Smart Systems Integration - Virtual Edition
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smartsystems integration

From Hardware-Software Contracts to Industrial IoT-Cloud Blockchains for Security

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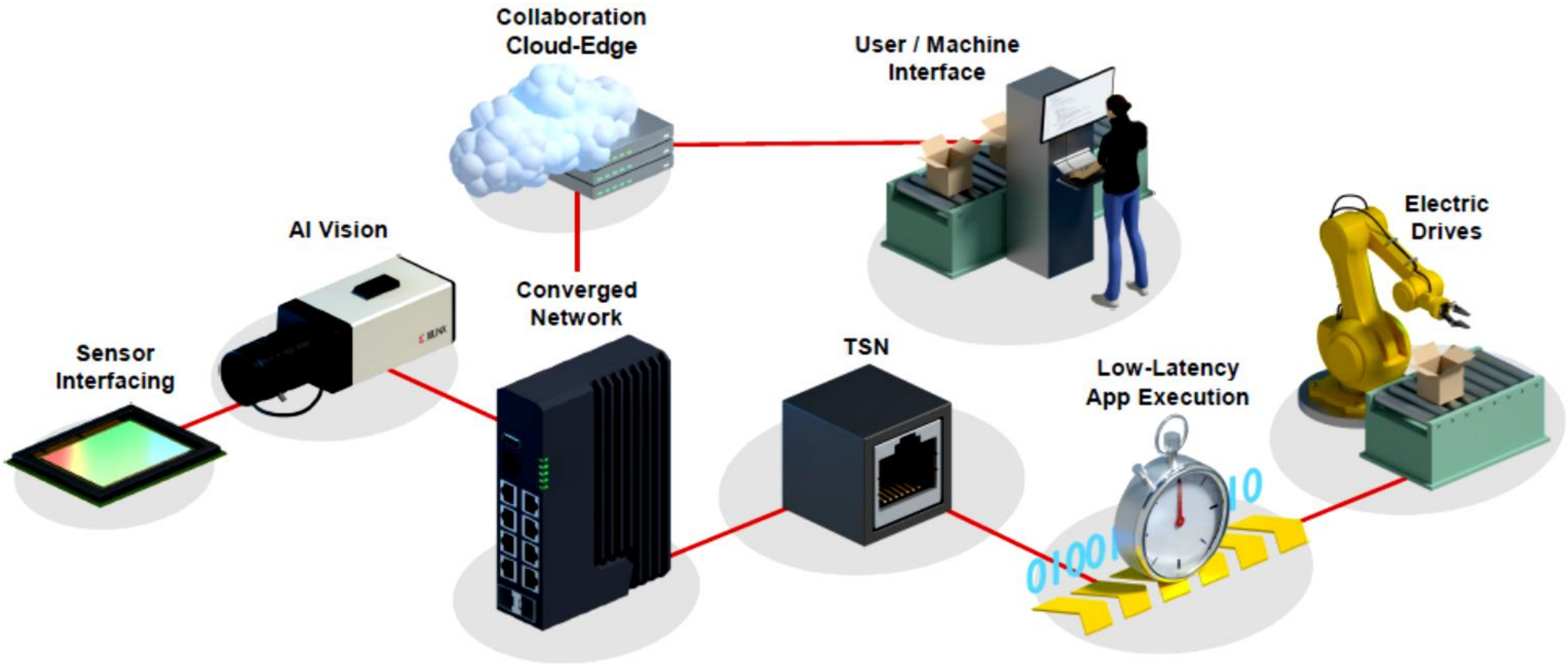
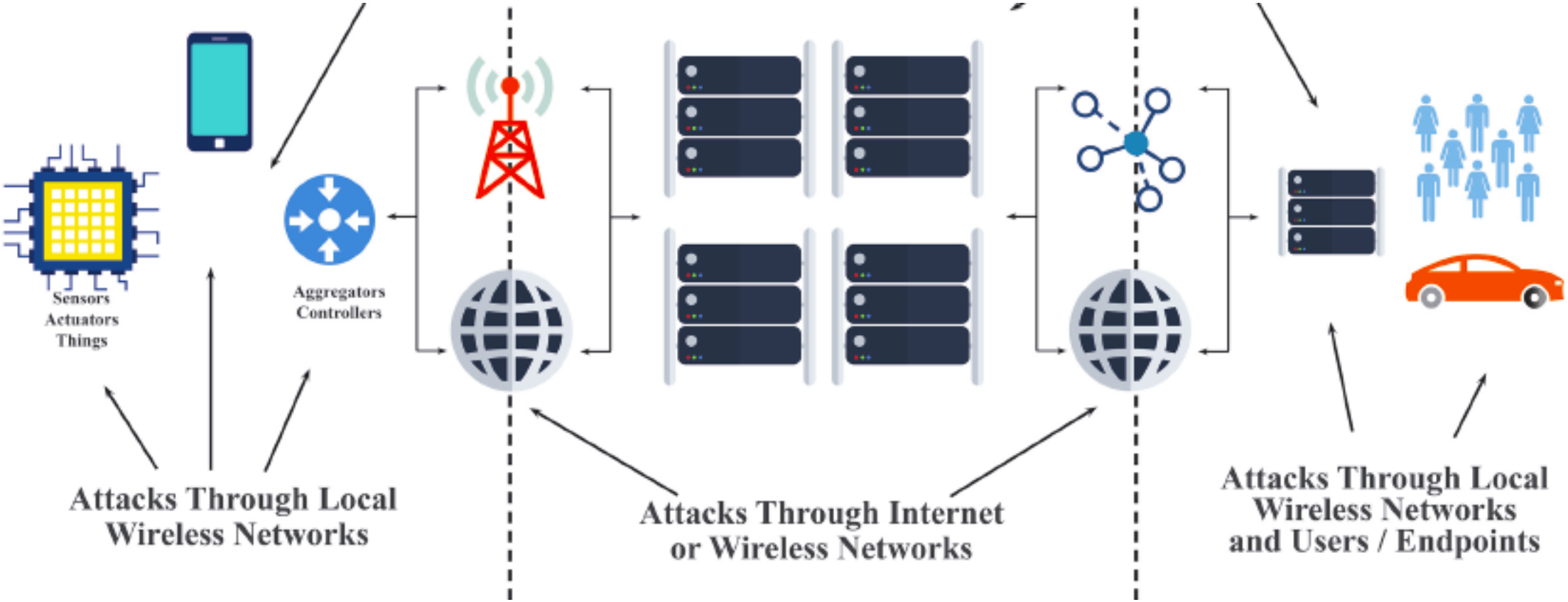
Outline

