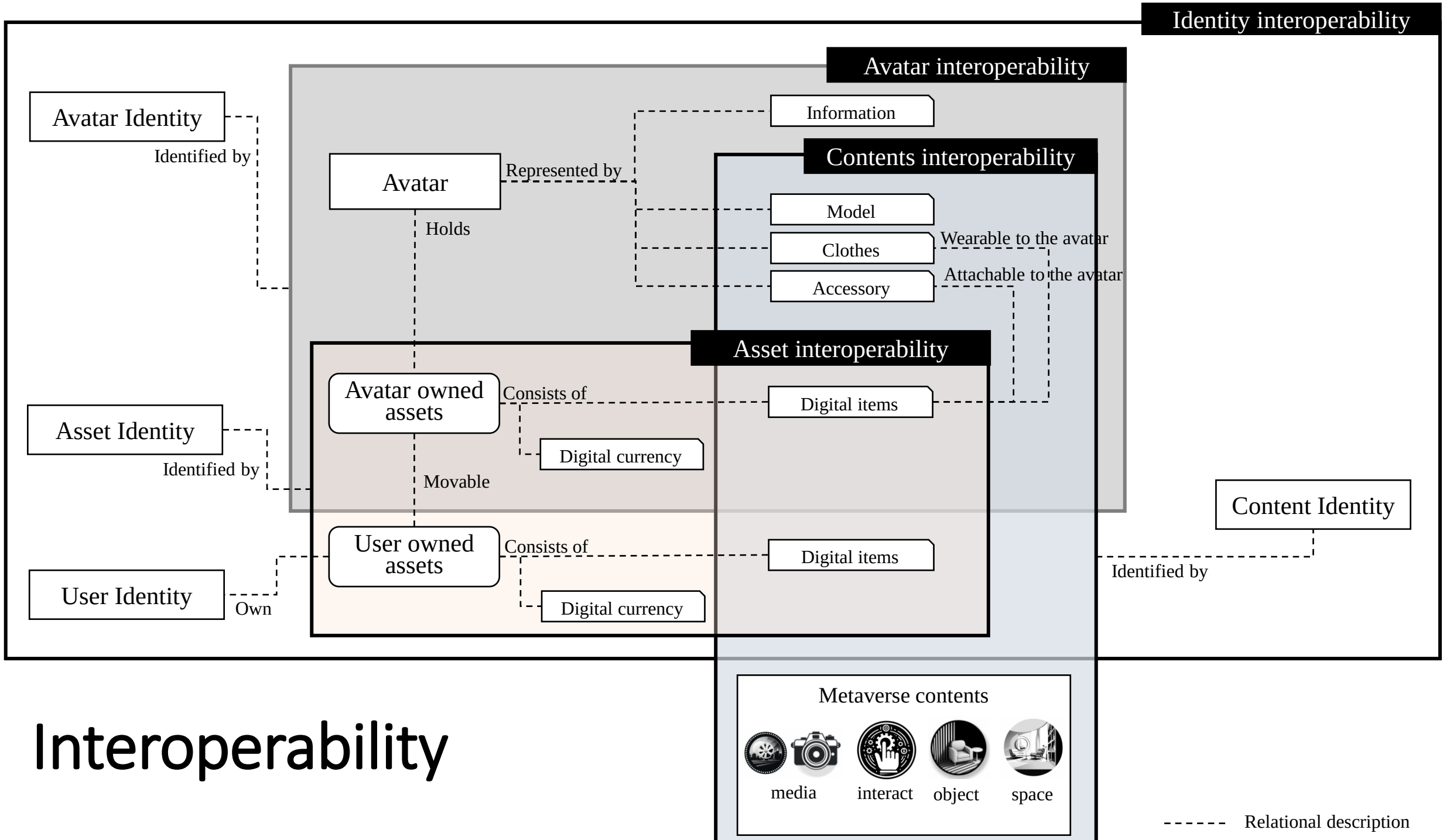
# Metaverse and Blockchain

118 Prague

# Two potential areas for IETF MV work

- Interoperability
- DCS (DLT - Blockchain)




# Interoperability

Blockchains store transactions over a distributed state and help

- to determine who owns what,
- to provide asset tracing, and
- to secure digital content and data.

Consensus protocols are the backbone of blockchains, validating transactions, adding blocks, and working on inconsistent state (PoW, PoS).

# ITU-T Vocab

3.2.1 **metaverse**: "Metaverse is an integrative and unified ecosystem of virtual worlds, which is based on interoperable Internet-based and enhanced reality systems, and offers immersive experiences to individuals during their digital and synchronous interactions, and new value generation opportunities to organizations".

3.1.6 **blockchain** [b-ITU-T X.1400] [b-ITU-T F.751.0]: A type of distributed ledger which is composed of digitally recorded data arranged as a successively growing chain of blocks with each block cryptographically linked and hardened against tampering and revision.

3.1.8 **database** [b-ITU-T Q.1290] Entity that stores user and/or network information.

3.1.9 **data interoperability** [b-ITU-T Y.4563]: Ability of two or more systems or components to exchange data and to use the data that has been exchanged.

3.1.10 **decentralized system** [b-ITU-T X.1400]: Distributed system wherein control is distributed among the persons or organizations participating in the operation of system.

