Informal Ad hoc Expert Group on Conceptual and Technical Aspects of Computerization of the TIR Procedure

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Blockchain technology for trans-European systems:

Trigger potential discussions for eTIR

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Geneva, 28 June 2018

Taxation and Customs Union

European Commission

TAXUD started exploration of blockchain technology in 2017

|	**1. Study and PoC in the excise domain (EMCS)**	**2. PoC in the field of temporary admission (eATA)**
Stake	Test the applicability of the technology as main component of an "illustrative" system	Blockchain as an additional layer to ensure trust in a centralised solution
Pattern	End-to-end, transaction-oriented pattern	Notarisation pattern
Blockchain	• Permissioned blockchain • Private blockchain • Hyperledger Fabric (open source)	• Permission-less blockchain • Private network but anchored to a public blockchain • Ethereum (open source)
Stakeholders	No involvement of Member States or Traders	With the collaboration of the International Chamber of Commerce
TAXUD Project	Technology exploration outside of TAXUD's projects context	Inscribed in TAXUD's electronic customs MASP (project fiche 3.2)

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Blockchain basis: Basic architectural components

Blocks	Blockchain network	Consensus mechanism

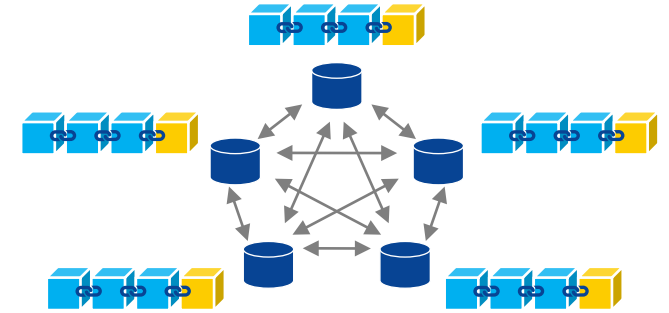Store data (e.g. transactions) and are linked in a chain.
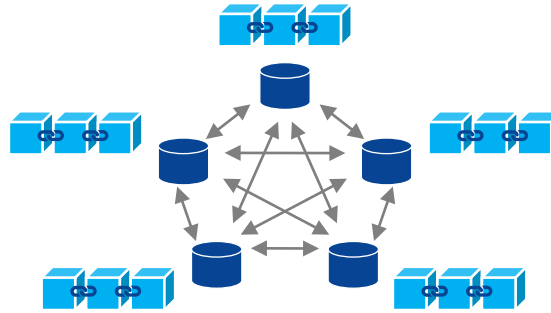
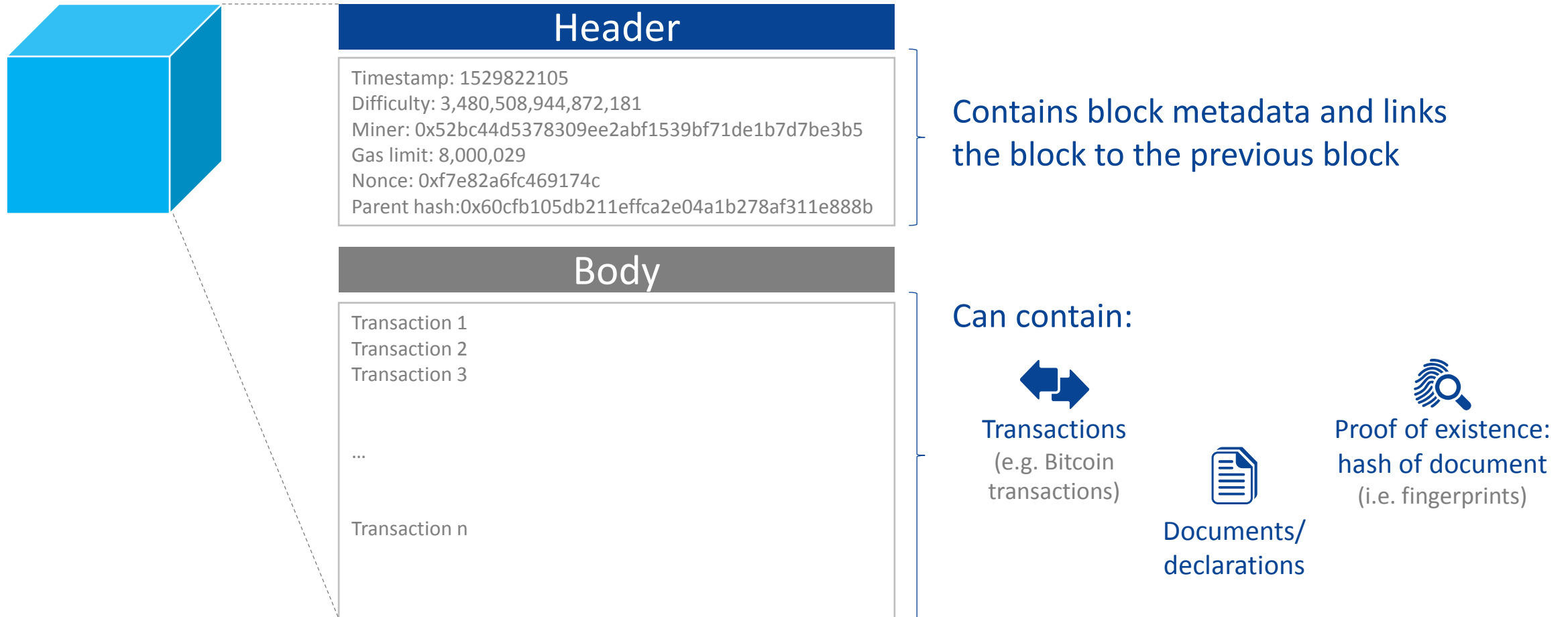P2P network where each node has a copy of the blockchain.

