



EUROPEAN CENTRAL BANK

EUROSYSTEM

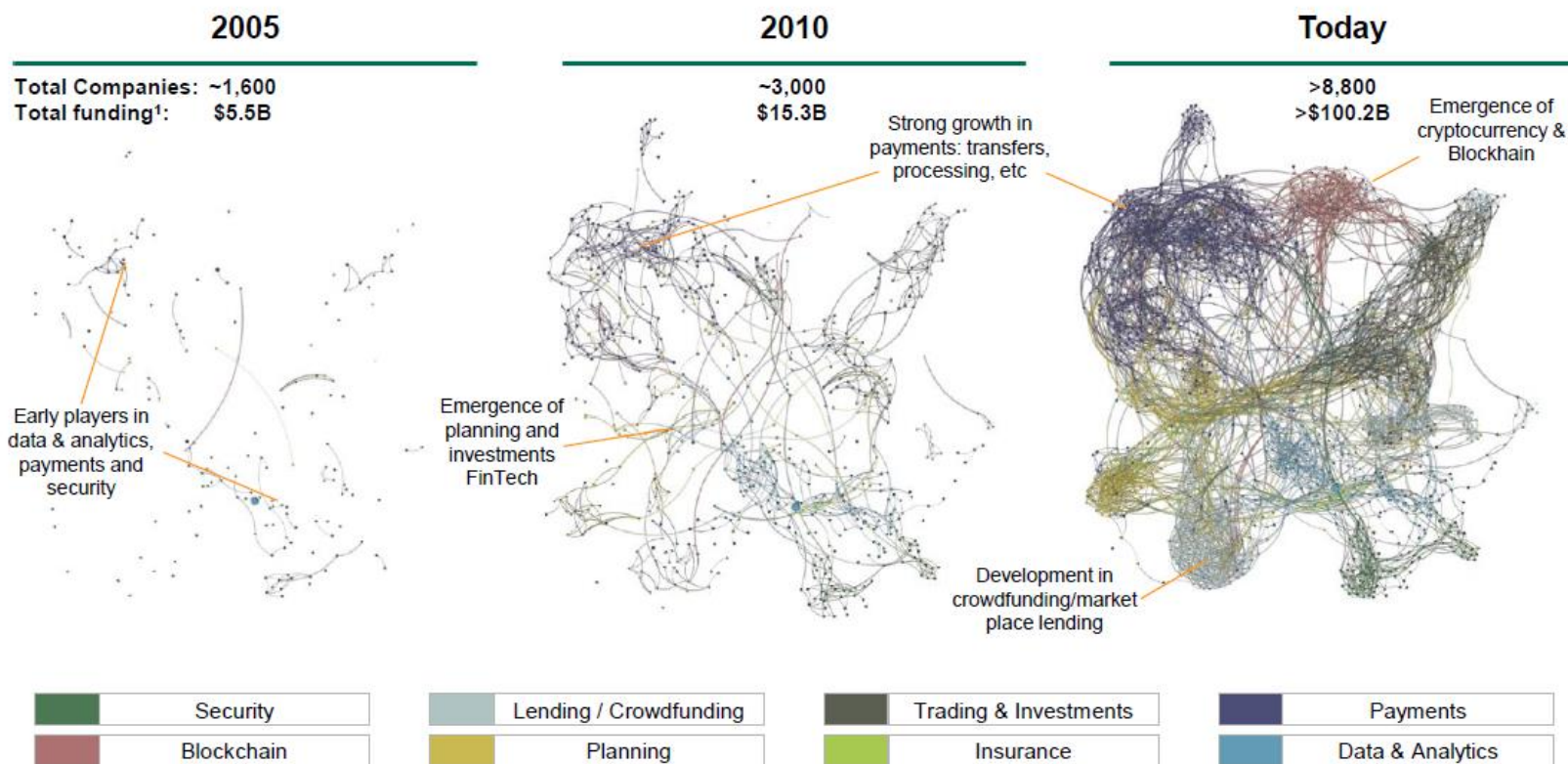
# Distributed Ledger Technologies and market infrastructure