- Industrial IoT revolution for predictive maintenance, asset analytics, etc
- Convergence of IIoT, Cloud, LPWAN, Blockchain technologies
- Enhancing IoT devices, gateways security
- Integration of LoRaWAN infrastructure with Hyperledger Fabric
- Conclusions

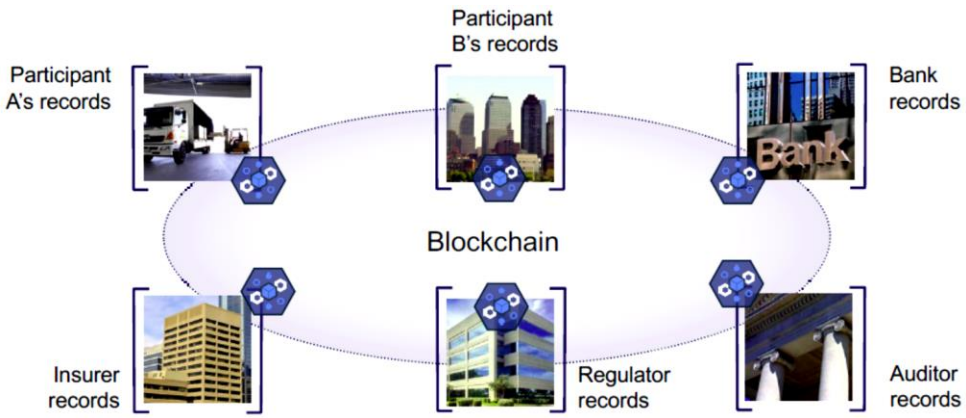
Industrial IoT: Internet of Trust !

