



Smart Contracts and their applications in 5G and Beyond

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Agenda

- Smart contracts: An introduction
- Security challenges related to smart contracts
- Designing secure smart contracts
- Smart Contracts' use cases and applications in 5G and beyond
- Conclusion



Smart Contracts

An Introduction

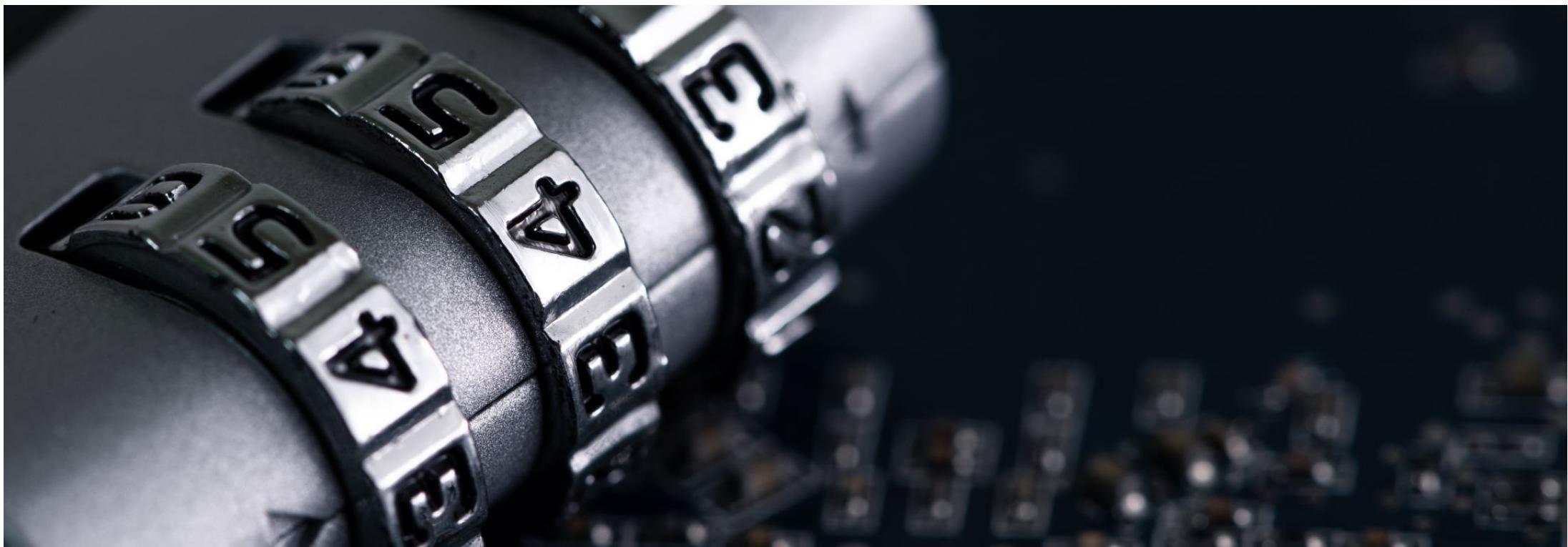
Software codes installed on distributed ledgers. Distributed Ledgers are **immutable** data structures where all the participants keep a copy on the ledger.

Properties of Smart Contracts

Immutable -- Once recorded cannot be changed or amended.

Auto-executable -- Triggered by software condition.

Transparent -- Because they are installed on PDLs – all participants of the ledger keep the same copy.



Security Challenges

Transparency

Because distributed ledgers are transparent, smart contracts and all their respective transactions are visible to all the parties of the contract.

Contracts are visible in a distributed ledger, if a visibility domain is not specified, can cause contracts to be visible to unintended parties within the distributed ledger.

Auto-Executable

Smart contracts are **self-executable** – Pre-programmed conditions trigger these contracts.

Erroneous code can trigger unwanted functions of the code which may cause monetary losses such as unwanted payments.

