EUROPEAN CENTRAL BANK

EUROSYSTEM

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Distributed ledger technologies (DLTs)
- revolution or evolution?

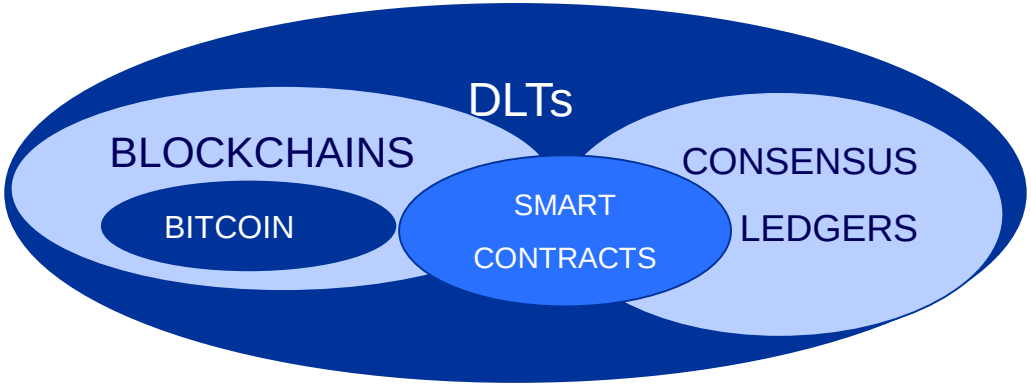
Helsinki - 14 June 2016

Introduction

- A distributed ledger is a shared database to record either transactions or account balances for a given set of assets and users

- DLT users can modify accounts in the distributed ledger and consider it as authoritative even without central management system

- The DLT landscape:

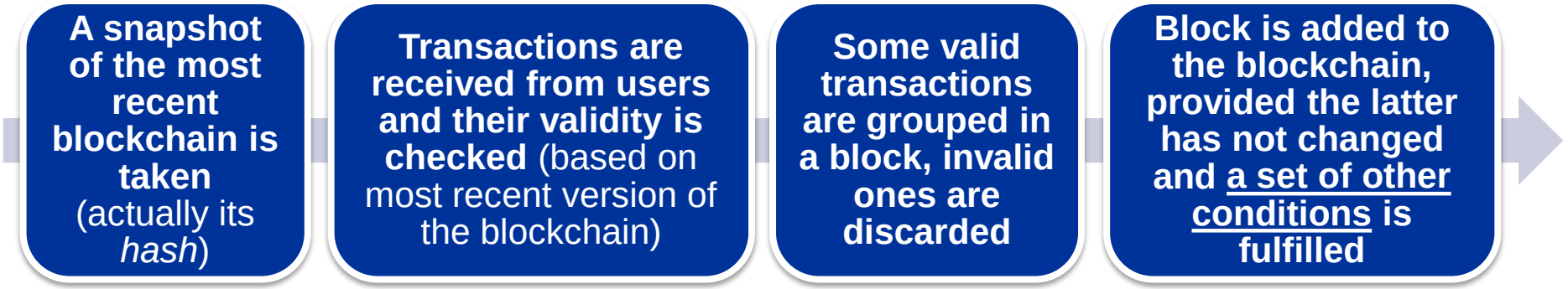


- Potential advantages:
  - ✓ Shared database saves reconciliation costs and may increase transparency
  - ✓ Multiplicity of validation nodes might make cyberattack more difficult and throughput higher
  - ✓ Smart contracts add functionalities
  - ✓ Coordination on new technology may deliver interoperability and straight-through processing

Blockchain as an ordered list of transactions

- Blockchain technology allows participants in a peer-to-peer network to validate (blocks of) new transactions and append them to the chain of previously validated (blocks of) transactions.

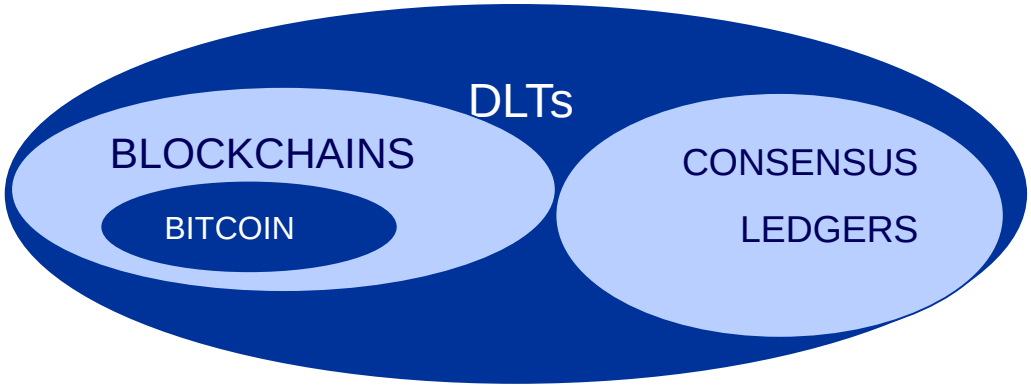
- How do validators act?