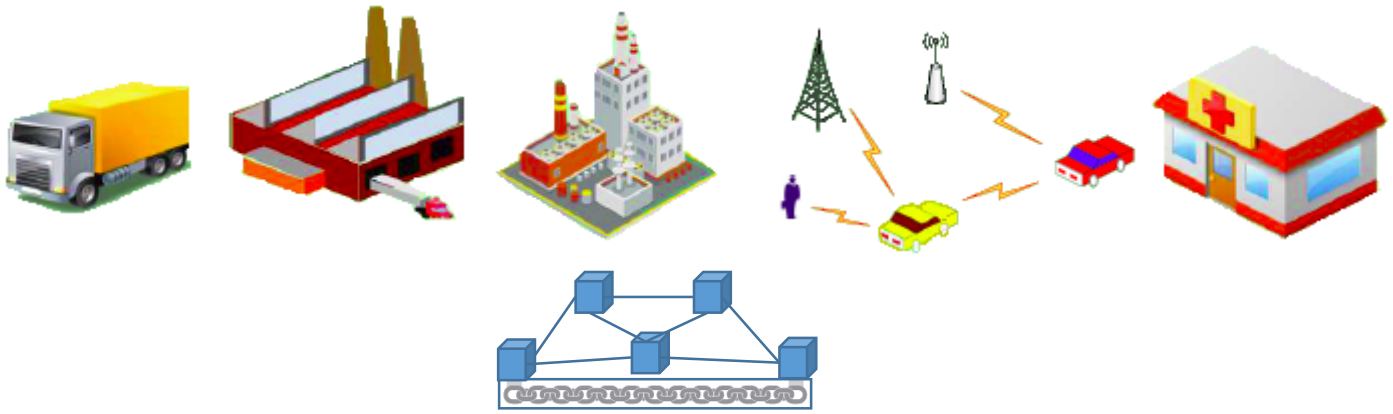


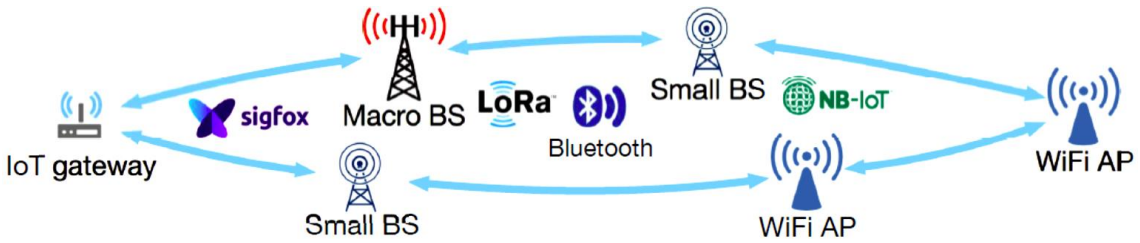
Security Risks in Connected IoT

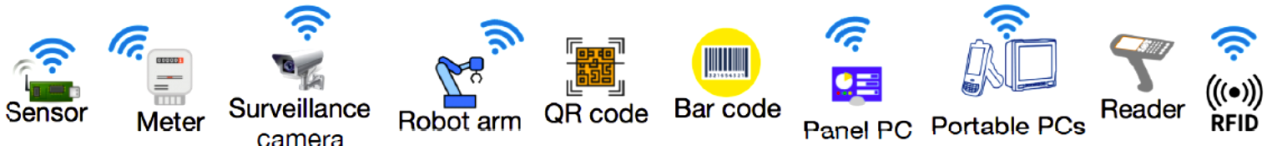


IIoT and Blockchain Convergence



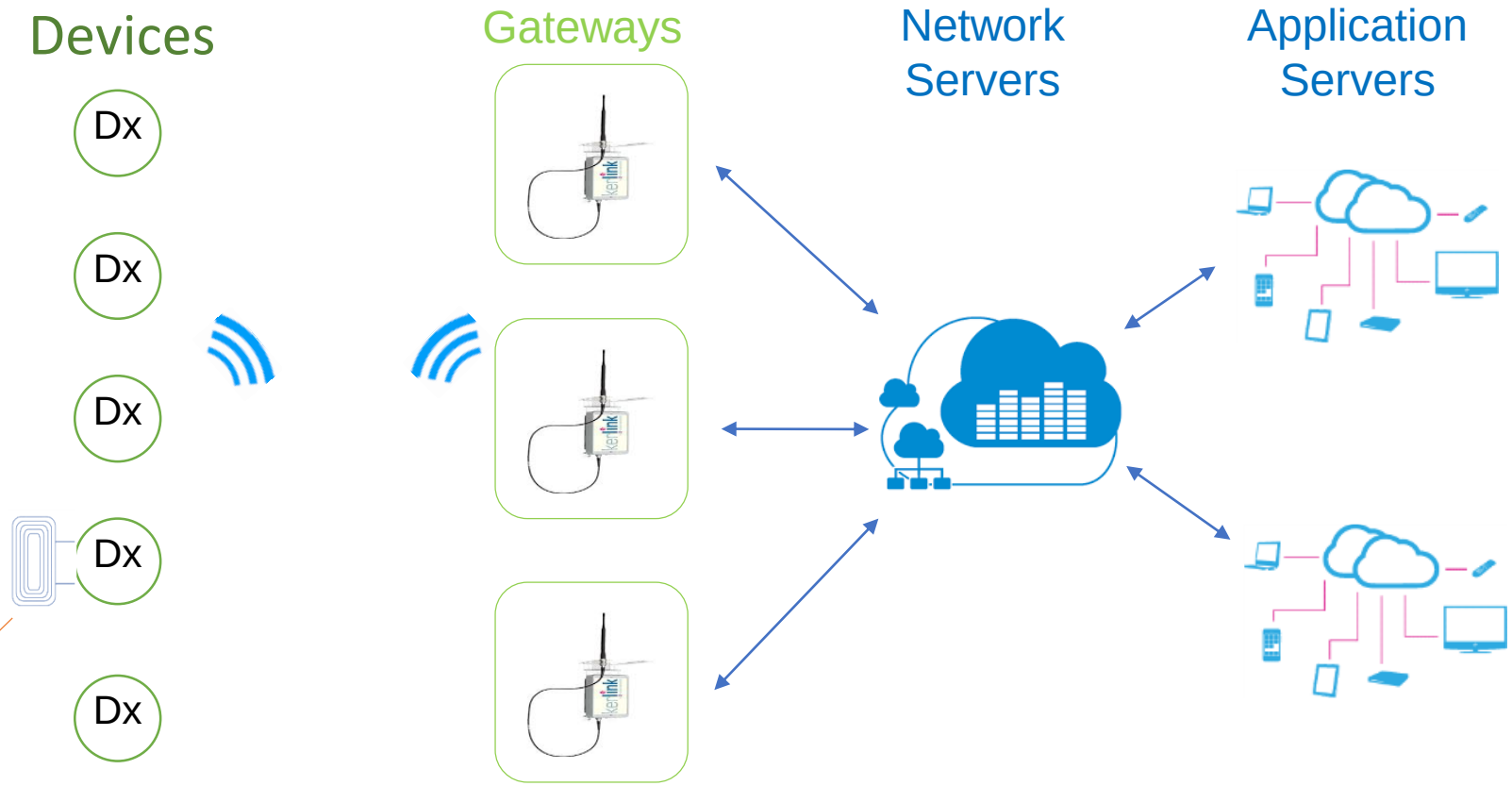






- Blockchain: Smart contract enforcement
  - Decentralization (identity management, access control)
  - Tamper-proof data (immutable, traceable, signed-timestamps)
  - Information security (confidentiality, integrity)
  - Privacy (disassociate public keys/hashes from user IDs