Immutability

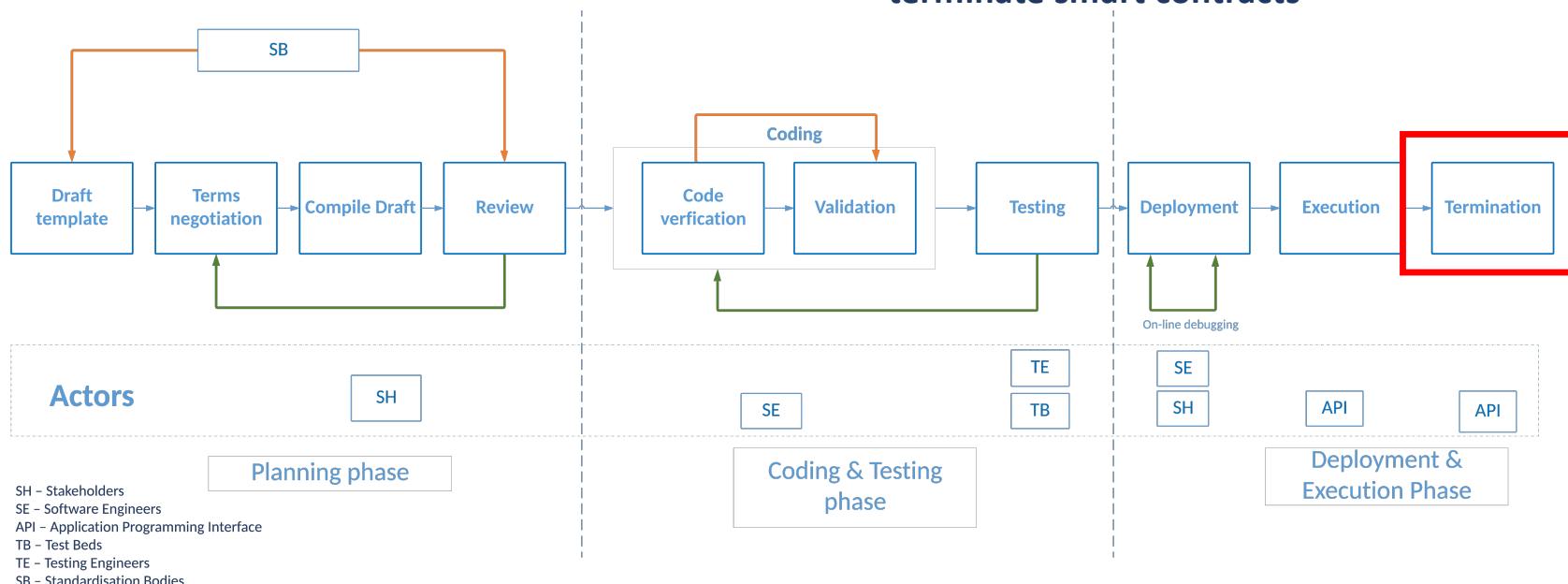
Smart contracts are **immutable** – because they are installed on a distributed ledger, cannot be changed or amended.

Smart contract can not be removed - old and dormant contracts if not secure can be dangerous.

If a smart contracts has some errors in a code, it can leave back doors open- means they may be callable by unauthorized contracts.

Smart Contract Development Lifecycle (ETSI PDL GR 004)

ETSI PDL GS 011 provide details on mechanisms to perform tests and terminate smart contracts



Contract moves to coding phase ONLY if all the stakeholders agree to the conditions defined and the contract meets the standards

Smart Contracts' Use Cases and Applications in 5G and Beyond



Smart Contracts as Service Level Agreements (SLAs)

SLAs are the service contracts between the service provider and the consumer - Smart contracts can create service agreements which are:

- ✓ Accountable – service quality promised in the SLAs must be honored.
- ✓ Automated – service contracts are executed without any human intervention and penalties and rewards are paid automatically.
- ✓ Transparent – service contracts are visible to both the parties.