3.1.15 **distributed ledger** [b-ITU-T X.1400]: A type of ledger that is shared, replicated, and synchronized in a distributed and decentralized manner.

3.1.16 **distributed ledger technology** (DLT) [b-ITU-T X.1400]: Technology that enables the operation and use of distributed ledgers.

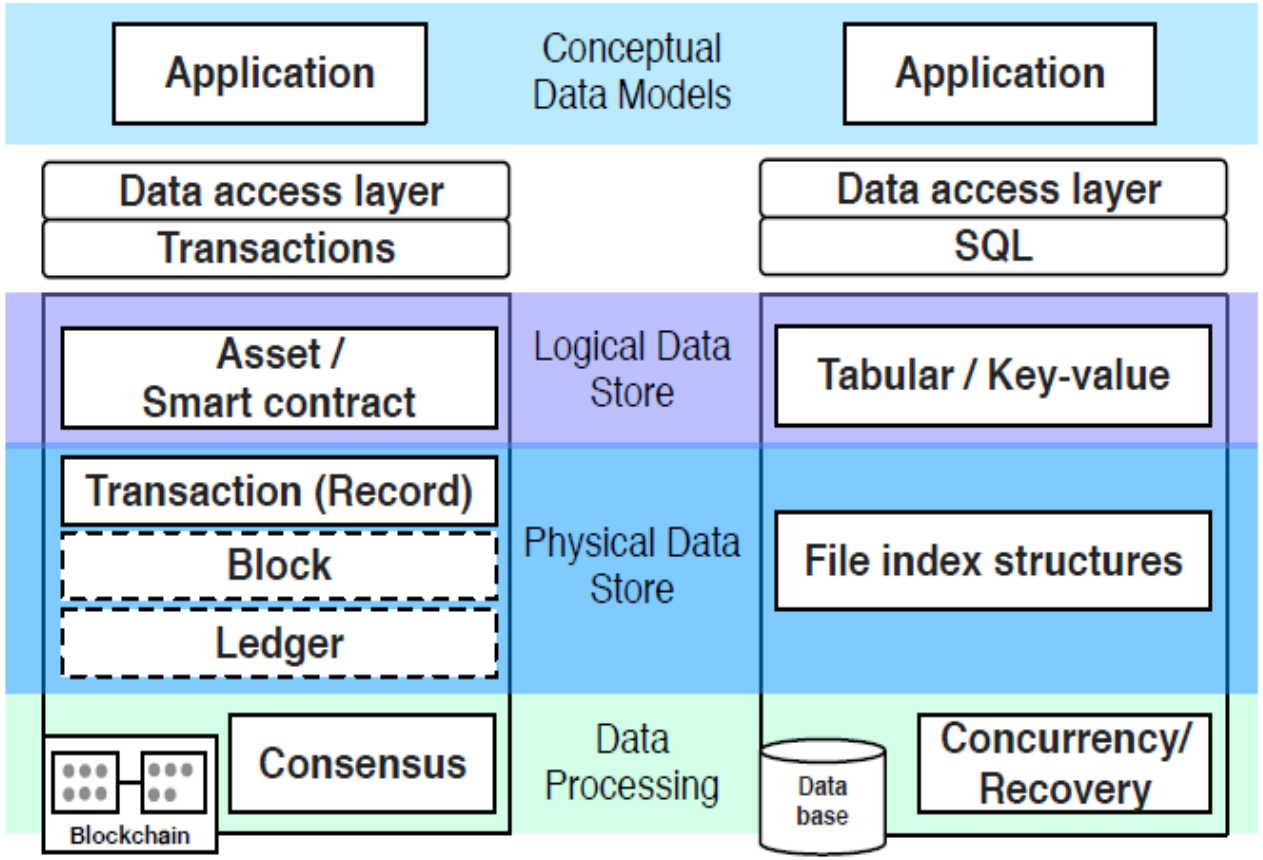
3.1.22 **ledger** [b-ITU-T X.1400]: Information store that keeps final and definitive (immutable) records of transactions.

# ITU-T BaaS

(5) Blockchain BaaS platform

Blockchain technology can endow data with the characteristics of being difficult to tamper with, thus supporting the cross-platform management and circulation of data/resources/assets. Users really own digital assets, which is the foundation for the Industrial Metaverse to build a credible value network and a new economic system. The blockchain BaaS platform can provide services such as smart contracts, consensus algorithms, privacy computing, cross-chain mechanisms, etc., promote the application of blockchain in the Industrial Metaverse, promote the flow, collaboration, and sharing of various virtual and real data/resources/assets among different manufacturing entities, and accelerate the reconstruction of existing business logic and business models.

