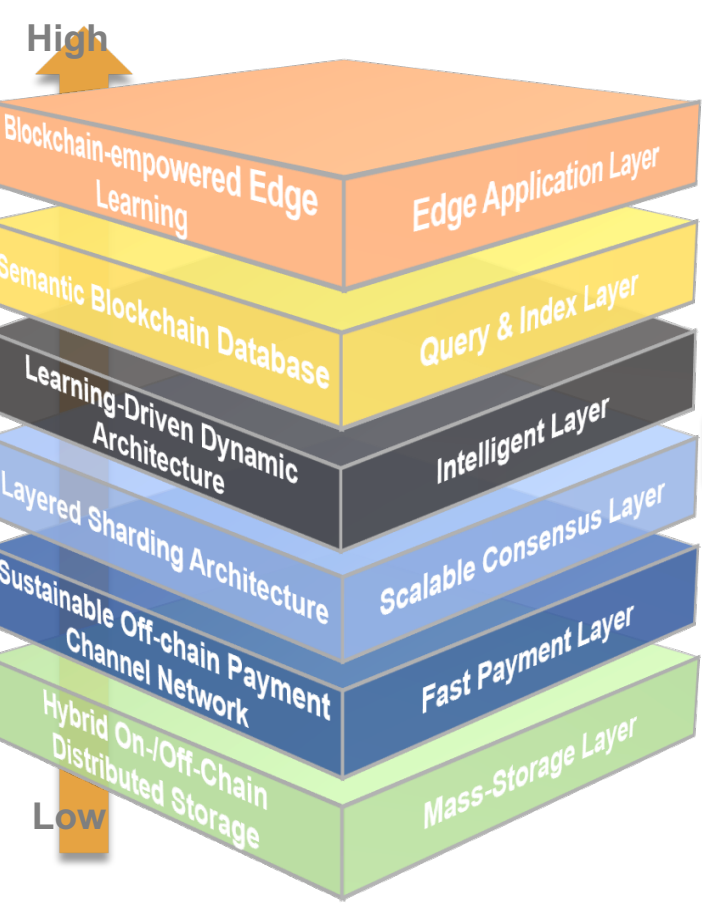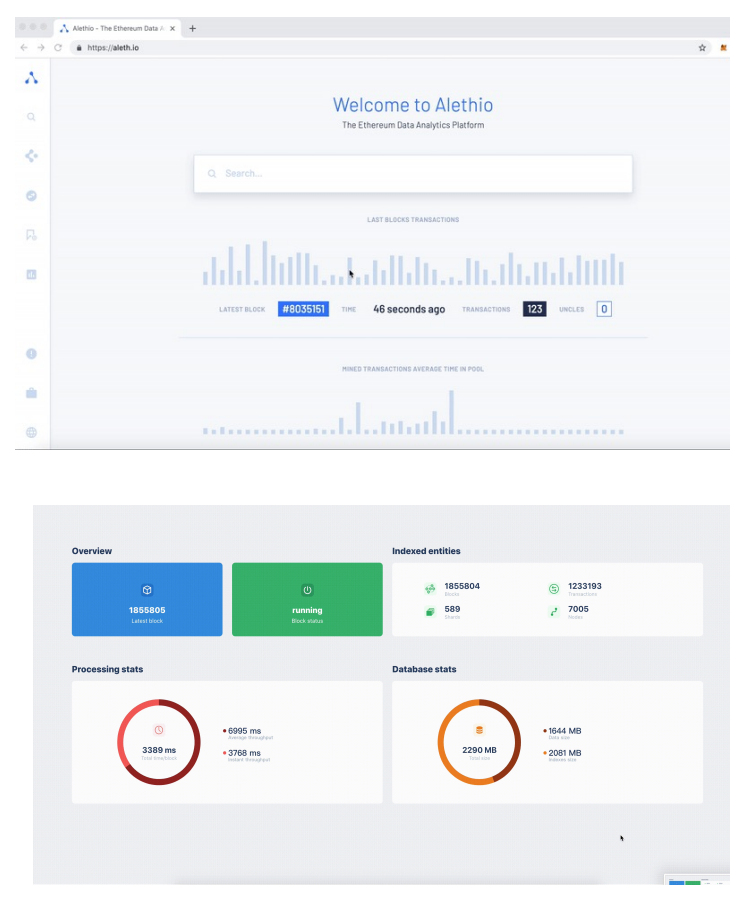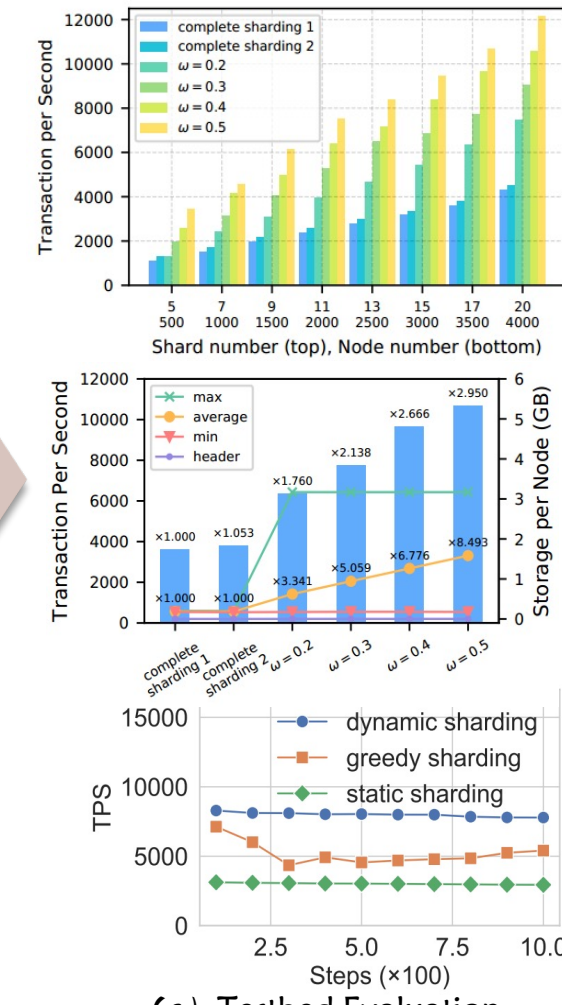# Next-Generation Blockchain with Scalability, Security, Privacy, and Intelligence
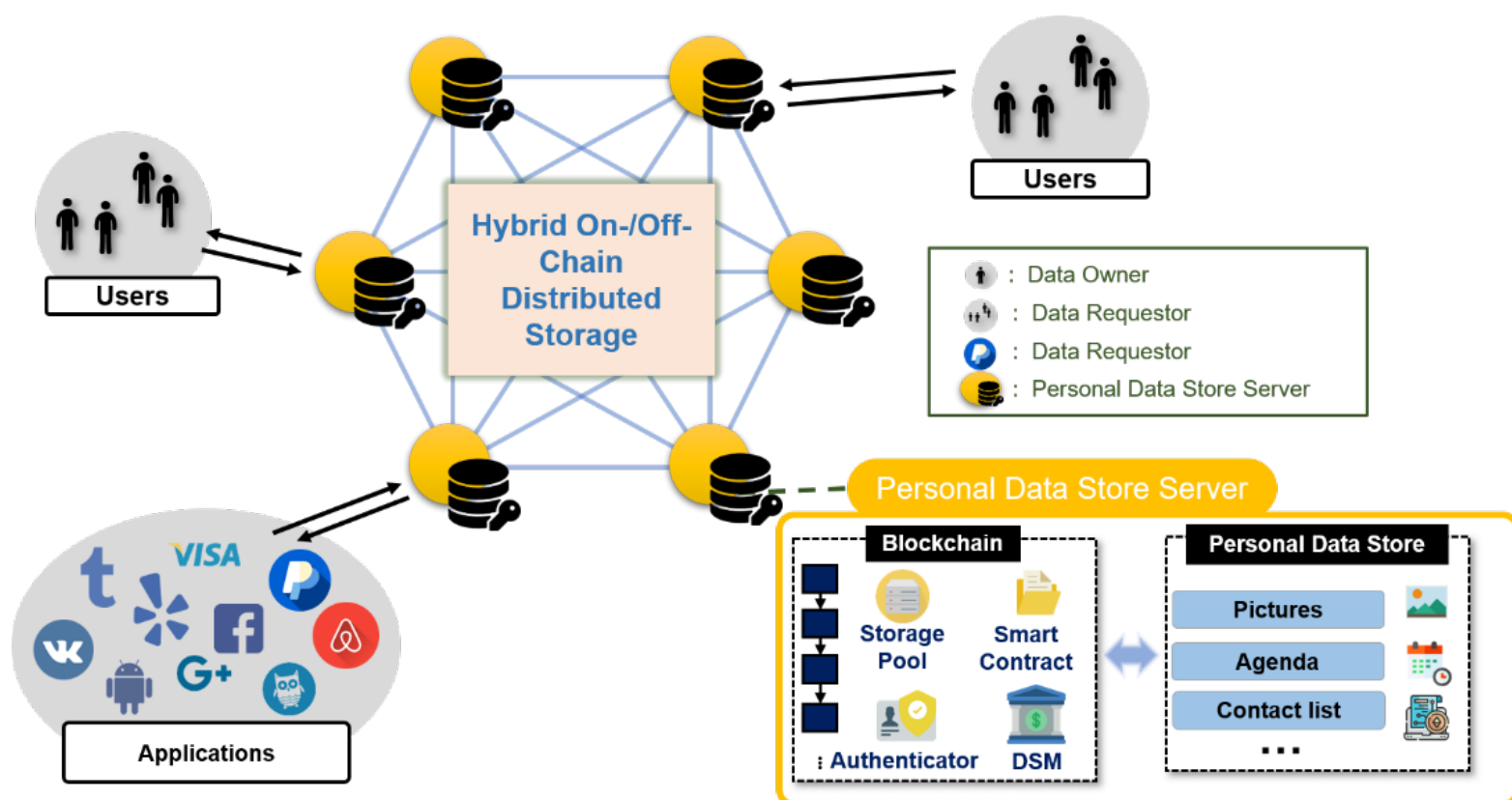