Resource Reservation through Smart Contracts in 5G and Beyond

Publications:

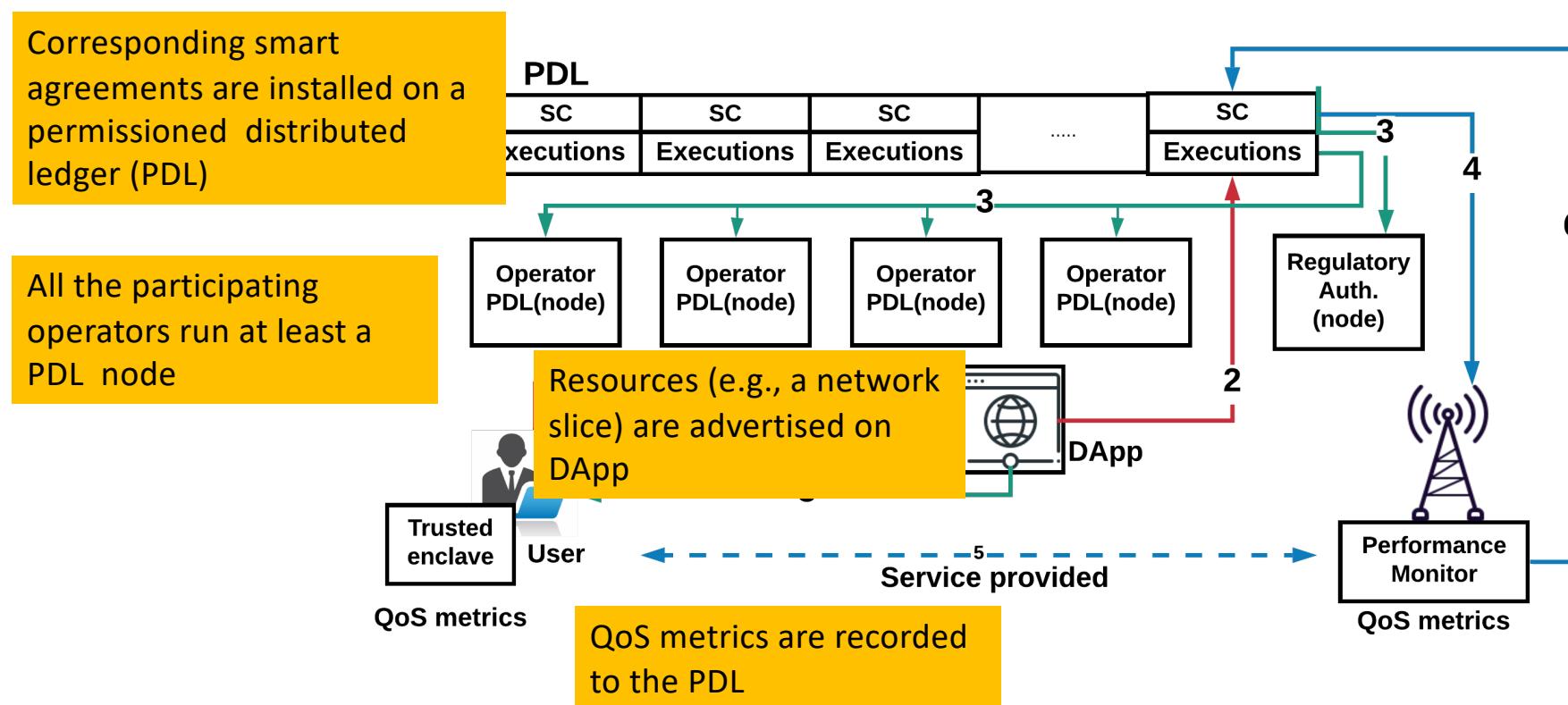
[AJIT: Accountable Just-in-Time Network Resource Allocation with Smart Contracts](#) (MobiArch 2020)

[How to Request Network Resources Just-in-Time using Smart Contracts](#) (ICBC 2021)