# Could you use a traditional DB?




- Databases are controlled by an admin
  - Client/server in nature
  - Malicious actors can alter data
  - Administrator decides which data is accessible and visible
- They are easy to implement and maintain
  - They are fast and scalable
- Blockchains are decentralized and allow permissionless participation.
  - Nearly impossible to alter data
  - No central administrator authority
  - But not particularly fast

# Key points of Blockchain in a Metaverse

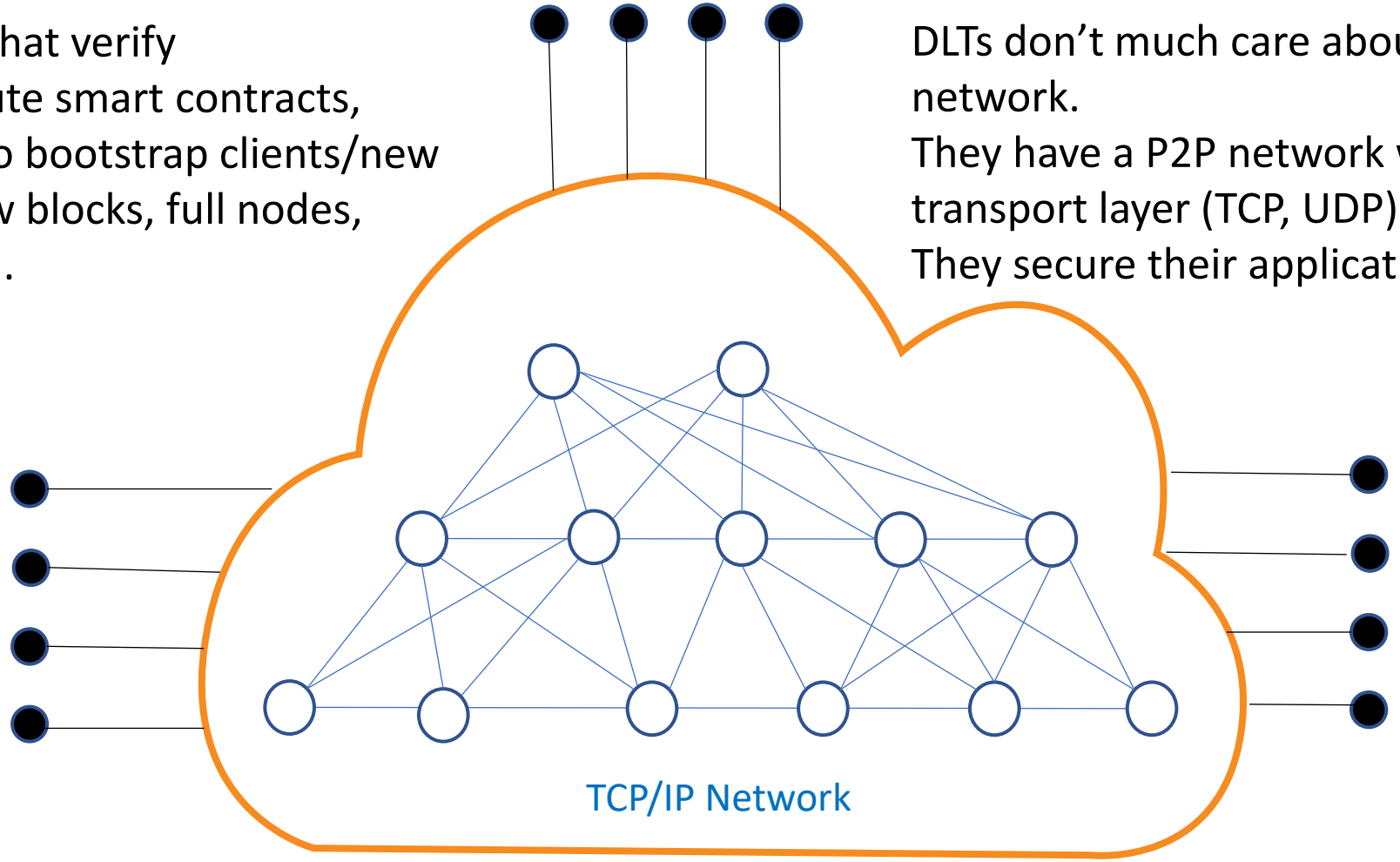
- Blockchain as a trust technology in the virtual world
  - Provides decentralized, possibly permissionless, and safe data storage

  -> Everyone sees the same virtual world, with blockchain allowing all nodes to synchronize on the same information.
- VR is one of many ways to access and experience a metaverse.
  - Whatever access device, identity can be provided by blockchain.
- Smart contracts help regulate relations and rules within a metaverse
  - Support transfer of value between worlds.
  - Provide a society where people immutably own assets, such as information, along with money

-> Blockchain provides (metaverse) society with agreed upon rules and history of events.