Enhancing Device Security



User Data

- Timestamp
- Source/Destination
- Product Data (ID, S/n, Attributes, Exp Date)

Read-Only Data

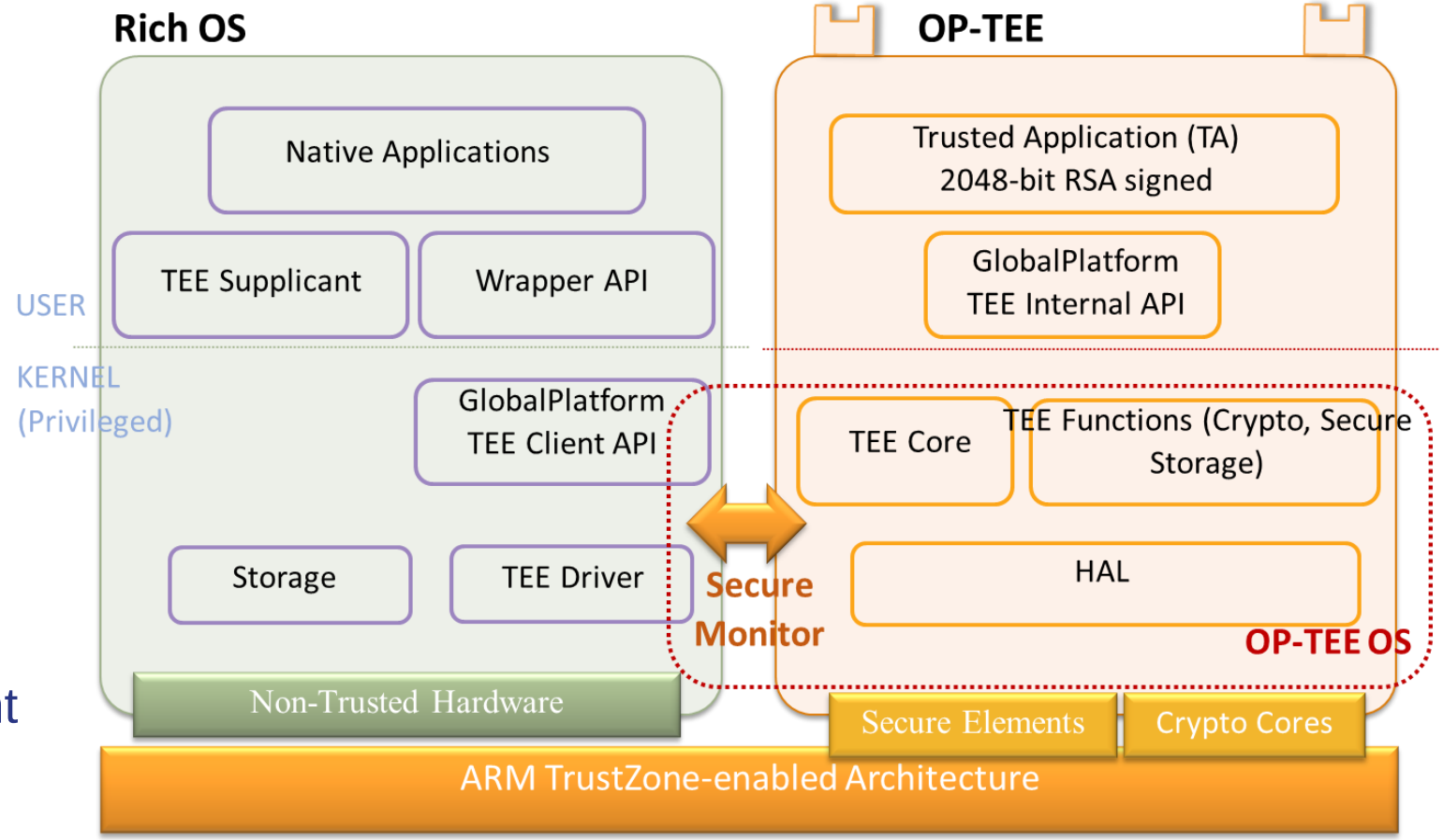
- Unique Tag-ID
- UID Signature
- Tamper Status