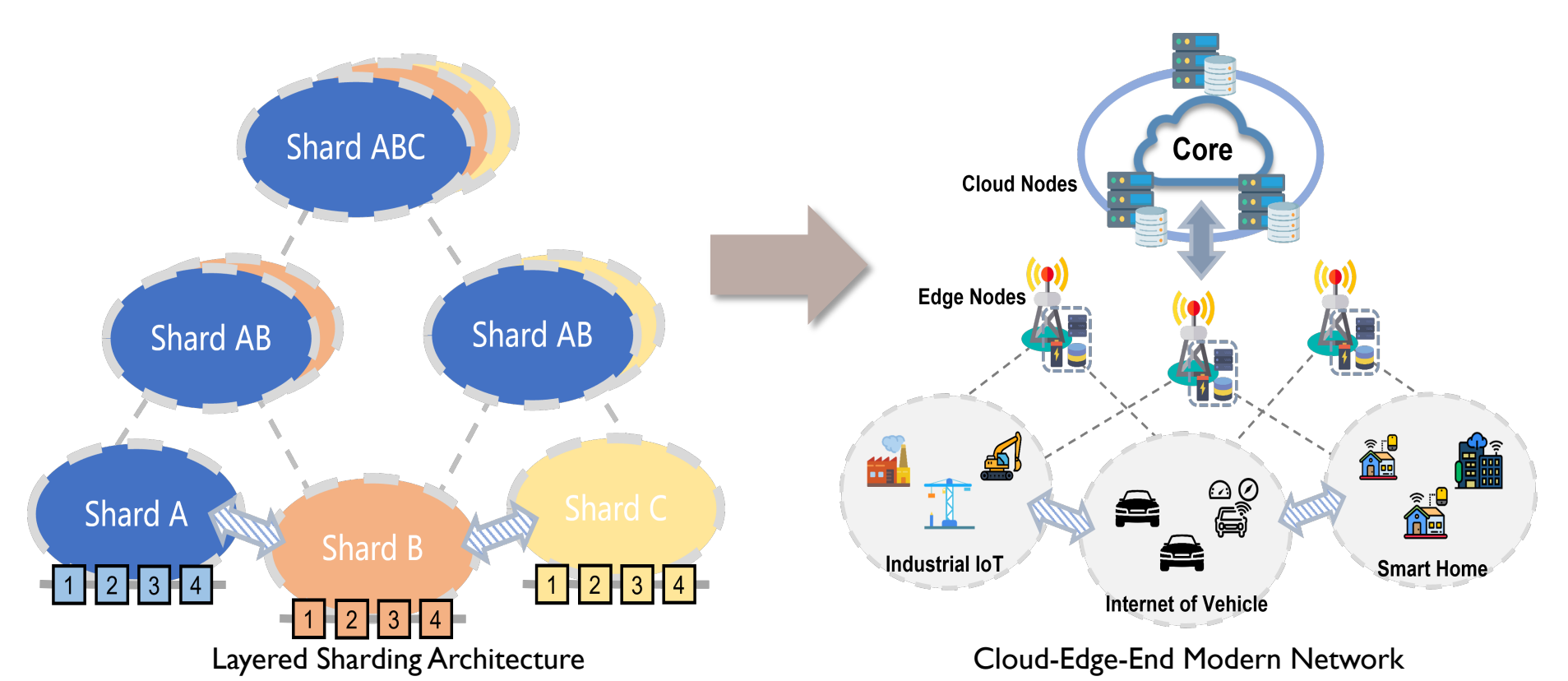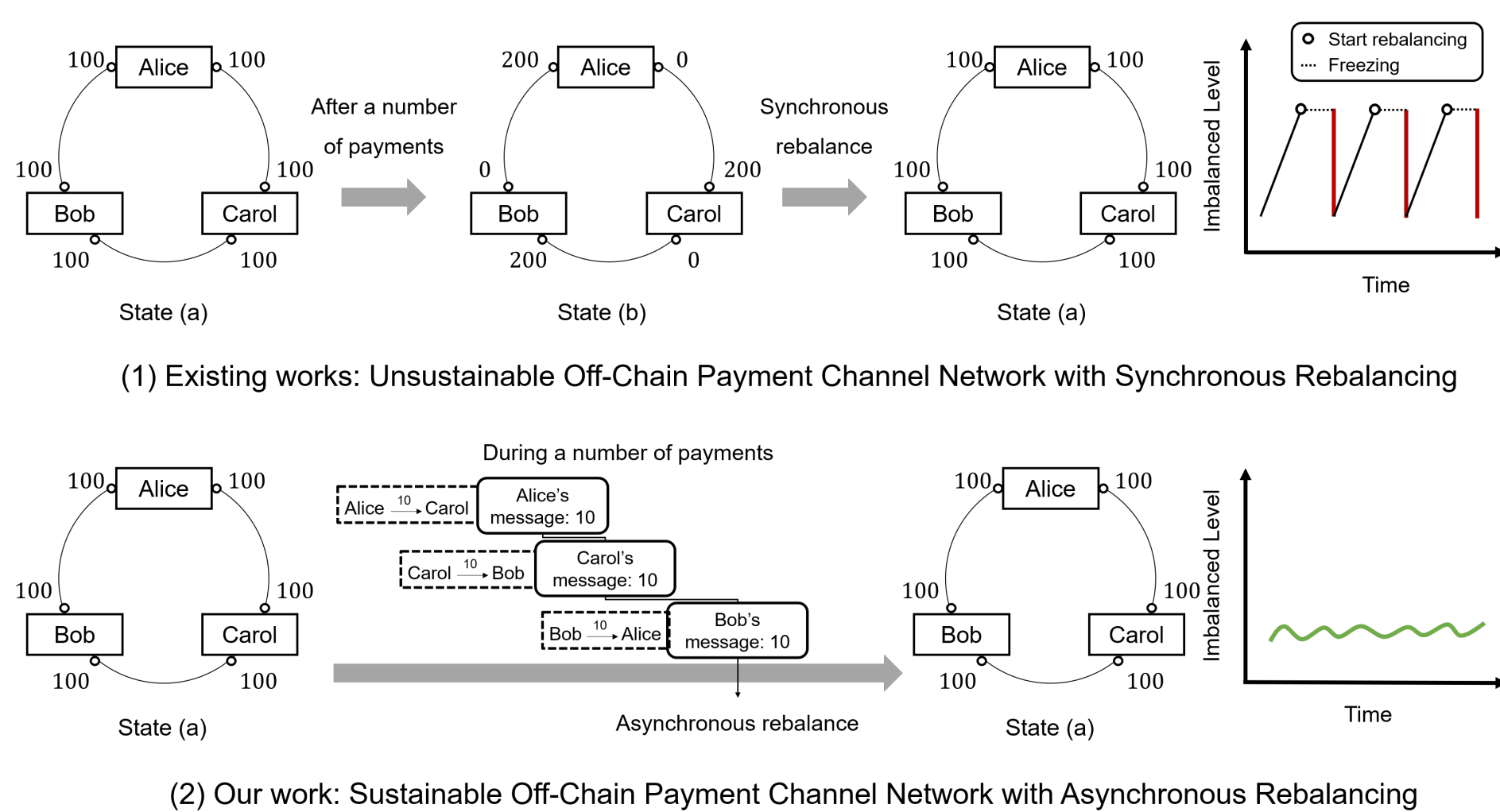(a) 6-Layer Architecture (b) Ethereum-based Prototype (c) Testbed Evaluation

❖ **Hybrid On/Off-Chain Distributed Storage for Mass-Storage Layer:** off-chain data storage and sharing platform for blockchain