Mechanism for deciding what blocks are accepted.

Consensus example:
- Proof-of-work
- Proof-of-stake

Blockchain basis: Blocks

Blocks are made with a header and a body:

Header

Timestamp: 1529822105
Difficulty: 3,480,508,944,872,181
Miner: 0x52bc44d5378309ee2abf1539bf71de1b7d7be3b5
Gas limit: 8,000,029
Nonce: 0xf7e82a6fc469174c
Parent hash:0x60cfb105db211effca2e04a1b278af311e888b

Contains block metadata and links the block to the previous block

Body

Transaction 1
Transaction 2
Transaction 3

...

Transaction n

Can contain:

Transactions
(e.g. Bitcoin transactions)

Documents/ declarations

Proof of existence: hash of document
(i.e. fingerprints)

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Blockchain basis: Cryptographic hash

A cryptographic hash is code assigned to data by algorithm:

"Data" ➡ **Algorithm** ➡ ''e1b367a702680e20e8894a00c2d32 ''

Impossible to recover the input data
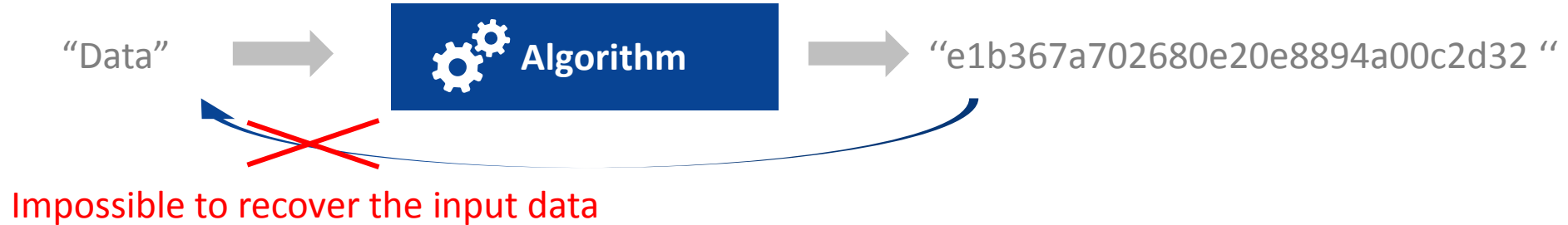
Different data have different hashes..

..which can be used to detect changes to data

"Data1" ➡ ''8a33f09340f7d52''

"Data2" ➡ ''ab2f490bd3849e''

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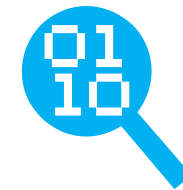
Blockchain basis: Blocks linkage