- The "set of other conditions" is the main difference between DLT blockchain technologies (e.g. Bitcoin, Tendermint, …)

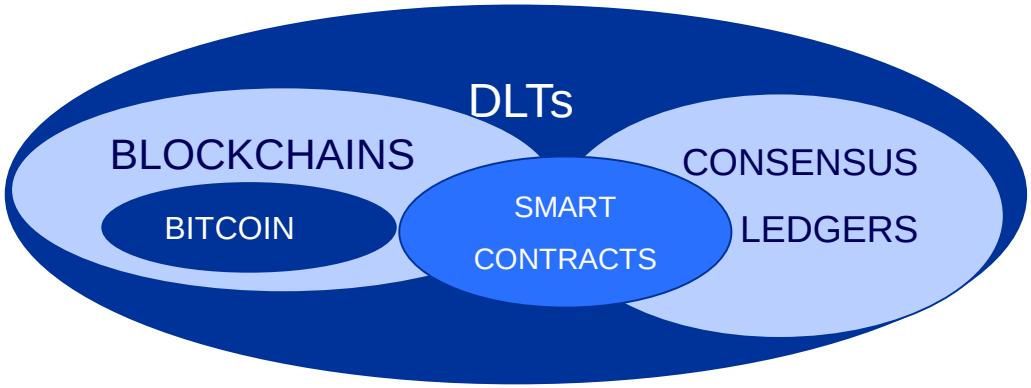
Consensus ledgers

- Differently from blockchains, these store snapshots of the accounts
  - a set of transactions are collected by a validating node and broadcasted to its peers
  - each validator waits for votes casted by others
  - when consensus over transactions is achieved, a new updated version of the ledger is considered authoritative



Smart Contracts

- Executable code can be stored in the distributed ledger
- Ledger is updated according to agreed business logic when specific events specified in the contract happen inside or outside the ledger



- Possibly the most disruptive aspect of DLTs
- Require computational effort and may be open-end → costly
- Automated corporate actions, collateral optimization, margining…
- Legal enforceability is an open question

Why are financial institutions interested?

- Market participants invested $1bn in DLTs in 2015

- Anecdotal evidence:
  - ***To reduce back-office costs***
    - Reconciliation of information across different layers of financial markets
      - financial institutions expect to spend $1.2bn to reconcile data in 2016 (AITE)
  - ***To facilitate reporting***
    - Reporting data to different regulators
      - regulators could access the ledger with special privileges to get data
    - Internal reporting
  - ***To lower risks to be hedged***
    - Shorter settlement cycle (potentially instantaneous)
      - lower collateral needs
      - lower capital requirements
      - **but**: higher liquidity needs (possibly offset with lending on DL)
  - ***…also as a competitive strategy?***

Restricted vs. unrestricted DLTs

- Restricted DLT: closed system among identified and accountable entities
- Unrestricted DLT: unknown entities can propose/validate transactions

- Some cons of all unrestricted DLTs:
  - Impossible to punish illicit behaviour
  - No KYC/AML
  - Efficiency of validation is lower

- Financial institutions mainly focusing on restricted DLTs
  - Governance, authentication and accessibility will be key issues

- Public vs. private ledger concerns privacy of holdings/transactions
  - There cannot be an unrestricted private ledger

- Pseudonimity is different from anonymity
  - Competitors in a pseudonymous, restricted, private DLT might still infer trading strategies if they are involved in validation