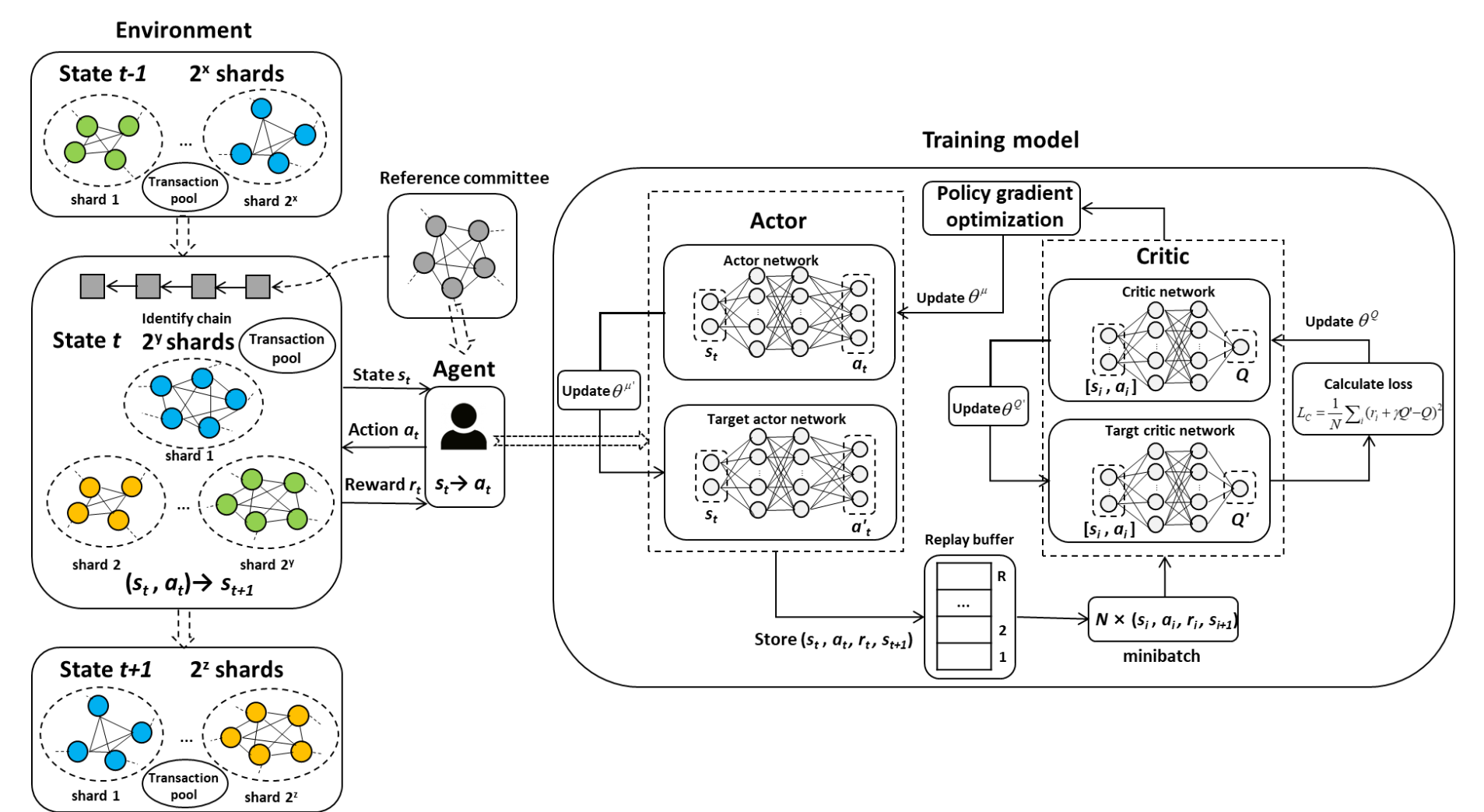

❖ **Layered Sharding Architecture for Scalable Consensus Layer:** off-chain achieves both linear scalability and efficient cross-shard transactions processing
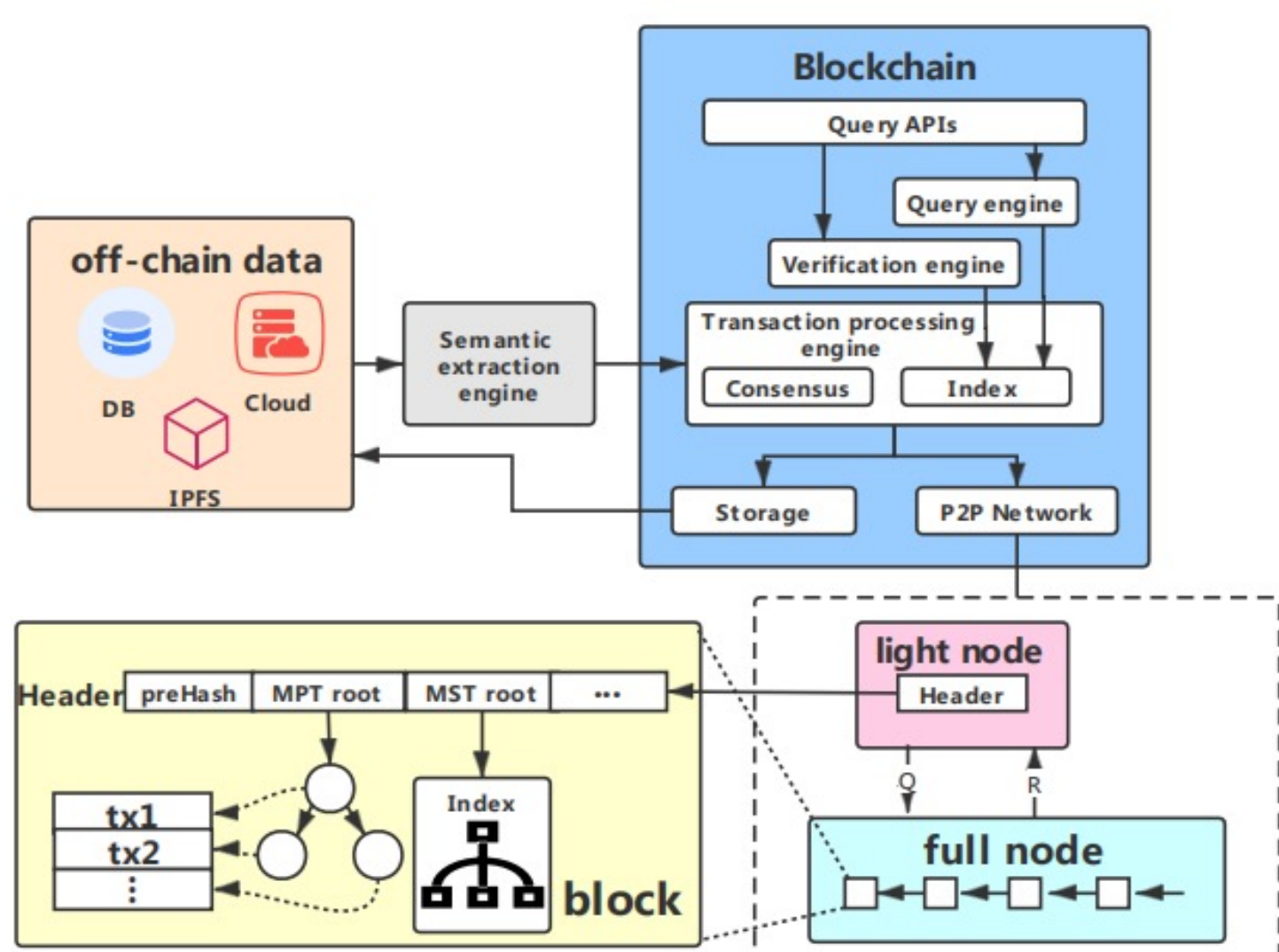