Link blocks in chain

Block #345

Block #346

Block #347

Header
Hash of previous block header
Hash of body

Header
Hash of previous block header
Hash of body

Header
Hash of previous block header
Hash of body

2

2

Body

Body

Body

1

1

1

Link body to header
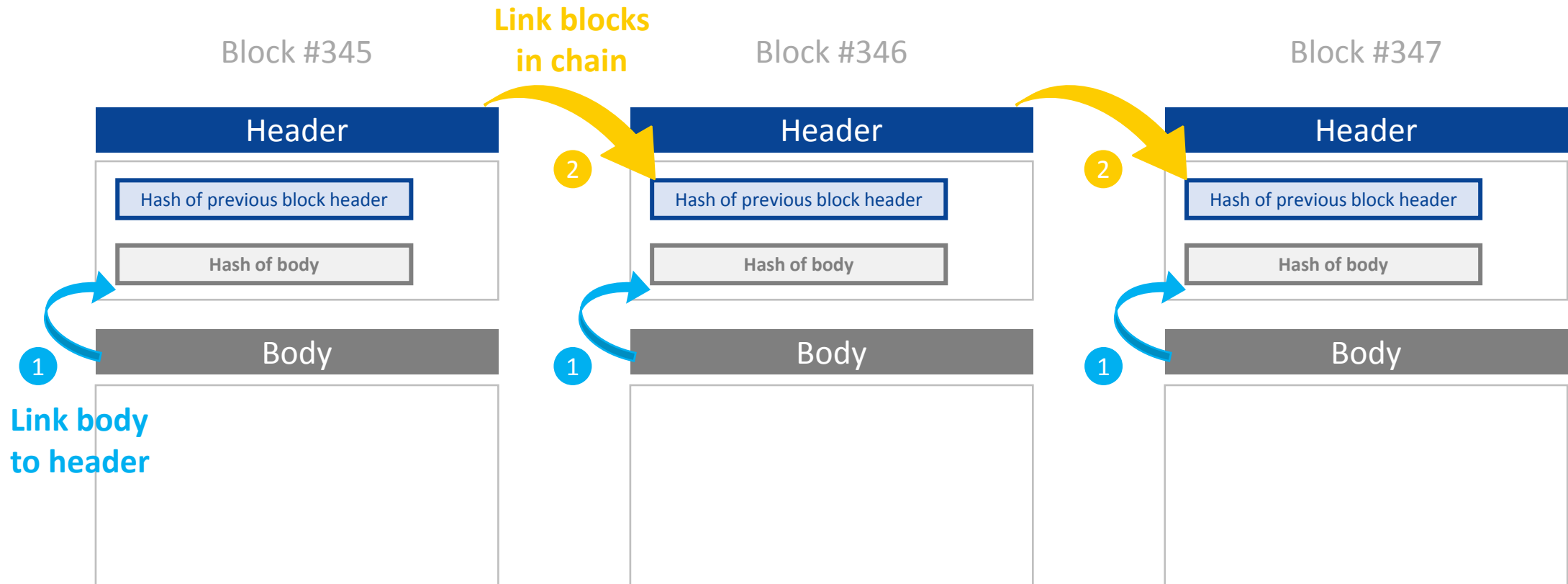
Linking provides protection against tampering with data.

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Potential uses of blockchain technology in a trans-European system environment