Secure Gateway via Trusted Devices

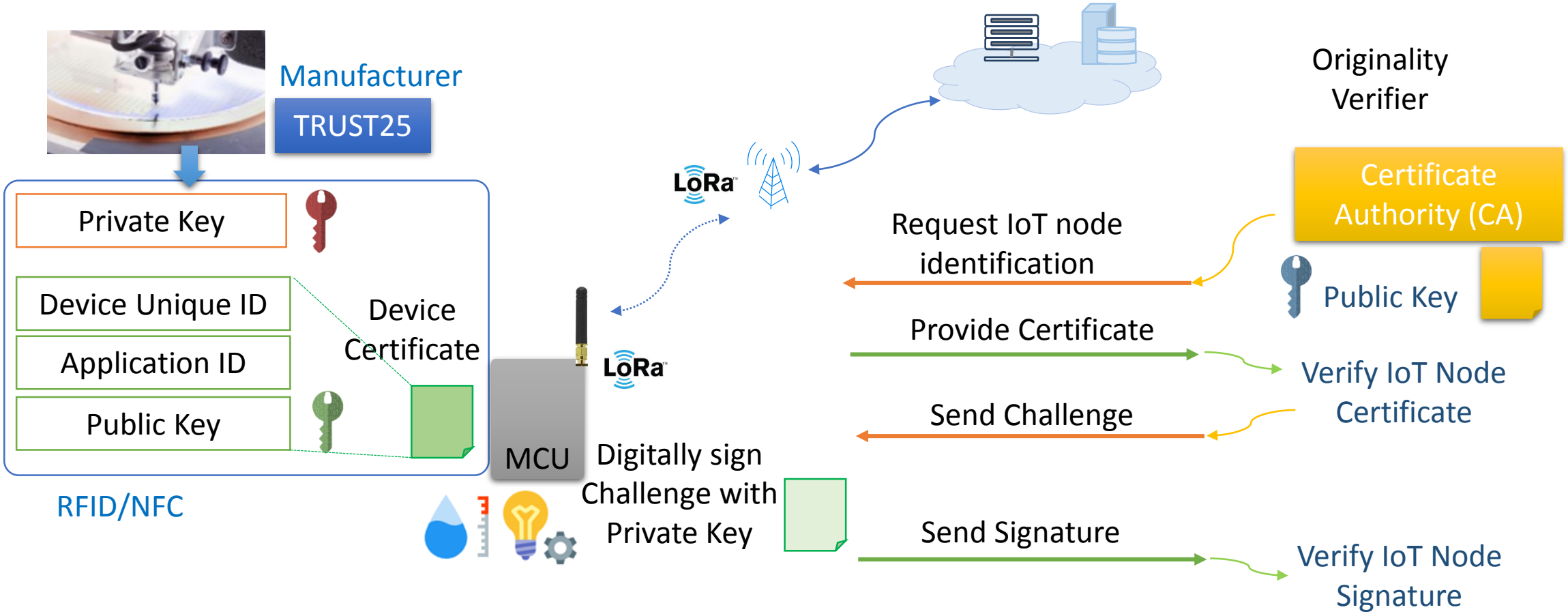
Gateway Security

STM32MP1-DK2

- Trusted boot-chain
- Trusted Execution Environment



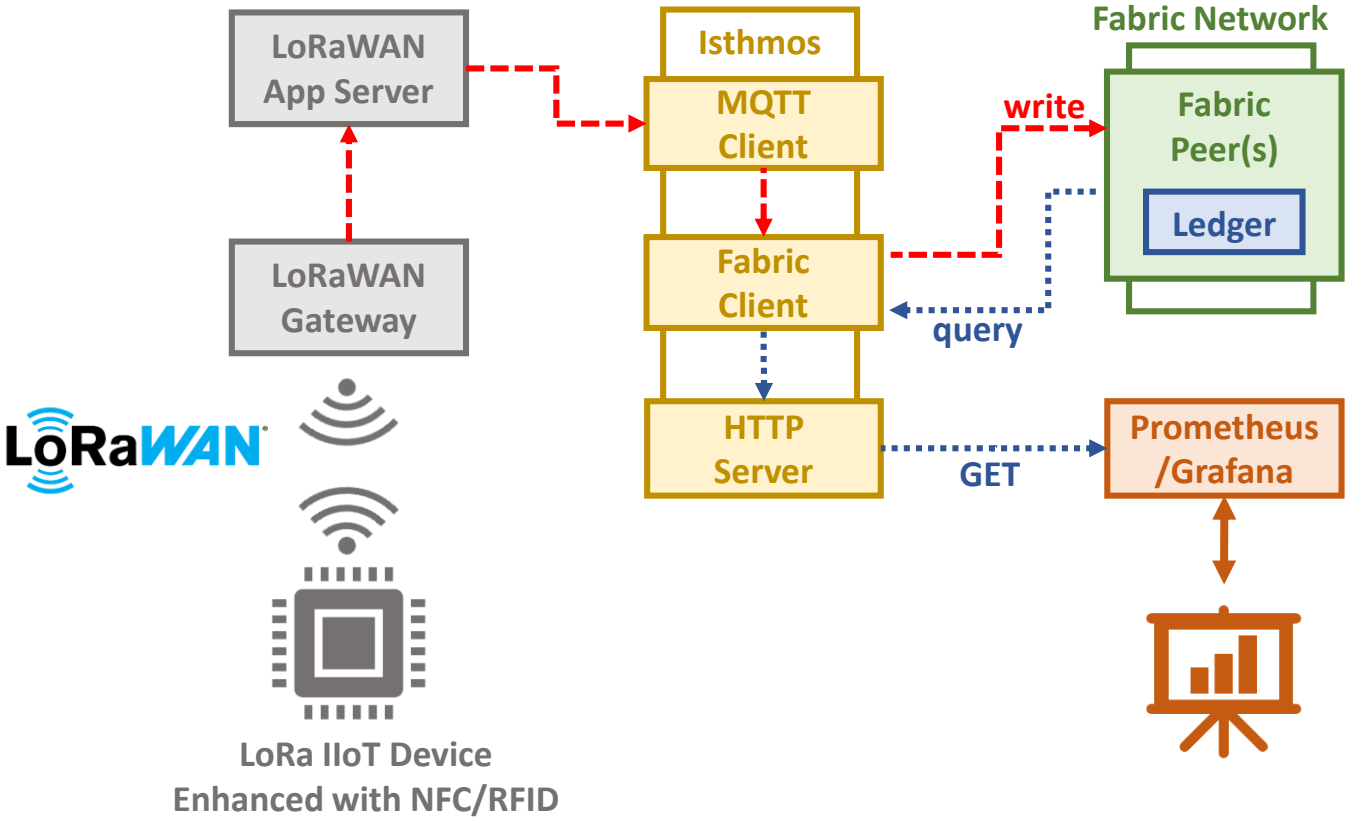
Authority Verification of End-Device



Isthmos Bridging/Proxy Service

- LoRaWAN and Fabric bridging to store IoT data to the Ledger
- API for other services to monitor and control Ledger operations
- Integrated features
  - Fabric SDK client to:
    - Register/enroll with the Fabric certificate authority (CA)
    - Interact with the Ledger to read/store data
    - Register for fabric events
  - MQTT client to:
    - Receive LoRa uplink messages to forward to Fabric
    - Forward downlink data (e.g., control commands) to LoRa IoT devices
  - HTTP server to allow monitoring services (e.g., Prometheous, Grafana)