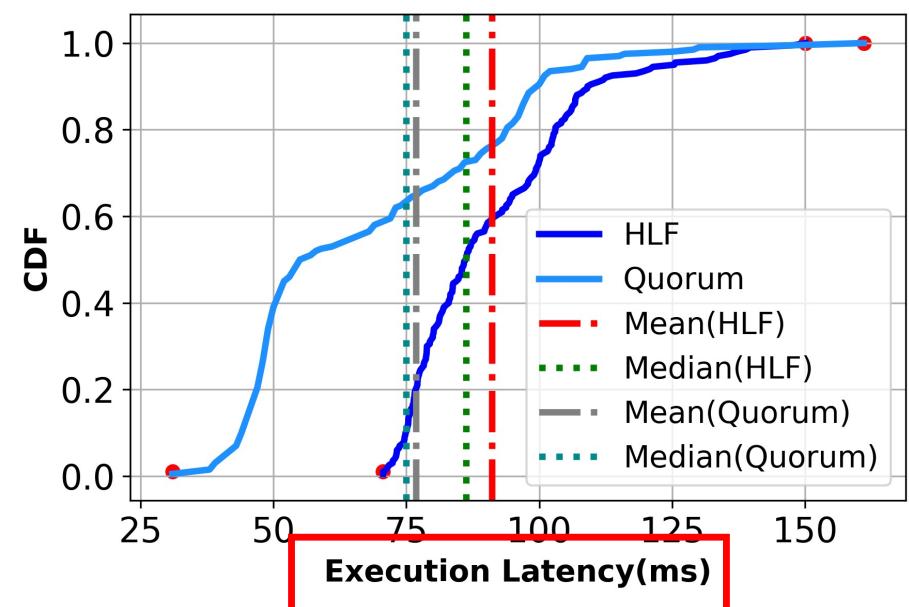
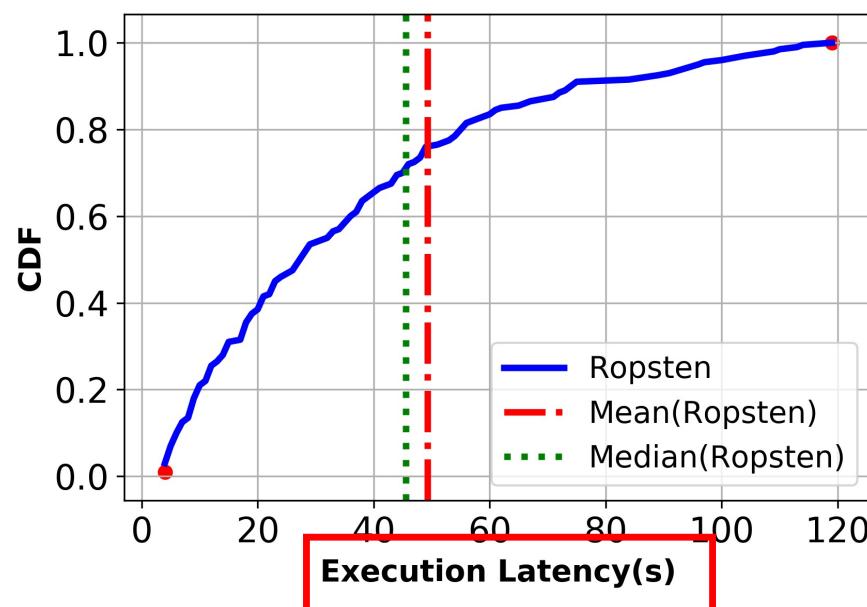
[Automated Quality of Service Monitoring for 5G and Beyond Using Distributed Ledgers](#) (IWQoS 2021)



Architecture



Comparison of Permissioned and Permissionless Distributed Ledgers for Smart Contracts



Infrastructure Sharing through Smart Contracts in 6G

Publications:

[BEAT: Blockchain-Enabled Accountable and Transparent Network Sharing in 6G](#) (Communications Magazine, March 2022)