Data sharing

Proof existence through notarisation

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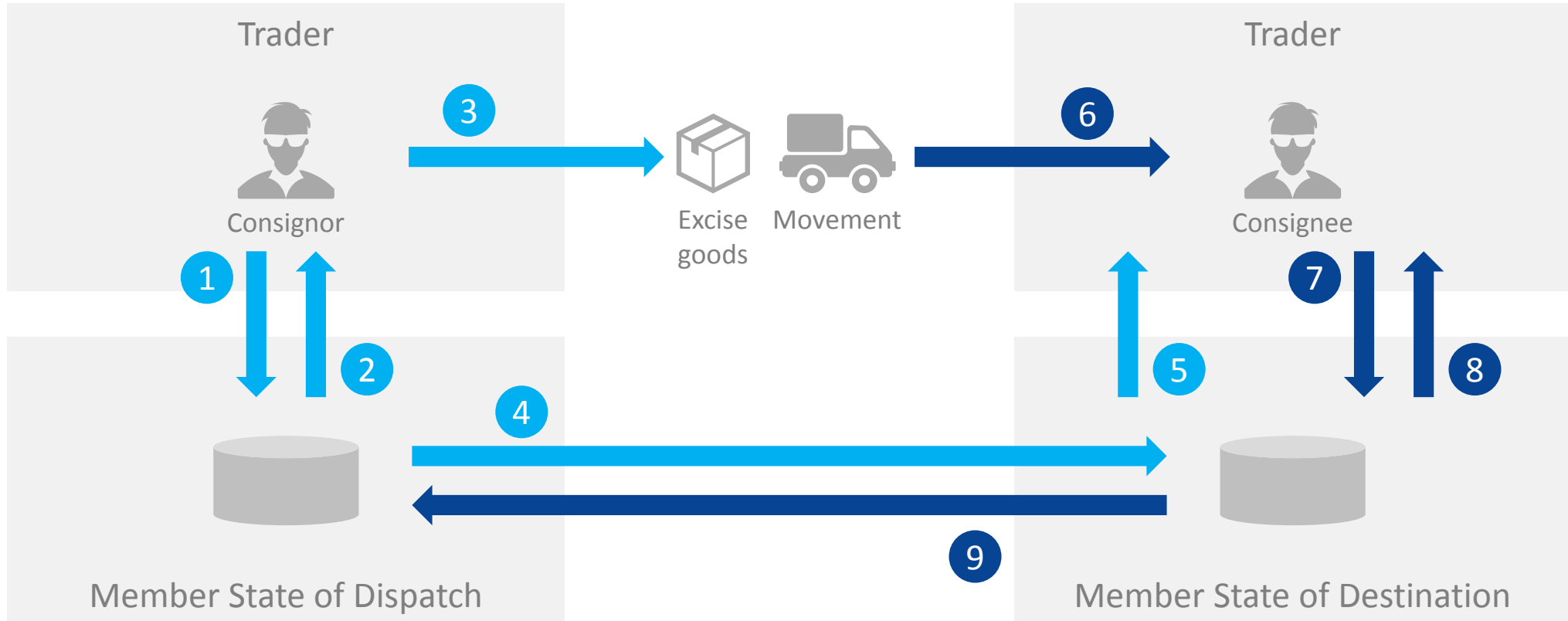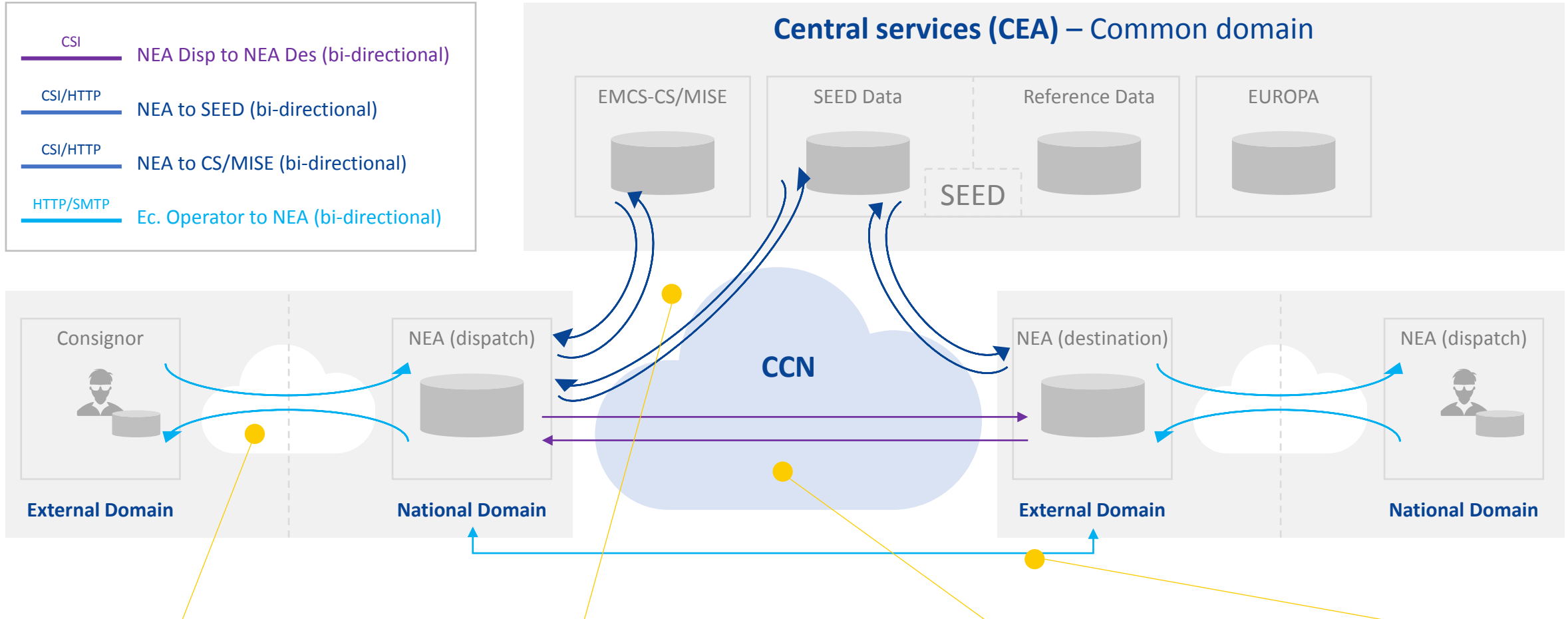
The EMCS blockchain PoC: from messages exchanges to data sharing

Non EU

EU

Duty suspension arrangement

MS of Dispatch → Movement → MS of Destination

Accompanied by e-AD & Guarantee

All data available in SEED

Shipper

Registered consignor

Supplier

Tax warehouse

Authorised Warehouse keeper of Dispatch

Port of importation

Tax warehouse

Authorised Warehouse keeper of Destination

Registered Consignee

Temporary Registered Consignee

Consignee

Port of exportation

→ **Validate the technical feasibility of using blockchain to facilitate and monitor the movement of "excise goods" in real-time**

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What is the EMCS?

"A Trans-European System for monitoring movements of excise goods under suspension of excise duty within the EU (very similar design to NCTS)"

What issues are we facing with the current EMCS?