Validation of transactions in DLTs

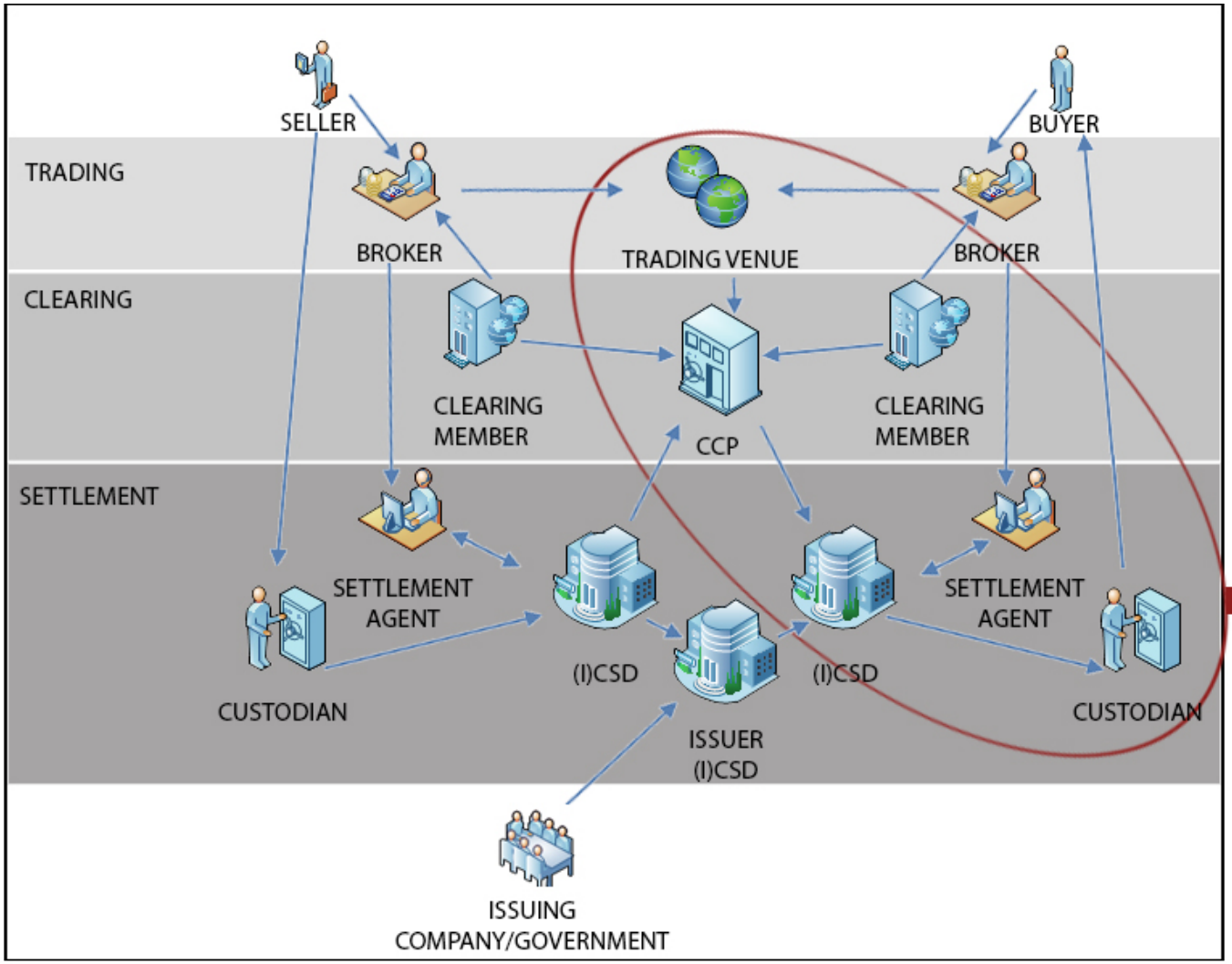
- Transaction in DLT environment is any change in the ledger:
  - Issuance/minting/redeeming
  - Credit/debit/escrow
  - Signing a contract

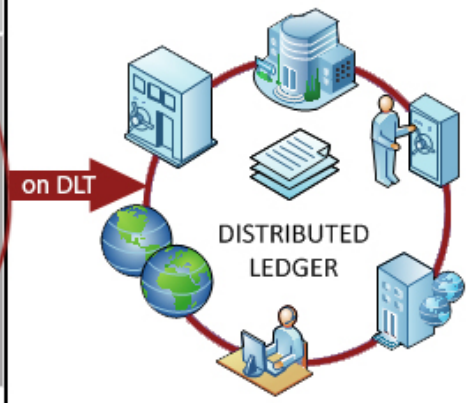
- Different validation methods
  - Proof of Work, Proof of Stake, Delegated, Identity, Collateral…

