On the Interoperability of Distributed Ledgers

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Outline

- Need for Interoperability
- Examples
- Mechanisms for Interoperability
- Challenges in Interoperability

What is Interoperability?

- Exchange of data or value between networks
- Preserve properties of decentralization

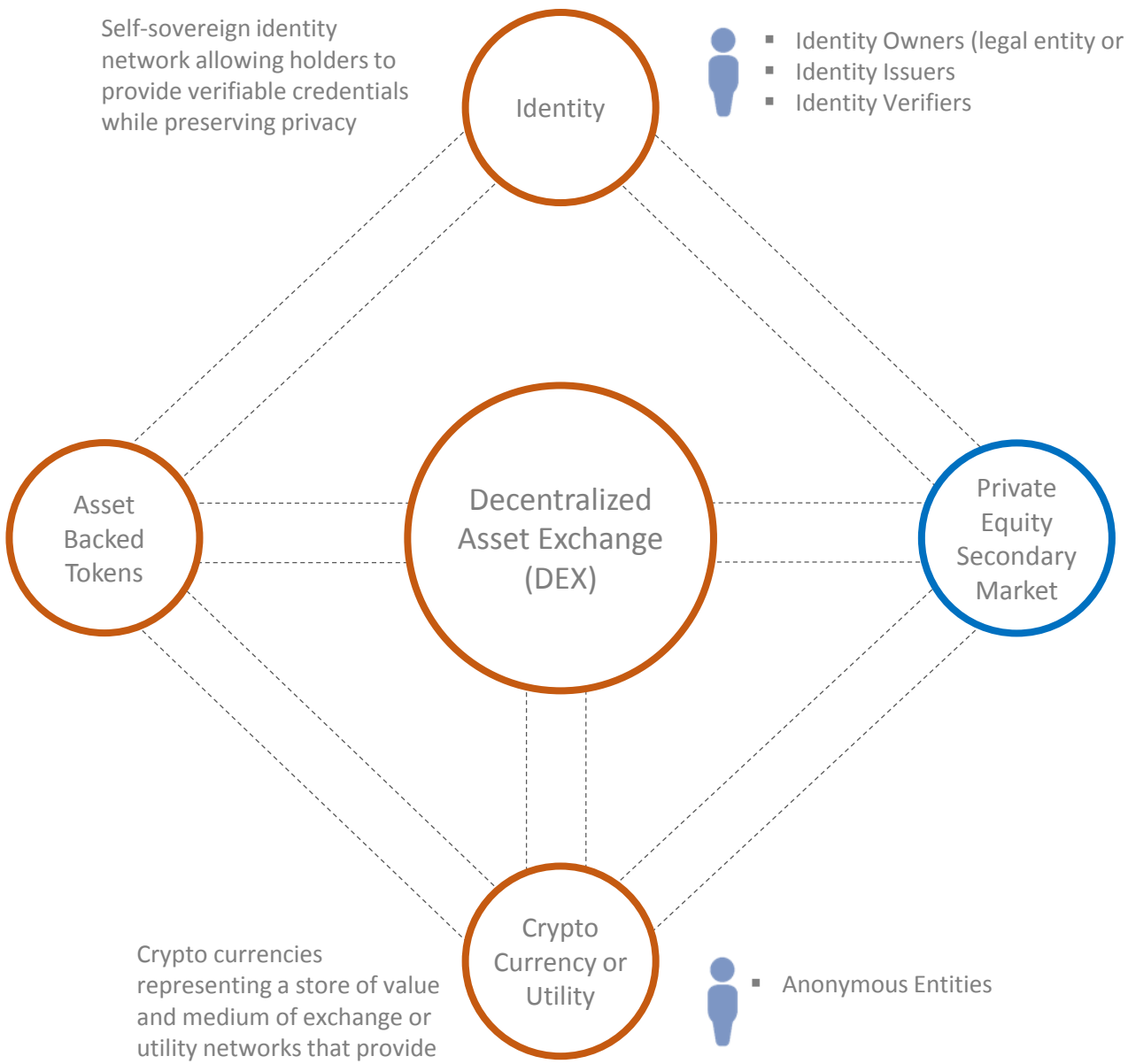
Need for Interoperability

- Data and Value Silos
- Drivers
  - Ledgers are Application Specific
  - Market Competition and Forks
  - Partitioning and Scalability
  - Confidentiality of Agreements and Data
  - Security
  - Governance
  - Regulations