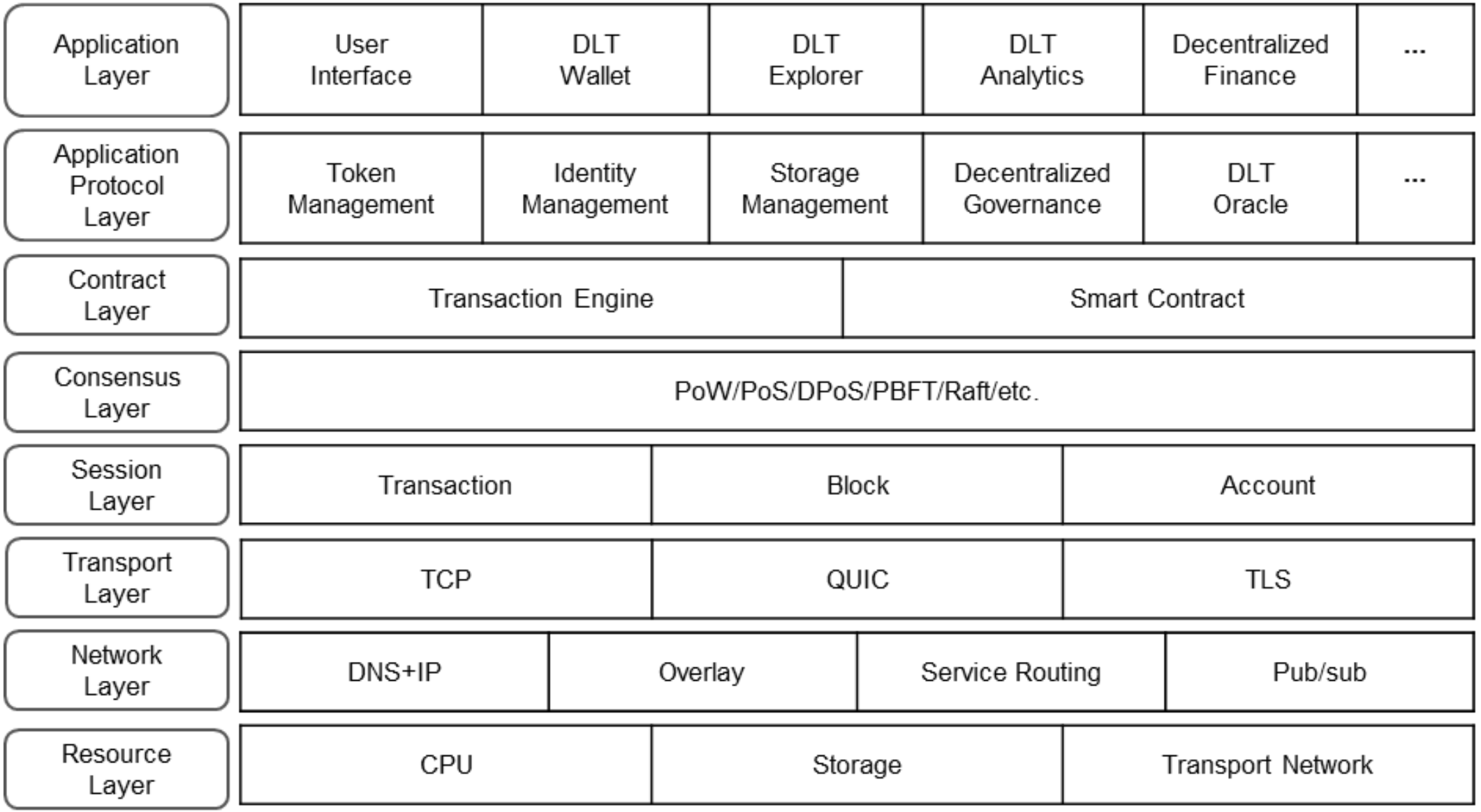
# Blockchain P2P Network

Consists of nodes that verify transactions, execute smart contracts, boot/seed nodes to bootstrap clients/new nodes, process new blocks, full nodes, lightweight nodes...




DLTs don’t much care about the underlying network.
They have a P2P network with a pool of transport layer (TCP, UDP) connections.
They secure their application.

# IEEE DLT Layering Architecture



# Disrupt the bad guys

- Attack surface expands with Metaverse. Criminals have their own ecosystem and blockchain will help disrupt that ecosystem with its own.
- Blockchain can help show proof of where criminal activity is occurring.
- Blockchain will make the bad guys expend more effort than perhaps intelligence gained.
- Whole idea of a blockchain is to make it publicly visible, perhaps we can use that to our advantage.

# IETF Opportunities

## Consensus algorithms

- Proof of Work (PoW), Proof of Stake (PoS), Proof of Capability, Proof of Space, Leased PoS, Stellar consensus protocol, Delegated Proof of Stake (DPoS), Transaction as Proof of Stake (TaPoS), Delegated Byzantine Fault Tolerance (dBFT), Casper PoS, Proof of Importance (PoI), Proof of Elapsed Time (PoET)...IETF DCS?