Legend:
- CSI — NEA Disp to NEA Des (bi-directional)
- CSI/HTTP — NEA to SEED (bi-directional)
- CSI/HTTP — NEA to CS/MISE (bi-directional)
- HTTP/SMTP — Ec. Operator to NEA (bi-directional)

Central services (CEA) – Common domain
- EMCS-CS/MISE
- SEED Data
- Reference Data
- EUROPA
- SEED

CCN

- Consignor
- NEA (dispatch)
- External Domain
- National Domain
- NEA (destination)
- NEA (dispatch)
- External Domain
- National Domain

Interfaces to Traders not harmonised across Member States

Long time-to-market for new EMCS releases

Multiplication of heterogeneous implementations and data sources

Duplicated development and conformance testing efforts

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What did we test in the EMCS PoC? (1/2)

Can we redesign the EMCS using a decentralised system (i.e. get rid of the Central Services)?

Technical feasibility

Level of complexity

Costs and benefits

Which scenario?

National domain

Common domain

External domain
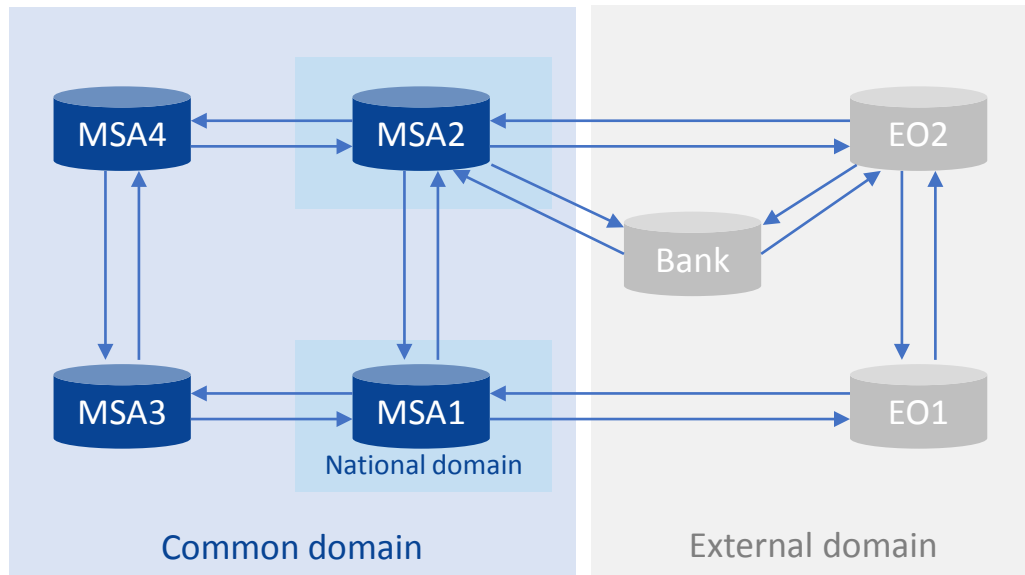
Scenario 1:
Government-to-government (common domain only)
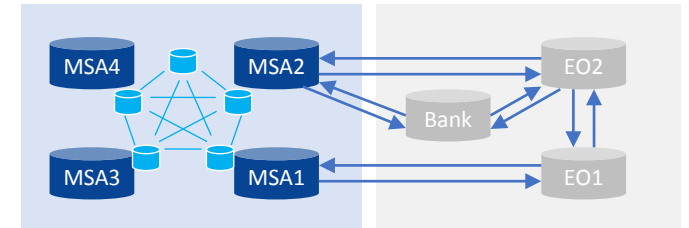
Scenario 2:
Trade digitisation (removing domain boundaries)
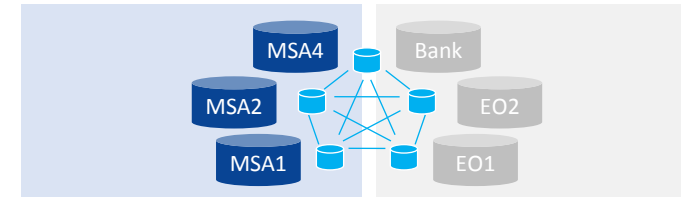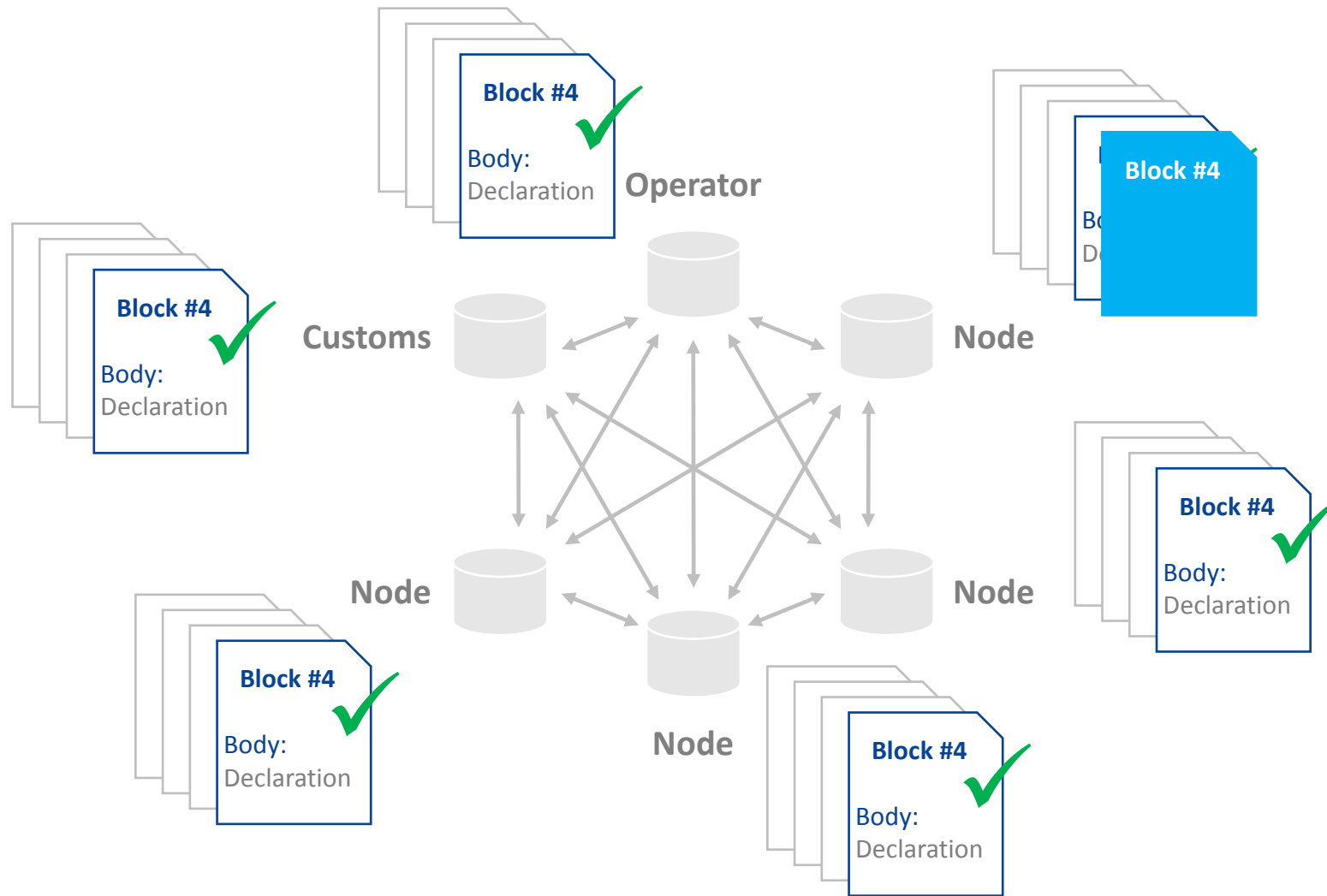
Scenario 3:
Hybrid (a realistic mix of the 2)