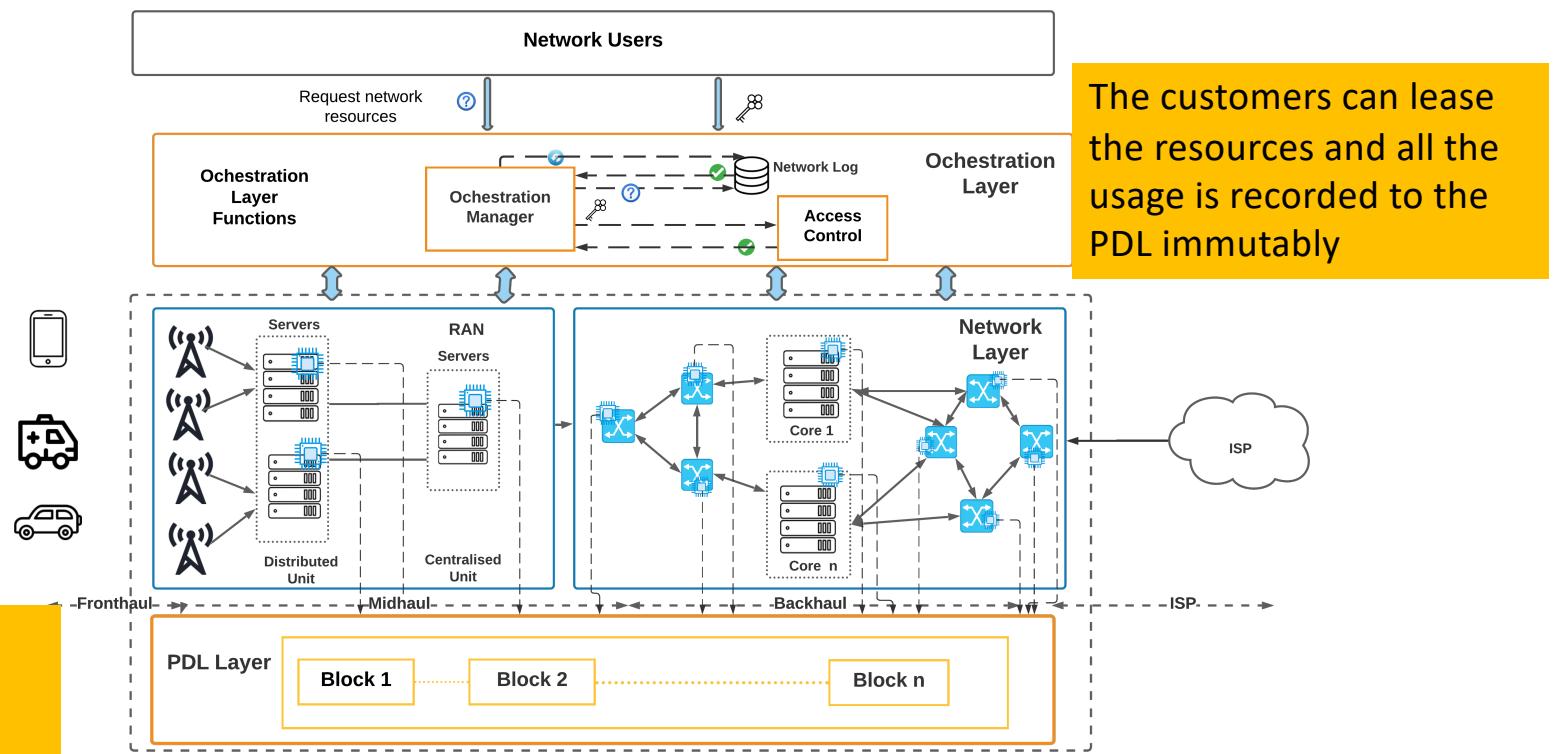
[BEAT: Blockchain-Enabled Accountable Infrastructure Sharing in 6G and Beyond](#) (Preprint available)