## Interoperability

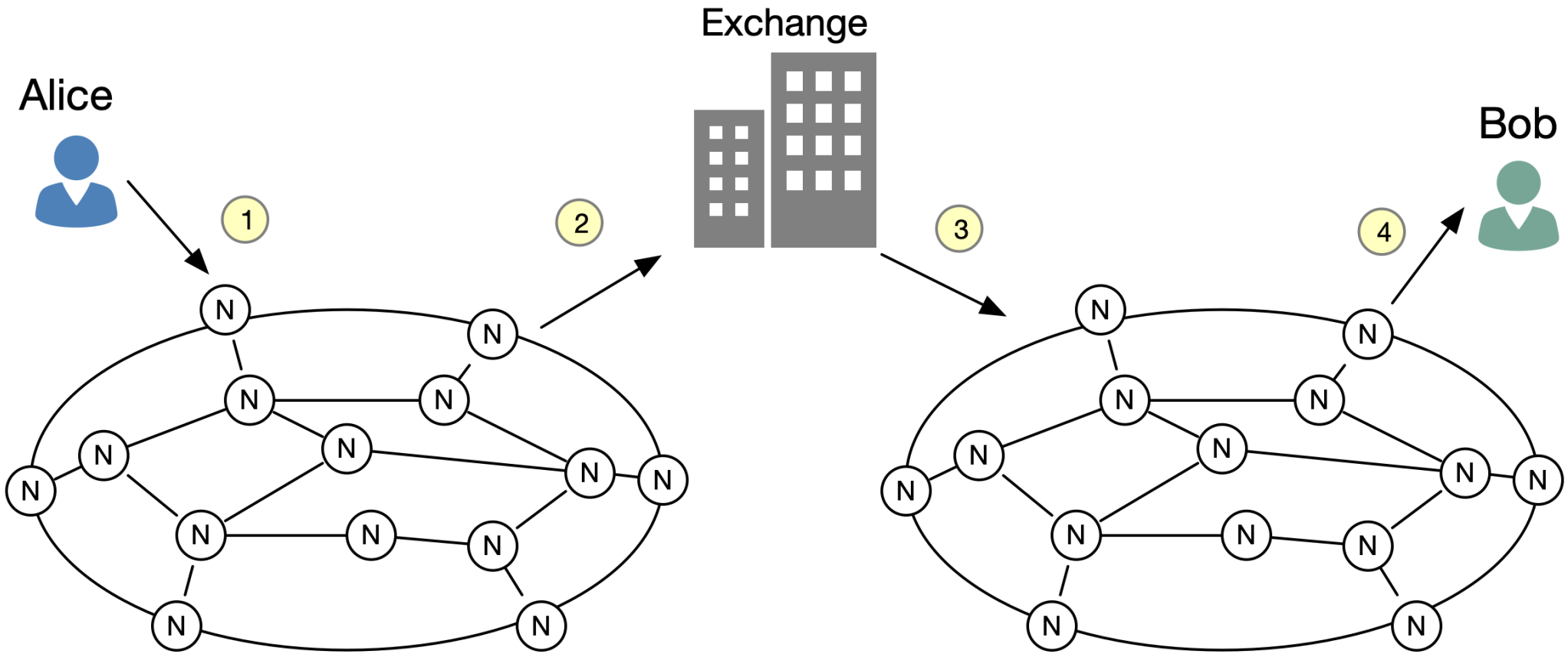
- Cross-Chain Bridges, SATP WG

## Integration with network functions

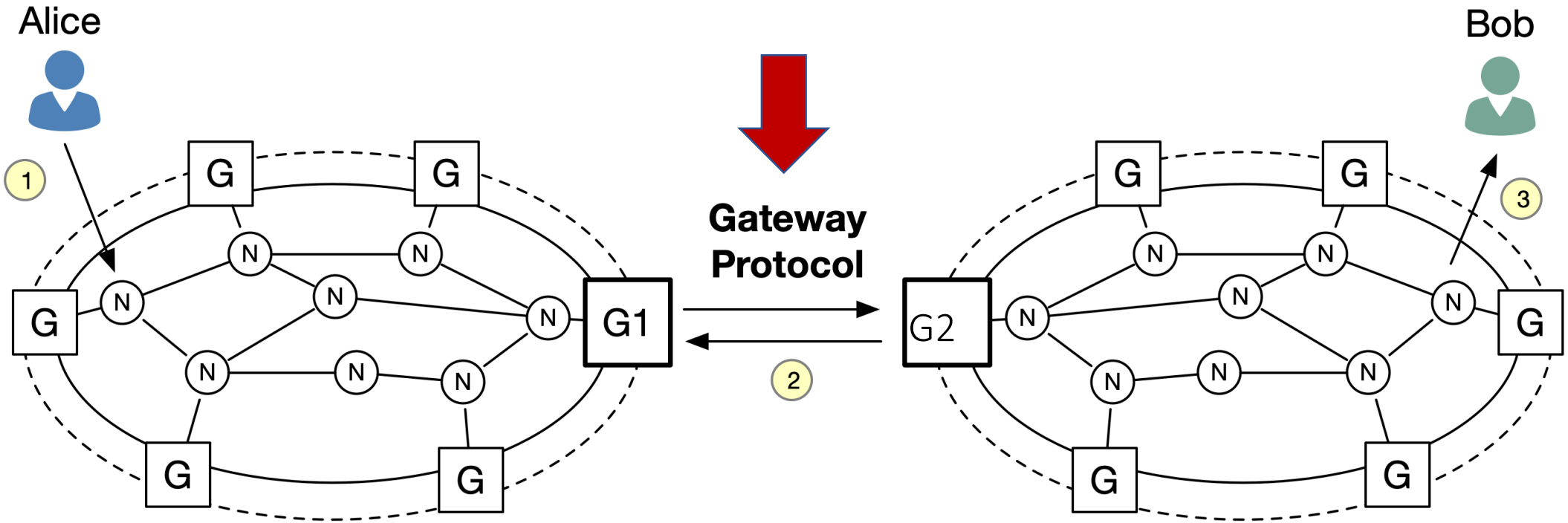
## Improve on scalability and costs

## Metaverse, BaaS…

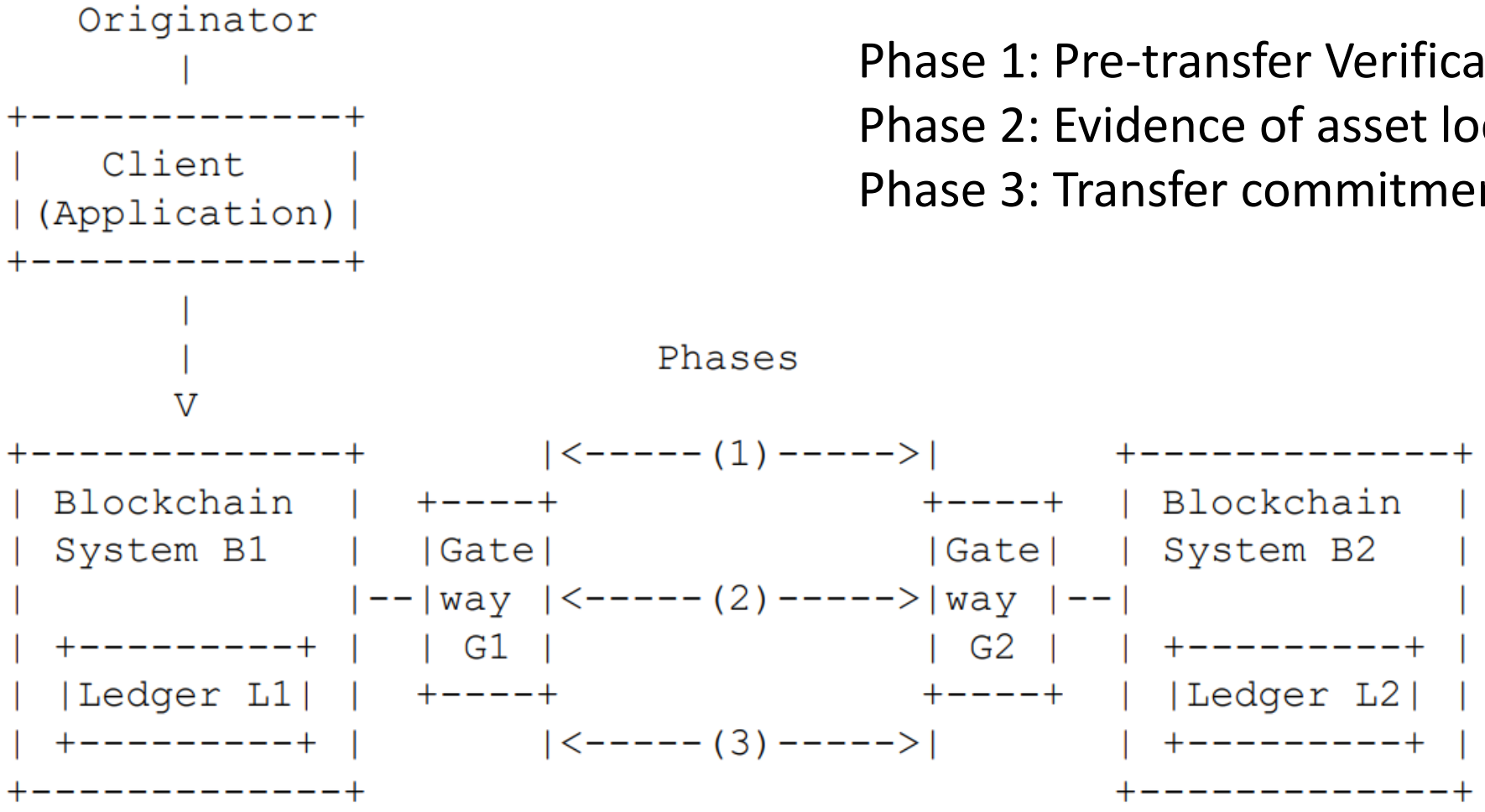
# Before SATP



# SATP

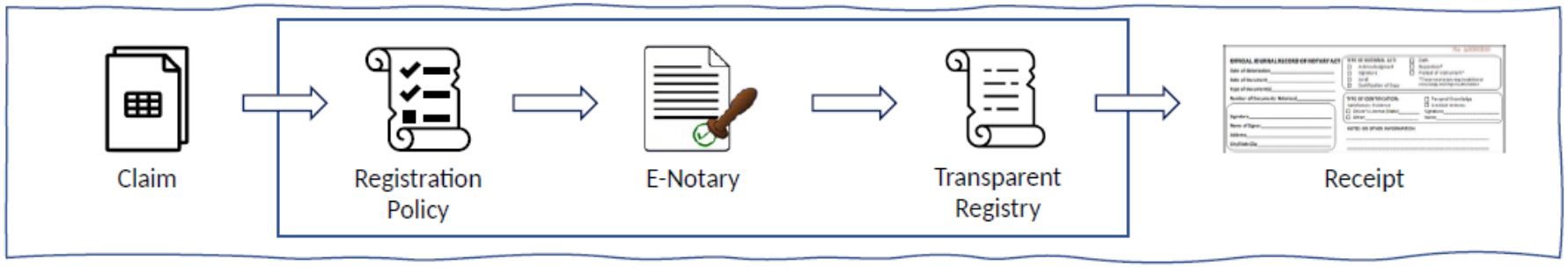


# SATP




Phase 1: Pre-transfer Verification of Asset and Identities
Phase 2: Evidence of asset locking or escrow
Phase 3: Transfer commitment

# SCITT Definitions and Terms




**Claim:** An identifiable and non-repudiable statement about an artifact made by an Issuer

**Registration Policy:** Configuration for the types of identifiers representing issuers that may be verified, or rejected, by the notary before being placed on the registry

**E-Notary:** The act of verifying the identity of an issuer, submitting content to the system (storage + registry), based on policy, issuing a receipt for valid entry in a registry

**Transparent Registry:** A verifiable data structure that provides a consistent, append-only, record of all registered claims. Transparency does not *necessarily* mean public access; the notary may implement an access control policy.