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Our PoC implements the "happy path"

From messages exchanges to data sharing

The eATA PoC: proof-of-existence through notarisation on the blockchain

Exploring electronic ATA Carnet notarisation (data anchoring)

Technical feasibility, key cost drivers and major risks

Quickly demonstrating feasibility, using Ethereum in the cloud

Confidentiality, access control, integration, interoperability, security, GDPR, performance and scalability, management of changes, extensions, CAPEX / OPEX and risks

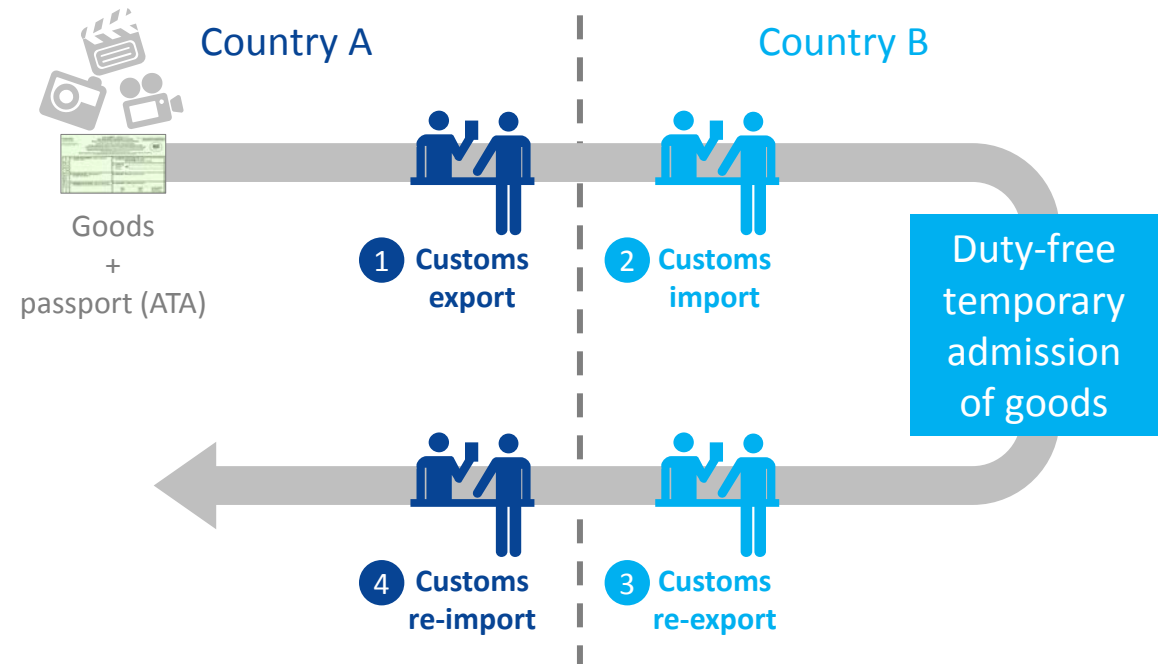Implementation started beginning of 2018; results due in September 2018