**Dirk Bullmann**  
European Central Bank

**Shuji Kobayakawa**  
Bank of Japan

ECB Operations Managers Group  
Frankfurt, 12 December 2017

Since 2000, FinTech investments has grown dramatically

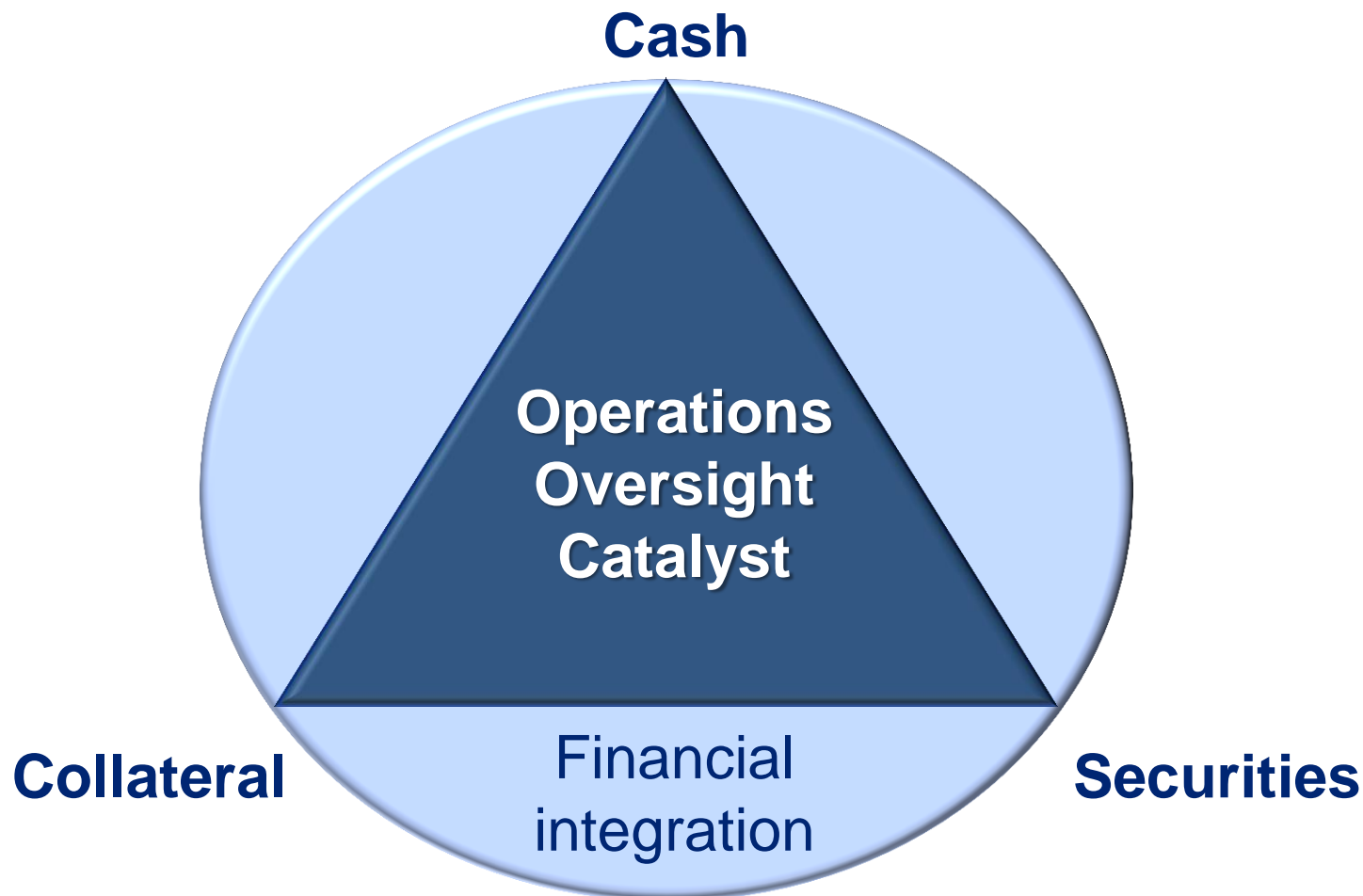


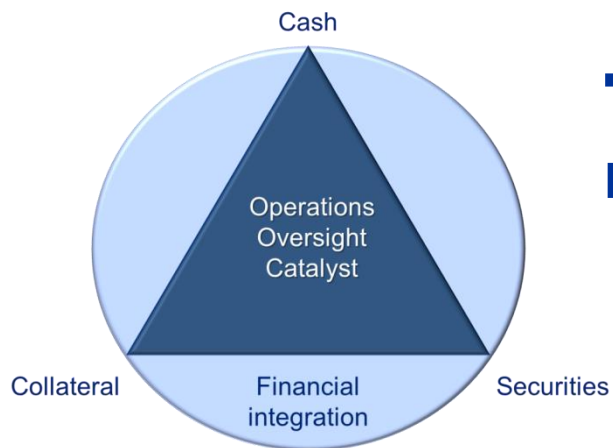
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Visualization based on ~1,800 FinTechs receiving the highest amount of private funding. Dataset mapped with Quid and allowed to cluster based on similar products, technologies, customers etc.  
 1) Data based on over 8,800 companies which were discovered across over 4 data sources. Total funding based on date of funding. Total companies based on founding year. Data as of November 2016.  
 Source: Quid, BCG /Expand/BCG Digital Venture/B Capital analysis