- Validating nodes:
  - All participants
  - Some participants
  - Only one participant! → DLT still potentially useful

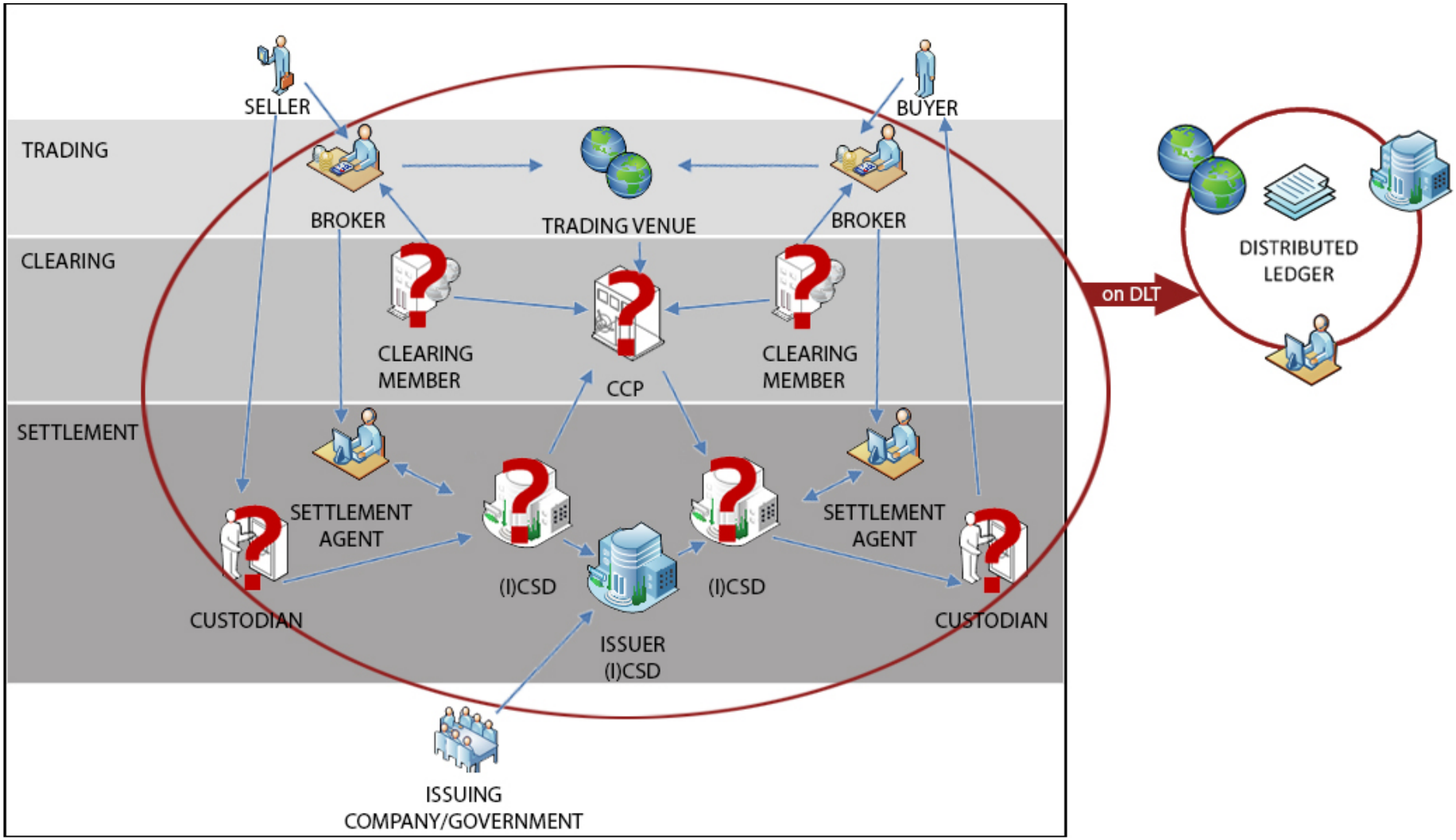
- Ongoing work:
  - Confidential validation
  - Throughput and concurrency
  - Governance and **standards**