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ATA carnet blockchain Proof-of-concept (PoC)

What is it?

- **More than 71 countries** have issued and accepted ATA paper carnets under the ATA convention.
- **+200,000 paper carnets** are issued per year worldwide.
- **ATA carnets digitisation** as part of EU digital customs.

How does it work?

Country A | Country B

Goods + passport (ATA)

1 **Customs export**
2 **Customs import**

Duty-free temporary admission of goods

4 **Customs re-import**
3 **Customs re-export**

⚠️ Digitisation brings trust issues between stake-holders in a worldwide system.
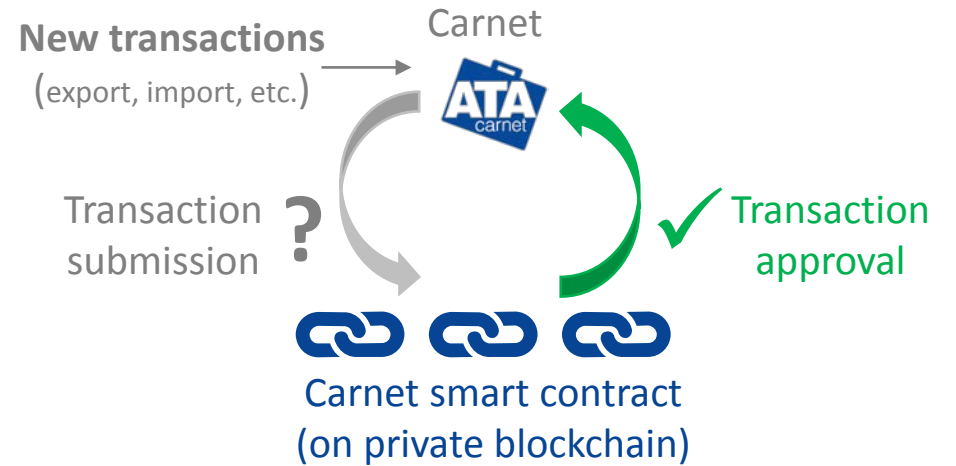
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Use cases description

1 Automation of consistency checks

Use of smart contract to reconcile ATA carnets movements based on metadata stored on the private blockchain to reduce workload for customs


New transactions
(export, import, etc.)

Carnet

Transaction submission **?**

Transaction approval ✓

Carnet smart contract
(on private blockchain)

2 Anchoring of carnets and of transactions

Anchoring of ATA carnets and transactions by the different stakeholders to address the trust issue (proof-of-existence)

Frequent Anchoring

Hashes

Private blockchain

Anchoring

Public blockchain

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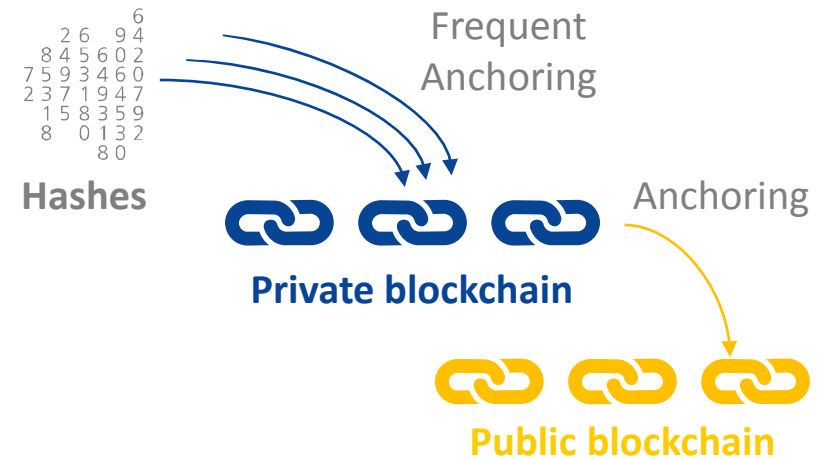
State of play on TAXUD blockchain activities