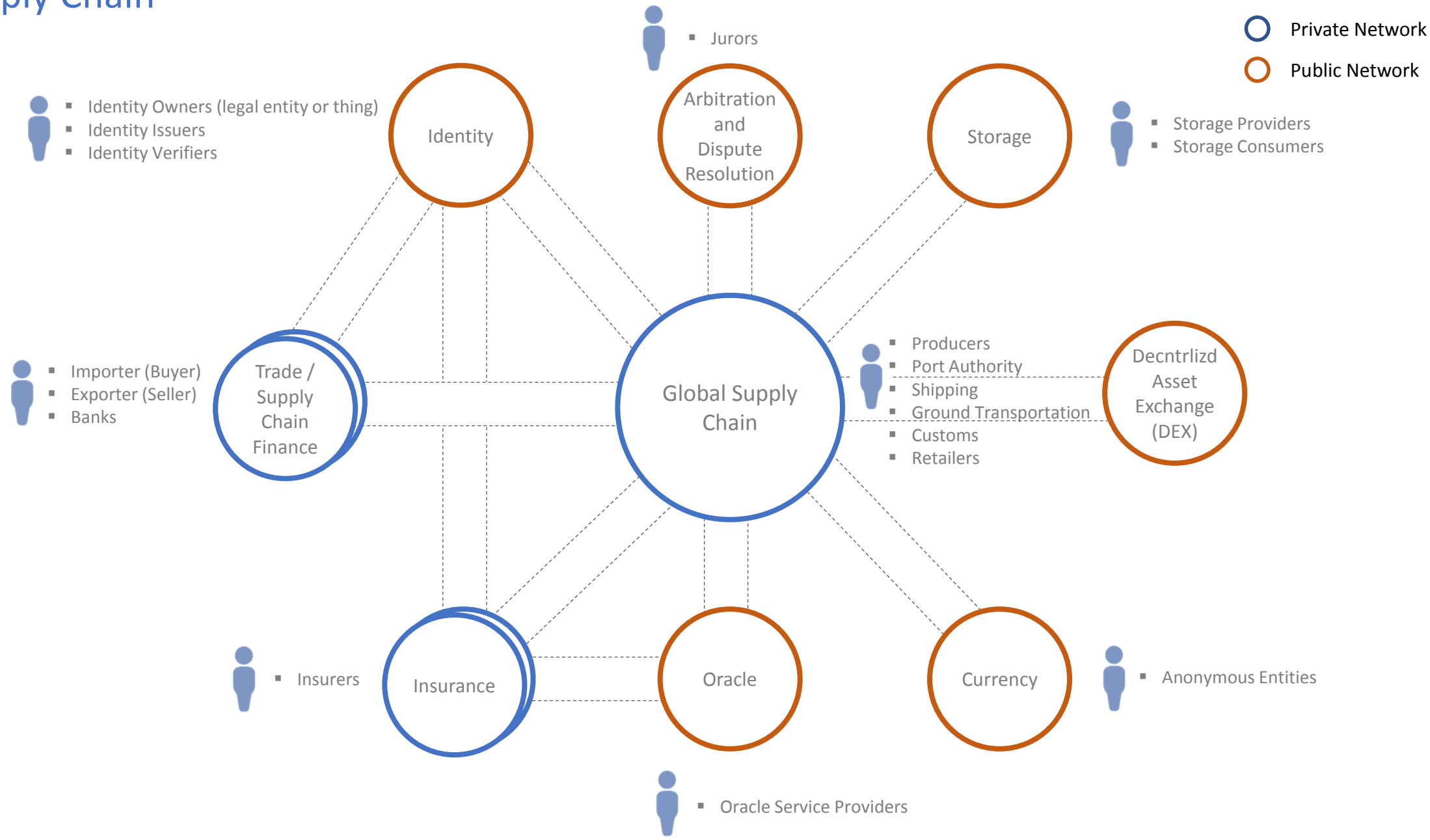
Examples

- Financial Services
- Supply Chain

Financial Services



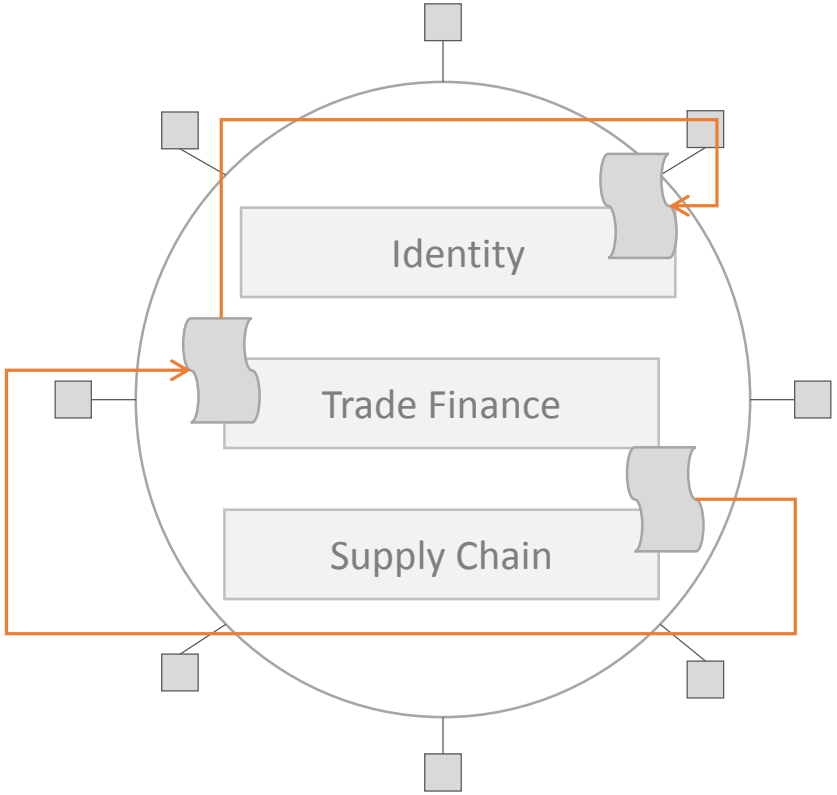
Supply Chain