Scenario 1: DLT to improve cluster efficiency

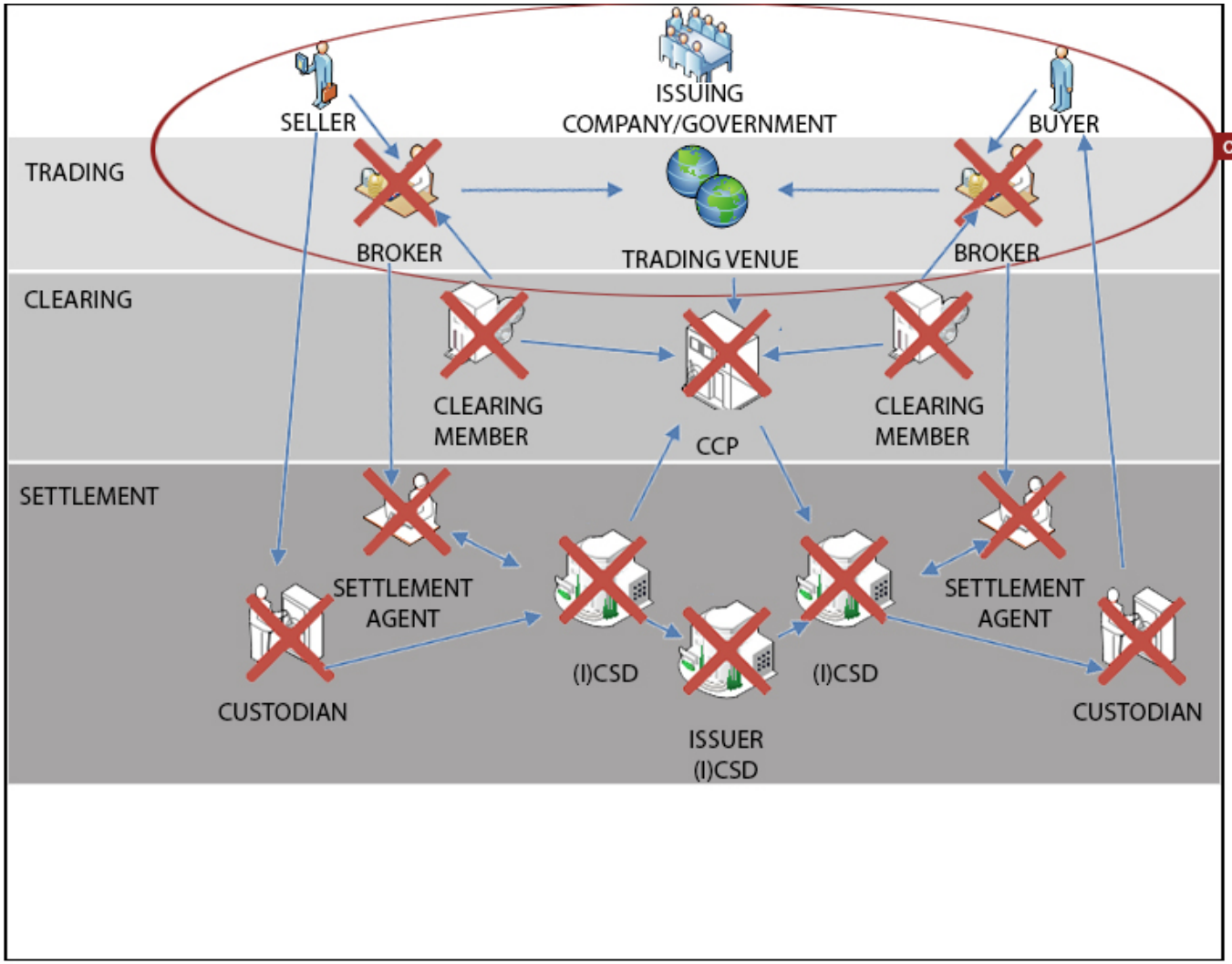




Scenario 2: market-wide adoption (disintermediation)



Scenario 3: peer-to-peer



Open issues

- Will clusters of market players adopt different DLT solutions?
  - That would create additional interoperability issues and limit potential gains
- Will a DLT be used to transfer IOUs or property of assets?
  - Potential adoption cannot be *en masse*: how to interface players/markets on-ledger with those off-ledger?
- Some developers advocate integration with CeBM systems
  - Only research work at this stage!
- DLTs would have lower impact if trading takes place off-ledger
  - Settlement not immediate and need for trade enrichment
- Is clearing needed for spot payment and securities transactions?
  - netting vs. throughput, collateral and capital vs. liquidity
- Validator=bookkeeper, coder=notary, gatekeeper=KYC/AML?

Thank You!

The views expressed are those of the author and do not necessarily reflect those of the ECB