EMCS study and PoC completed; demonstrated blockchain potential

Challenges identified
- Data confidentiality
- Scalability and performance
- Security
- Deployment, operation and re-configuration
- Compliance to data protection & privacy regulations (GDPR..)

eATA PoC implementation started (January 2018 and ongoing)

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Next steps

Actions are being taken

- Workshop in May 2018 with MS on Blockchain for customs and taxation

- Awareness and training for Policy Officers & technical staff

- Research activities in several critical areas

- Partnership at Commission level to contribute to European initiatives (with DG CNECT, DG MOVE, DG DIGIT)

Objectives for 2019

- Validate that we can deploy and operate across MS

- Steer system design in the right direction (policy changes, use cases)

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Thanks for your attention!

#EUBlockchain
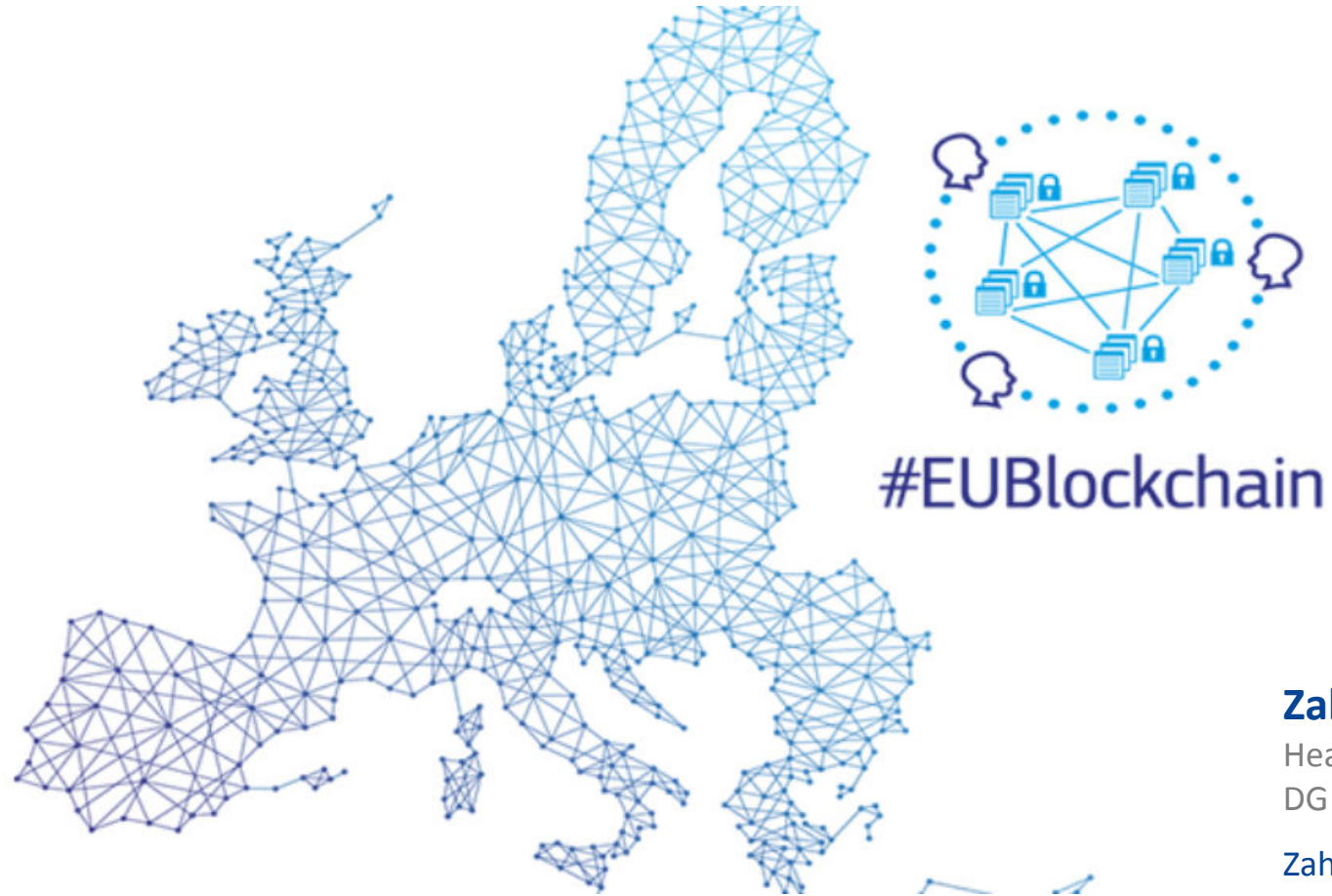
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