Layered Sharding Architecture   Cloud-Edge-End Modern Network

❖ **Sustainable Off-chain Payment Channel Network for Fast Payment Layer**: off-chain balance the network without channel freezing

(1) Existing works: Unsustainable Off-Chain Payment Channel Network with Synchronous Rebalancing

(2) Our work: Sustainable Off-Chain Payment Channel Network with Asynchronous Rebalancing
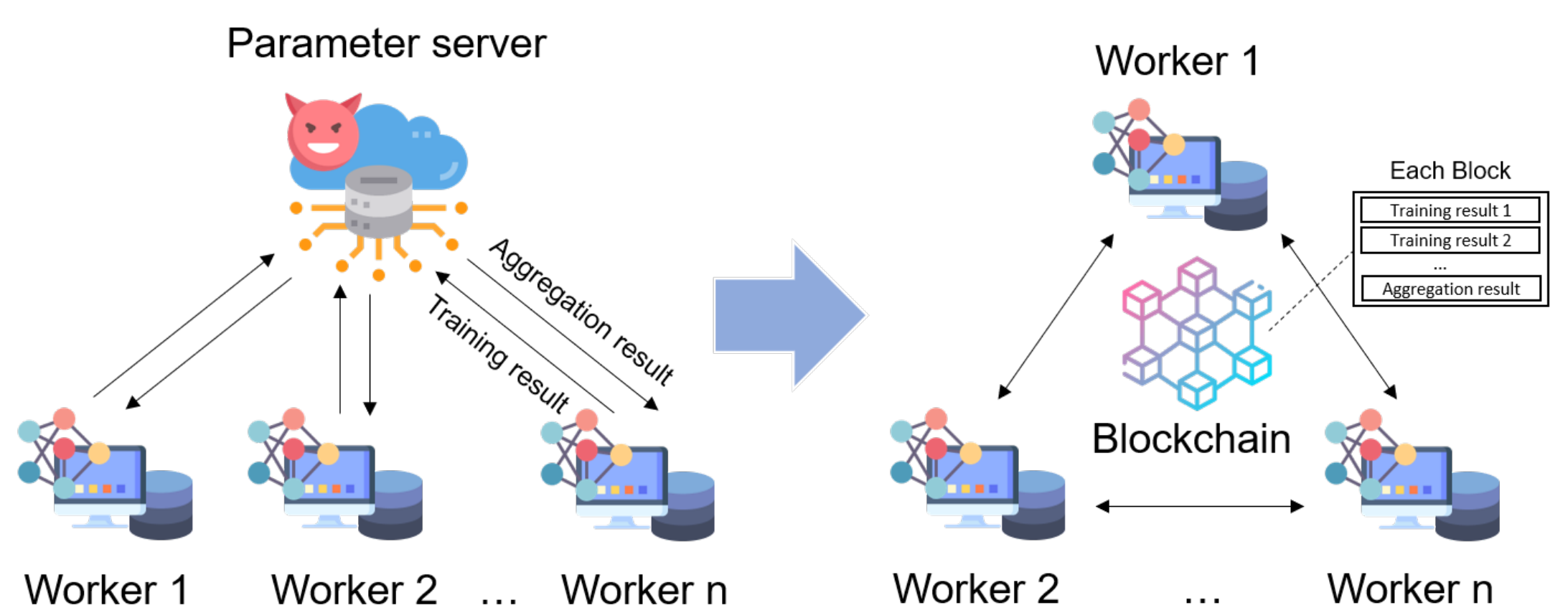
❖ **Learning-Driven Dynamic Architecture for Intelligent Consensus Layer:** DRL-based dynamic sharding-based framework to achieve a good balance between performance and security without compromising scalability

❖ **Blockchain Database for Semantic Query & Index Layer**: provide multi-keyword query, range query, Top-K query, and cross-chain query on the blockchain storage

❖ **Blockchain-empowered Edge Learning for Edge Application Layer:** build a blockchain-empowered edge learning platform and provide trustworthy training for edge devices

(1) Traditional Edge Learning   (2) Blockchain-empowered Edge Learning