Source: Fintech Control Tower, Expand, November 2016

## ECB approach: Assessing impact of FinTech / DLT on central bank roles





# The future of Eurosystem market infrastructures

Keeping pace with technological advance and changing needs of users



## Consolidation of TARGET2 and T2S

Improve efficiency, cut down operational costs, easier access to services via harmonised interface, etc.



## TARGET Instant Payment Settlement

Ensure efficiency and market integration in the settlement of instant payments (operating hours up to **24/7/365**)



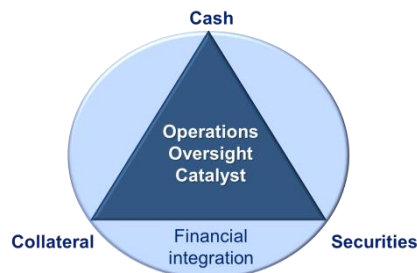
## Eurosystem collateral management system

Further harmonisation of the Eurosystem's collateralisation techniques and procedures



## **Hammer (DLT) looking for a nail (Eurosystem market infrastructures)?**

- Eurosystem operates two of the world's largest market infrastructure services (TARGET2 and TARGET2-Securities)
- New projects have been launched (TARGET Instant Payments Settlement) and additional initiatives are being assessed
- DLT cannot be the solution at this stage of development but benefit of possible future use is being explored



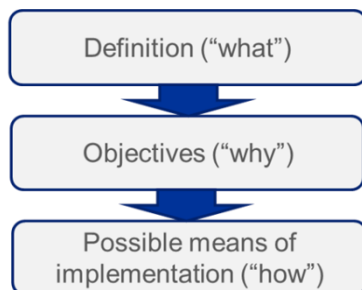
## Operator role

### ➤ Experimental work with DLT

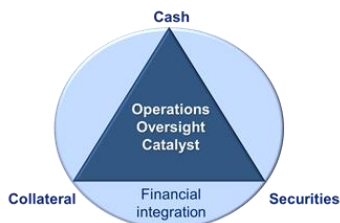
ECB/Bank of Japan cooperation: In December 2016, joint research project launched to study the possible use of DLT for market infrastructure.

ESCB / Eurosystem work: Cooperation and joint work to better understand opportunities and challenges of DLT.

### ➤ Central Bank Digital Currency / Digital Base Money

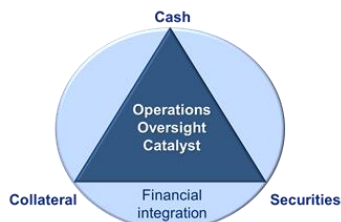


*“The ECB will continue to provide banknotes.”*  
(Yves Mersch, ECB Board member, 04/2017)



## Catalyst role

- **Financial market integration** efforts must not be jeopardised by new technologies
- Coordinated efforts are necessary to harmonise potentially DLT-enabled business processes at the industry level and with public authorities; **DLT-Task Force** (ECB Secretariat / chaired by + composed of market participants); first findings published in September 2017