Mechanisms for Interoperability

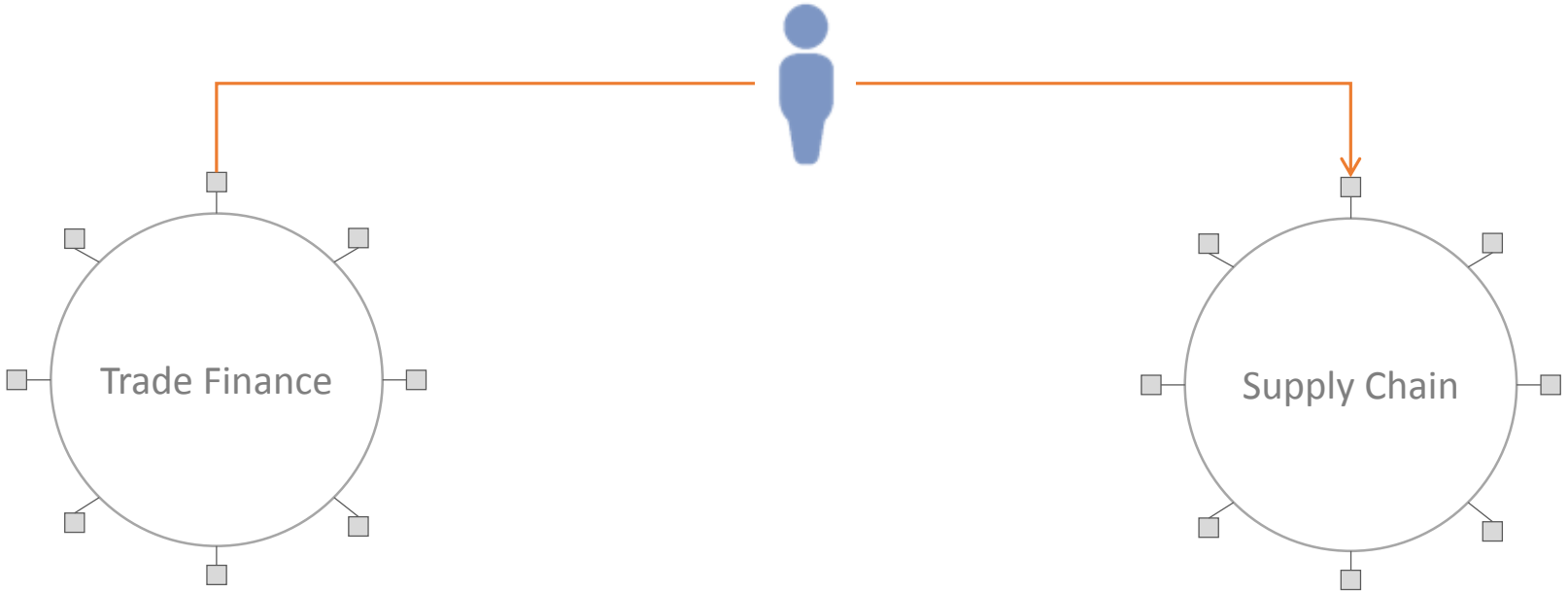
- Interoperability on a Shared Platform
- Interoperability via Message Exchanges (and Accompanying Proofs)
- Interoperability via Protocols
- Interoperability Frameworks

Interoperability on a Shared Platform



Multiple Dapps deployed on the same smart contract platform
(e.g. Ethereum, Fabric*, Corda)