**Receipt:** An offline, universally-verifiable proof that an entry is recorded in the registry. Receipts do not expire, but it is possible to append new entries that subsume older entries

https://ietf-scitt.github.io/draft-birkholz-scitt-architecture/draft-birkholz-scitt-architecture.html#name-definition-of-transparency

# Blockchain Routing Opportunities

- Trust packet capture data
- Network mgmt moves to a decentralized, smart contract-based system
- Signing routing advertisements, proof of transit.
  - BGP/RPKI. ROA's in a blockchain
- Overlays, such as LISP, to find best DLT peer

# Goal for draft-mcbride-rtgwg-bgp-blockchain

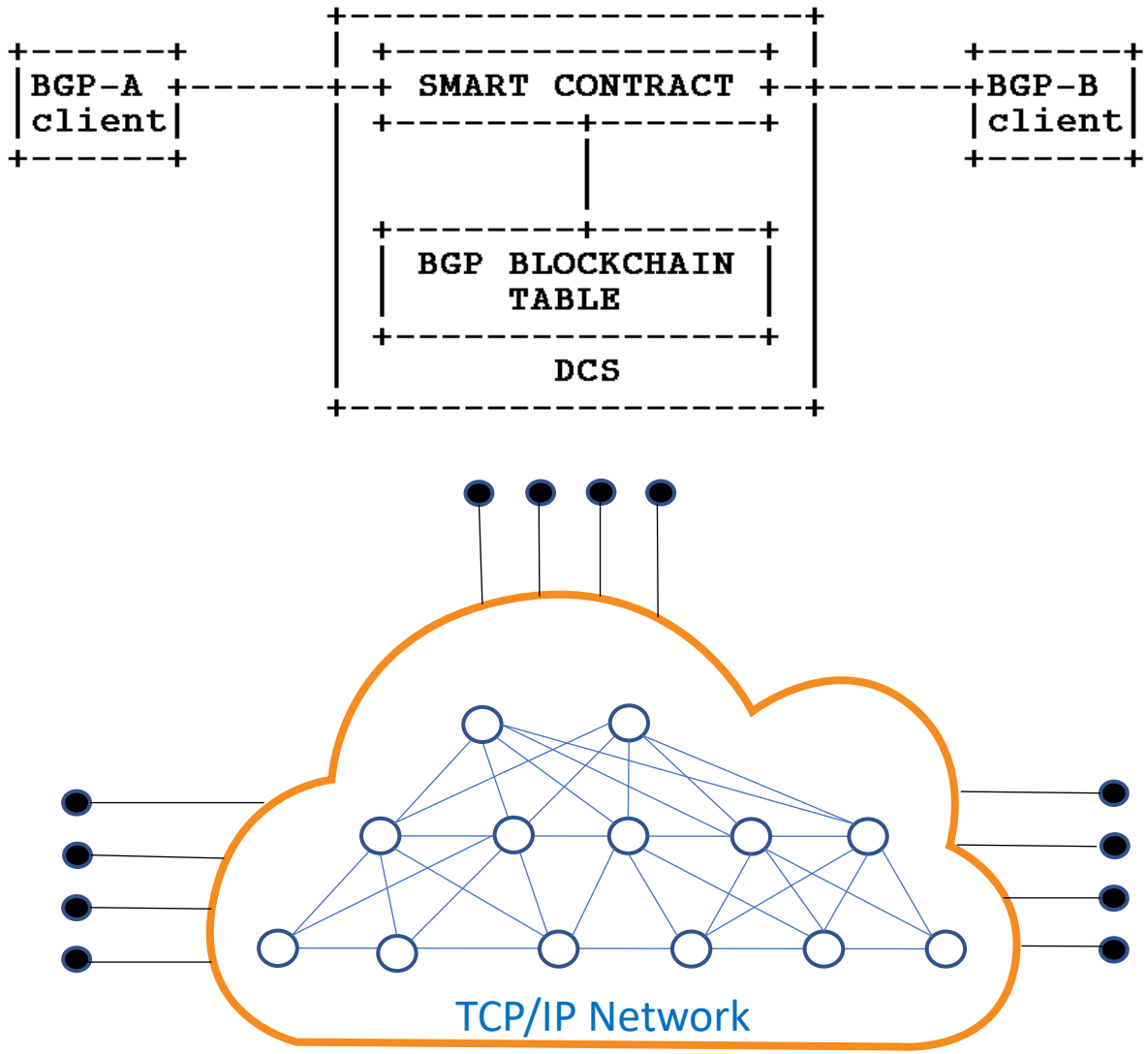
Review possible **opportunities** of using *Distributed Consensus Systems* (DCSs) to secure BGP policies within a domain and across the global Internet

Propose that BGP data could be placed in a DCS and smart contracts can **control how the data is managed**

Create a **single source of truth**, something for which DCSs are particularly well suited, as a **complement** to existing IRR and RPKI mechanisms

# Bit of Background

- **Smart contracts** are programs realizing BGP-related operations and store their (distributed) state in a DCS
  -> A DCS could be used to supplement existing BGP management
- A **BGP related smart contract** could be executed when some condition such as receiving an update with too many prepends or hijacking detection
- DCS realized through a **P2P Network** where participating nodes verify transactions, execute smart contracts, boot/seed nodes to bootstrap clients/new nodes, process new blocks, full nodes,lightweight nodes...