## Oversight role

- E.g. assessing impact on oversight framework

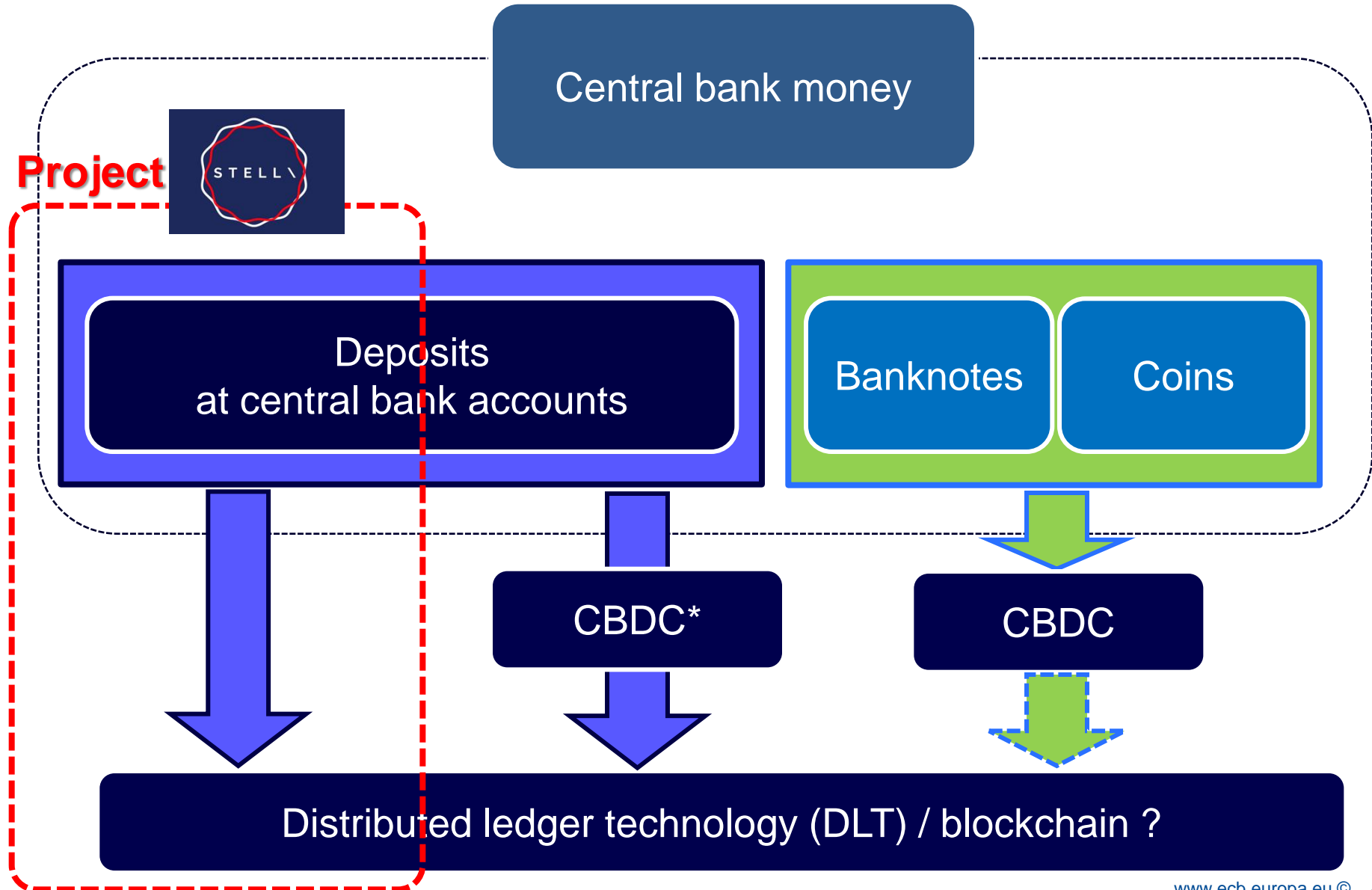


## Bank of Japan and European Central Bank

## Project Stella







\* Central Bank Digital Currency



## ➤ **Objective**

Deepen understanding of DLT

Not geared towards replacing existing central bank services with DLT-based solutions

## ➤ **Use case**

In-depth experiments on whether specific liquidity-saving mechanisms of TARGET2 and BOJ-NET could be run on DLT

Assessment of performance (efficiency) and availability (safety)