Interoperability via Message Exchanges

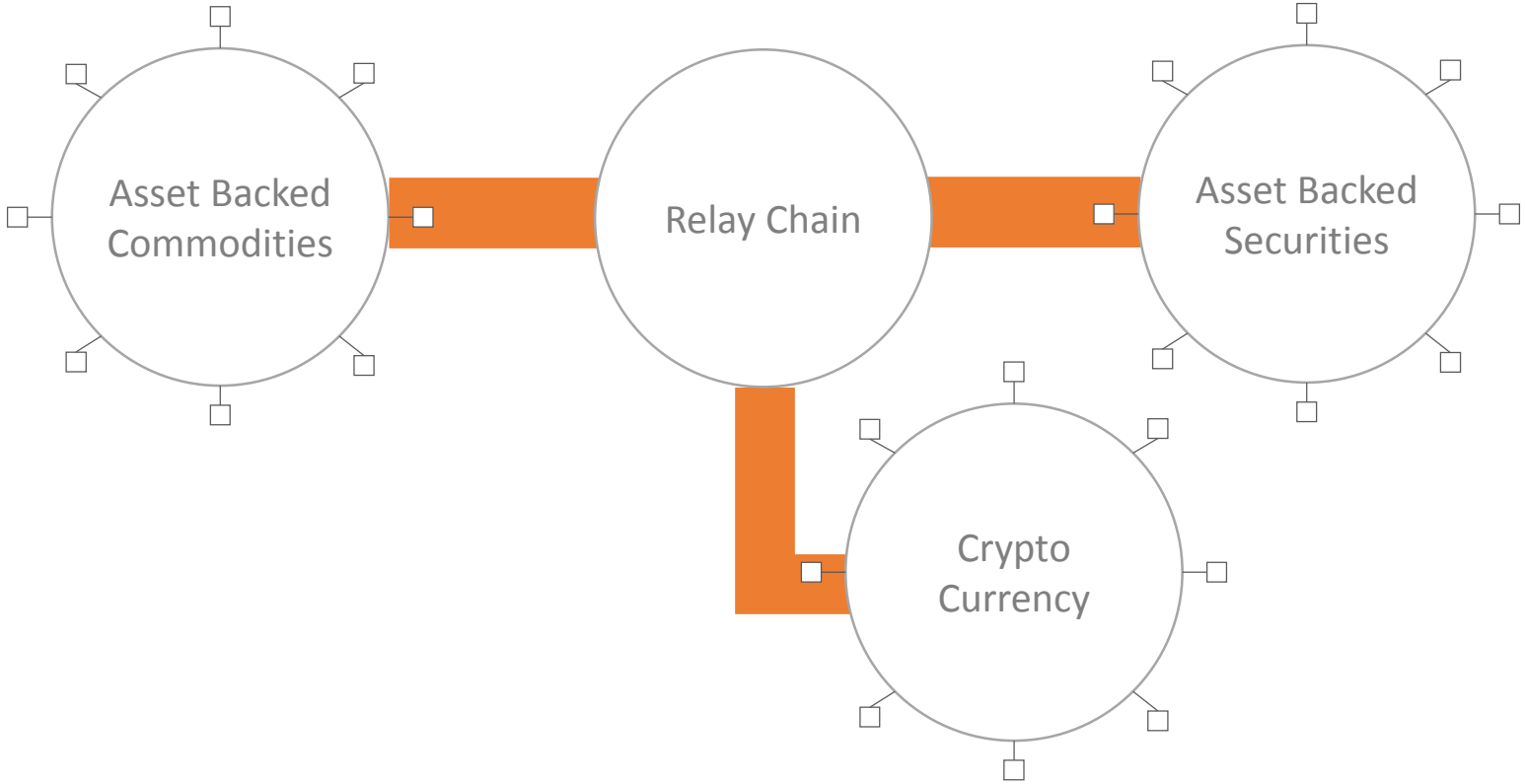


Pass messages and accompanying proofs between networks
(e.g. Signed records and histories, Merkle proofs)

Interoperability Protocols

Standard protocols for exchanging value
(e.g. HTLCs - Atomic Swaps, Inter-Ledger Protocol)

Interoperability Frameworks



An inter-blockchain framework with guarantees enforced by a shared “relay” chain
(e.g. Polkadot, Cosmos, Sidechains, Plasma)

Interoperability Challenges

- Trust and Integrity
- Global Guarantees and Invariants
- Privacy and Confidentiality
- Discovery and Addressability
- Regulation, Law and Compliance
- Standards
- Governance

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Methods to reason about trust and integrity that can be exposed to applications that drive cross-network workflows.

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Mechanisms for preserving guarantees or invariants across disparate networks.

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Mechanisms for preserving privacy and confidentiality when exchanging messages between networks, preventing leakage.

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The discovery of classes or specific instances of assets and data, and the addressability of assets and data along with their histories and dependencies.

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Complying with regulations and laws when interoperating with networks across different jurisdictions.

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Standards play a key role in driving interoperability. History has shown that driving standardization is always a challenge.

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Independent governance structures around each of the networks poses challenges for each of the above, making interoperability between existing networks difficult.

Summary

- Emerging data and value silos will create challenges in interoperability
- If designing decentralized networks is hard, interoperability is harder
- Designing a set of interoperability primitives that are easy to analyze and reason under different conditions will allows us to construct complex workflows
- Standards will play a key role