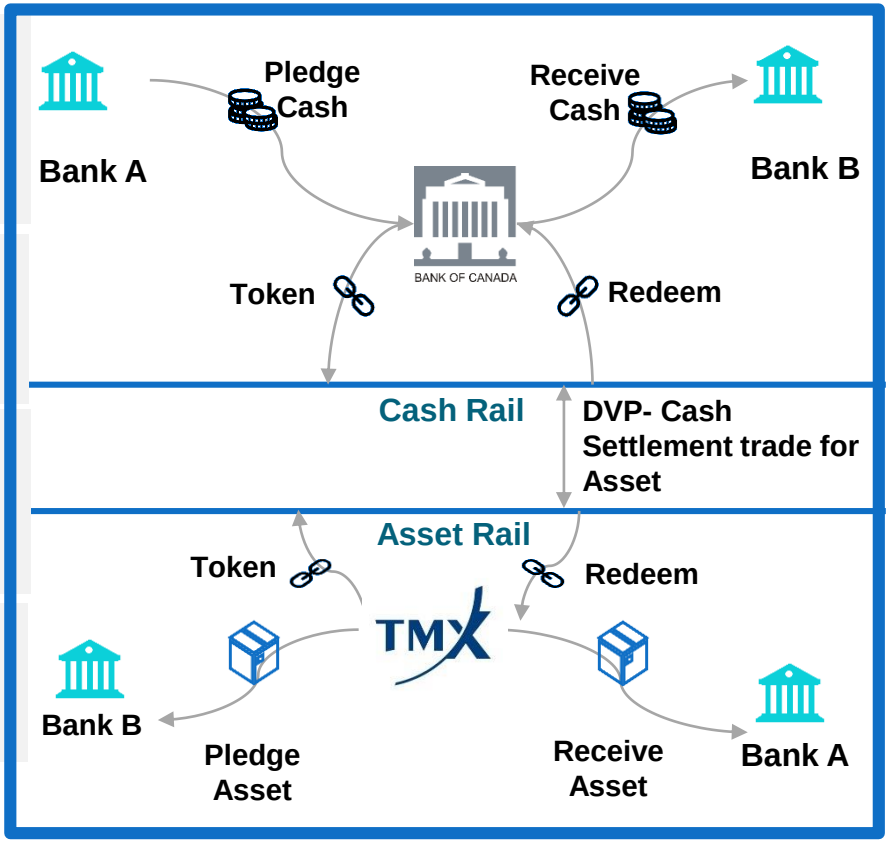
Bank of Canada, CDS, Payments Canada, LVTS member banks and CDS members

Post Trade Settlement

The lifecycle of post trade settlement is represented on ledger

Credit Extension

LVTS members extend credit to CDS members on ledger



Lessons Learned: Phase 3

- More complex when cash and equity systems have different participants: solved through combination of doorman service, notary involvement, and smart contracts
- Credit extension needed in current system and DLT system to ensure necessary liquidity
- DLT cost savings for participants still uncertain when only post-trade settlement is on ledger
- Wide range of scope (e.g. multiple assets, functionality, etc.) of a DLT system may be required to realize significant value

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Next Steps

Next Steps

- A second phase III project is underway between MAS and BoC on cross-country settlement of central bank tokens via interoperability between two DLT solutions

Thanks. Questions?