## ➤ **Test set-up**

In-house test environment / cloud computing services

Hyperledger v0.6.1



# Main findings (1)

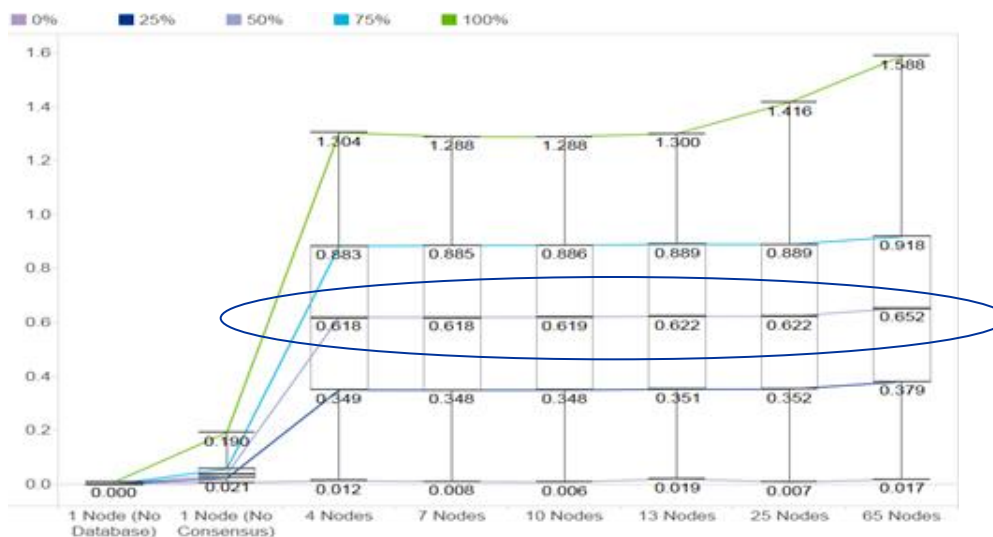
## ➤ Performance

Current performance needs of RTGS system (ca. 10-70 requests per seconds - RPS) can be processed without difficulty

Non-negligible trade-off between traffic and performance when RPS increased up to 250

Latency stayed at around 0.6 seconds when nodes were 4-65

Liquidity-saving mechanisms (smart contract) not a major factor for latency (adding 0.01-0.02 sec.)

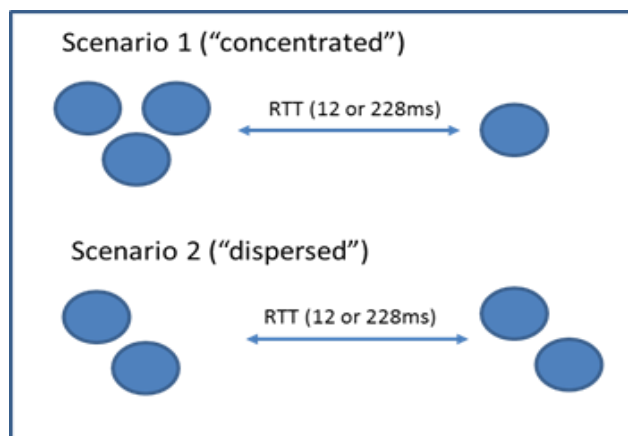




## Main findings (2)

### ➤ Performance (ctd.)

DLT performance is affected by distance between nodes



(RTT = round trip time  
12 ms = distance Frankfurt/Rome, Tokyo/Osaka  
228 ms = distance Frankfurt Tokyo)

[Scenario 1] quorum required to achieve consensus was close together: negligible impact on latency

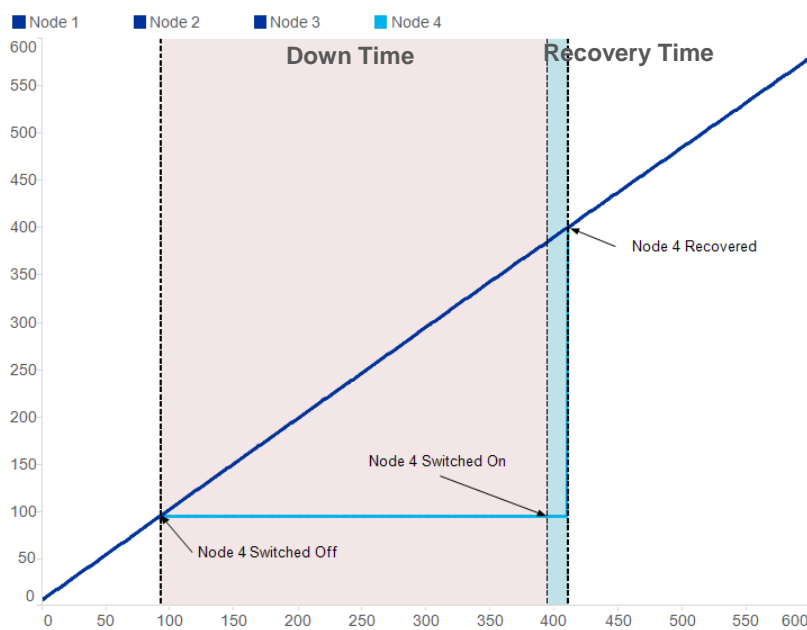
[Scenario 2] if quorum is dispersed: higher impact on latency (up to 0.3 seconds)



## Main findings (3)

### ➤ Availability

DLT solutions were found to be resilient to the failure of individual network nodes