# RIR – RPKI Blockchain Options

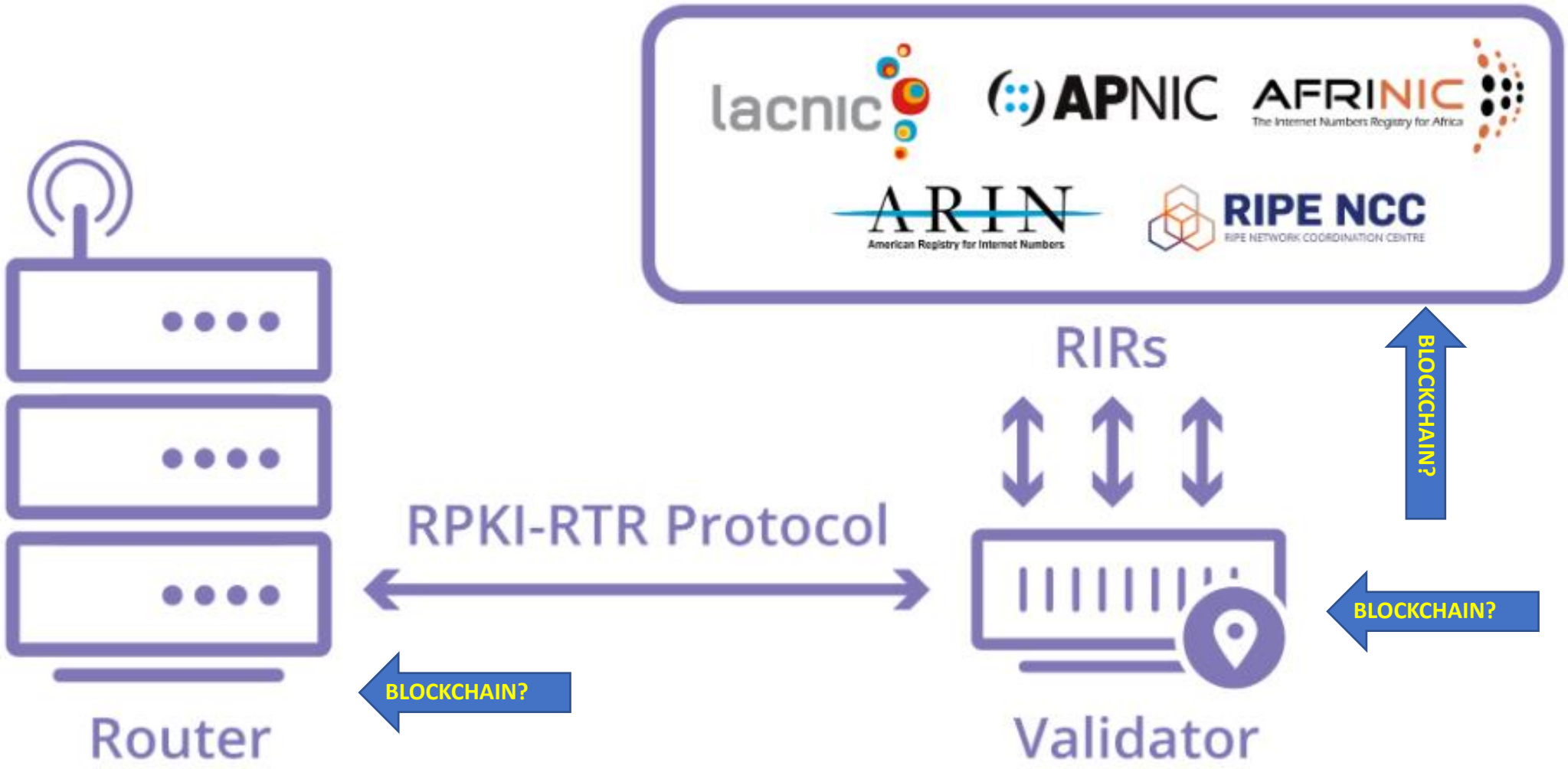



Image: Cloudfare

# Goal for draft-trossen-rtgwg-impact-of-dlts

**Perspective of the DLT Application:**

- DLTs do not typically care about the underlying TCP/IP network
- They have a P2P overlay network (TCP, UDP based) and that is their focus
- They focus on securing their application and do not worry about the network

**Perspective of the Network:** What is the impact of choices made by the application design on the network, e.g., in terms of costs, traffic generated etc.?

**Our work aims to understand the <u>impact</u> of DLTs on provider networks and the possible <u>opportunities</u> to improve on those impacts**

# Summary

- Blockchain is currently the backbone for Metaverse assets
    - Various DCSs in use
- There are several opportunities for network innovation and standardization including within the IETF
    - Interoperability, DCS, Routing, Scalability, BaaS, Quantum Blockchain
- We’ve been presenting in RTGWG and submitting papers in various conferences. Please join us.