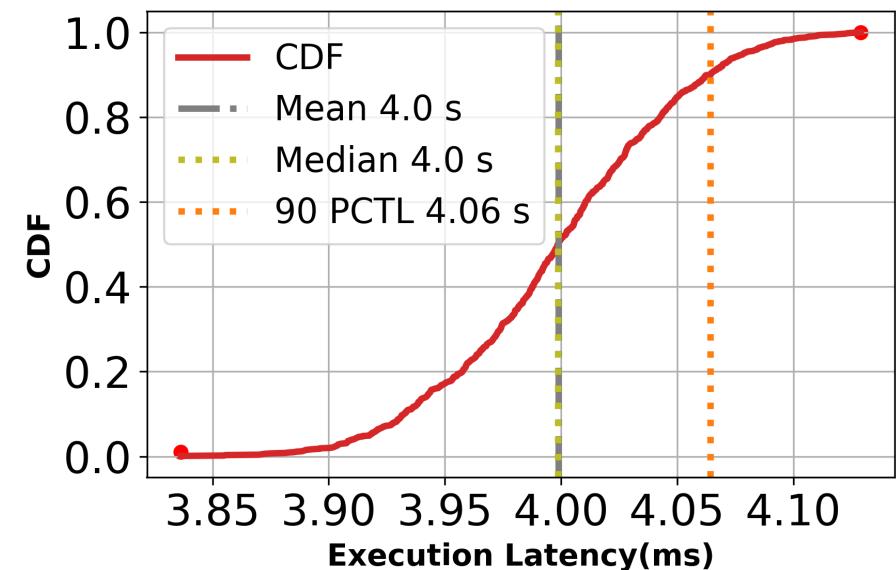
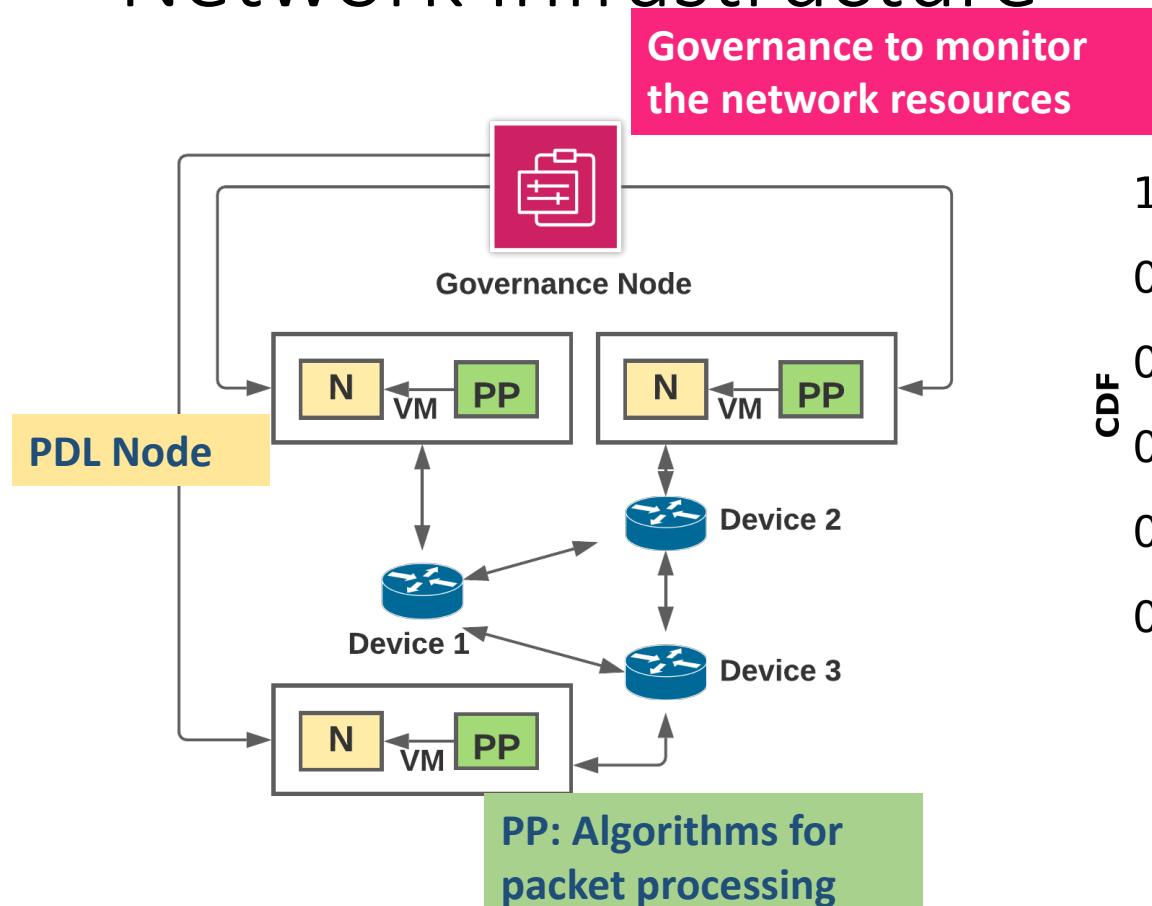
Architecture

All the devices are equipped with a PDL node

Forming a PDL network within a network infrastructure



Smart Contract Latency in a Simulated Network Infrastructure



Conclusion

- ✓ Smart Contract provides a transparent, auto-executable and immutable means to record contracts.
- ✓ However, to enable their viability the inherent properties need management and standardisation efforts.
- ✓ Standardisation initiatives can enable the adoption of smart contracts as future contracts.