X axis: seconds elapsed; Y axis: block height

As long as number of nodes required by consensus algorithm (3 out of 4 nodes) was operational, availability was not affected

Validating nodes mostly recovered in less than 30 seconds

Certificate authority could become single point of failure

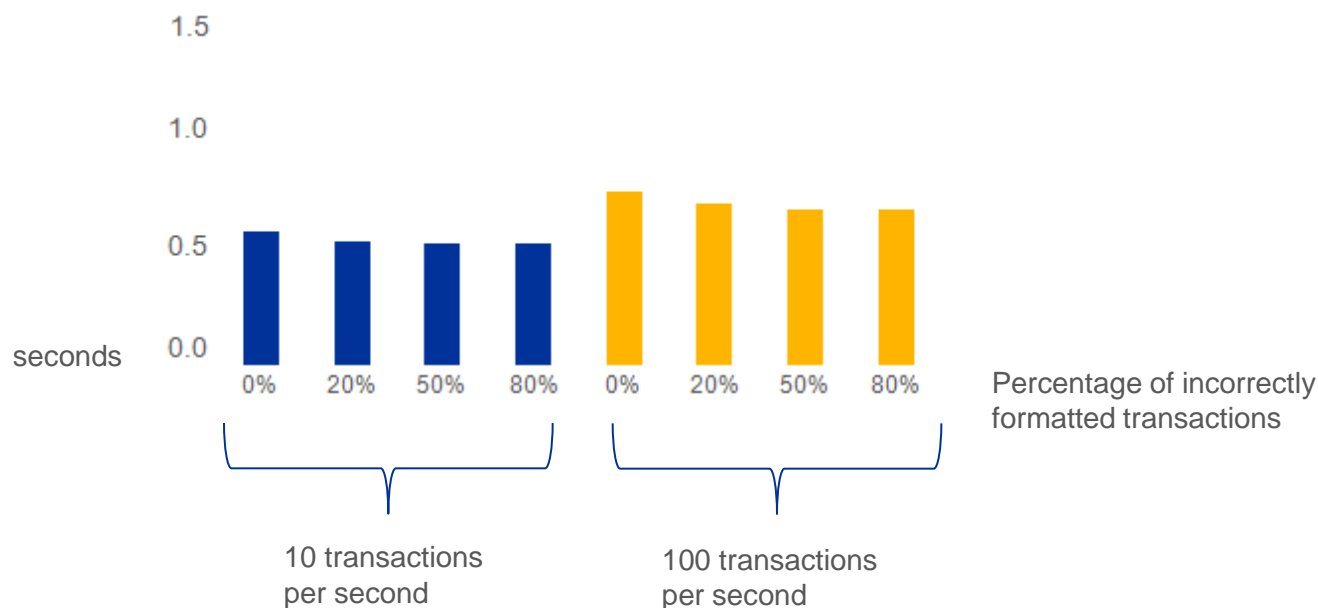


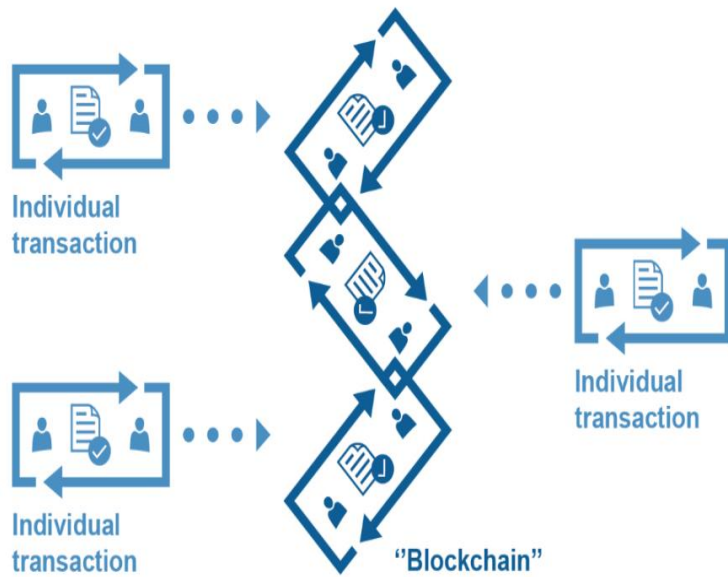
## Main findings (4)

### ➤ Availability (ctd.)

DLT solutions were found to be resilient to incorrectly formatted messages

Latency remained between 0.5 and 1 second





**Thank you!**  
**Questions?**