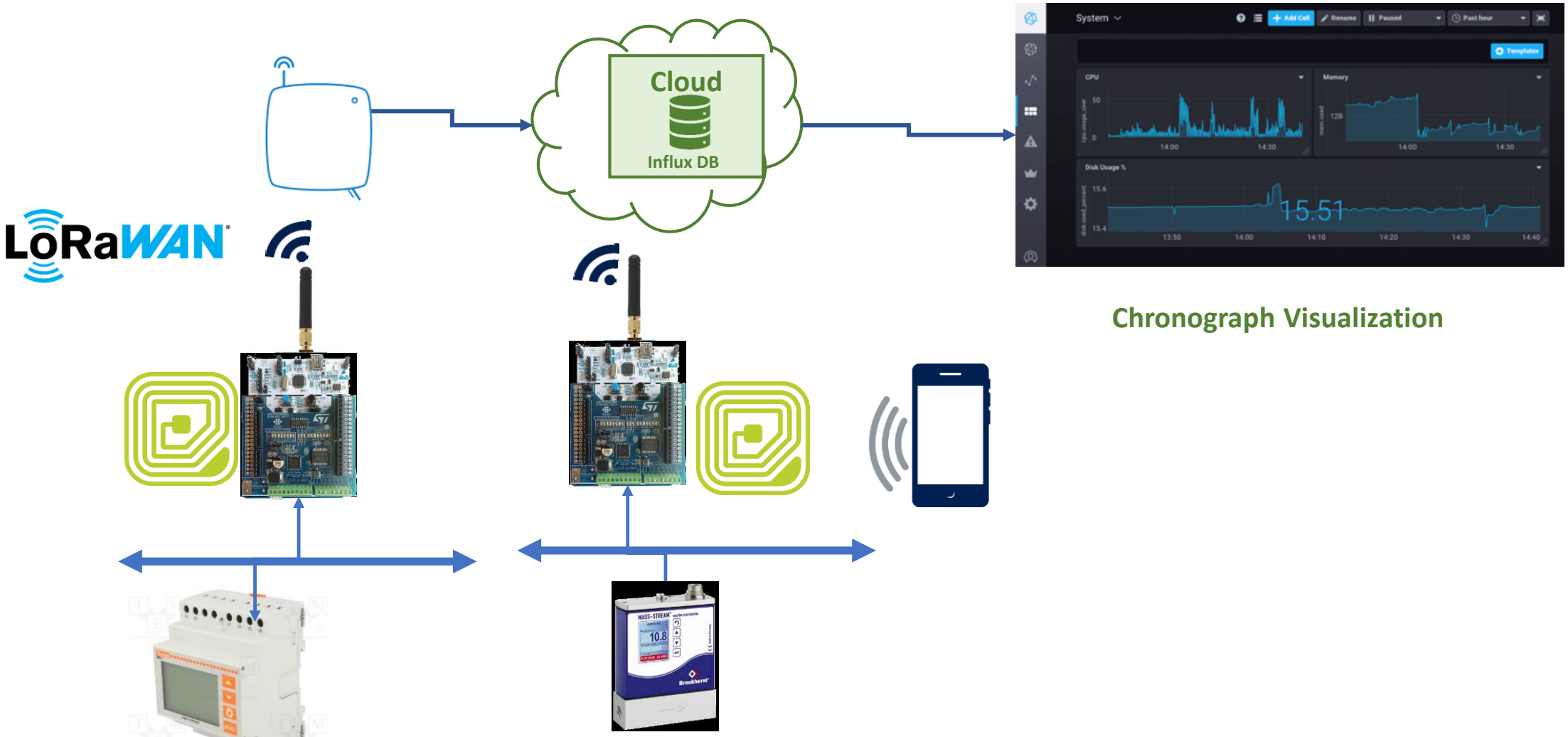
Integrated LoRaWAN and Hyperledger Fabric



Use Cases

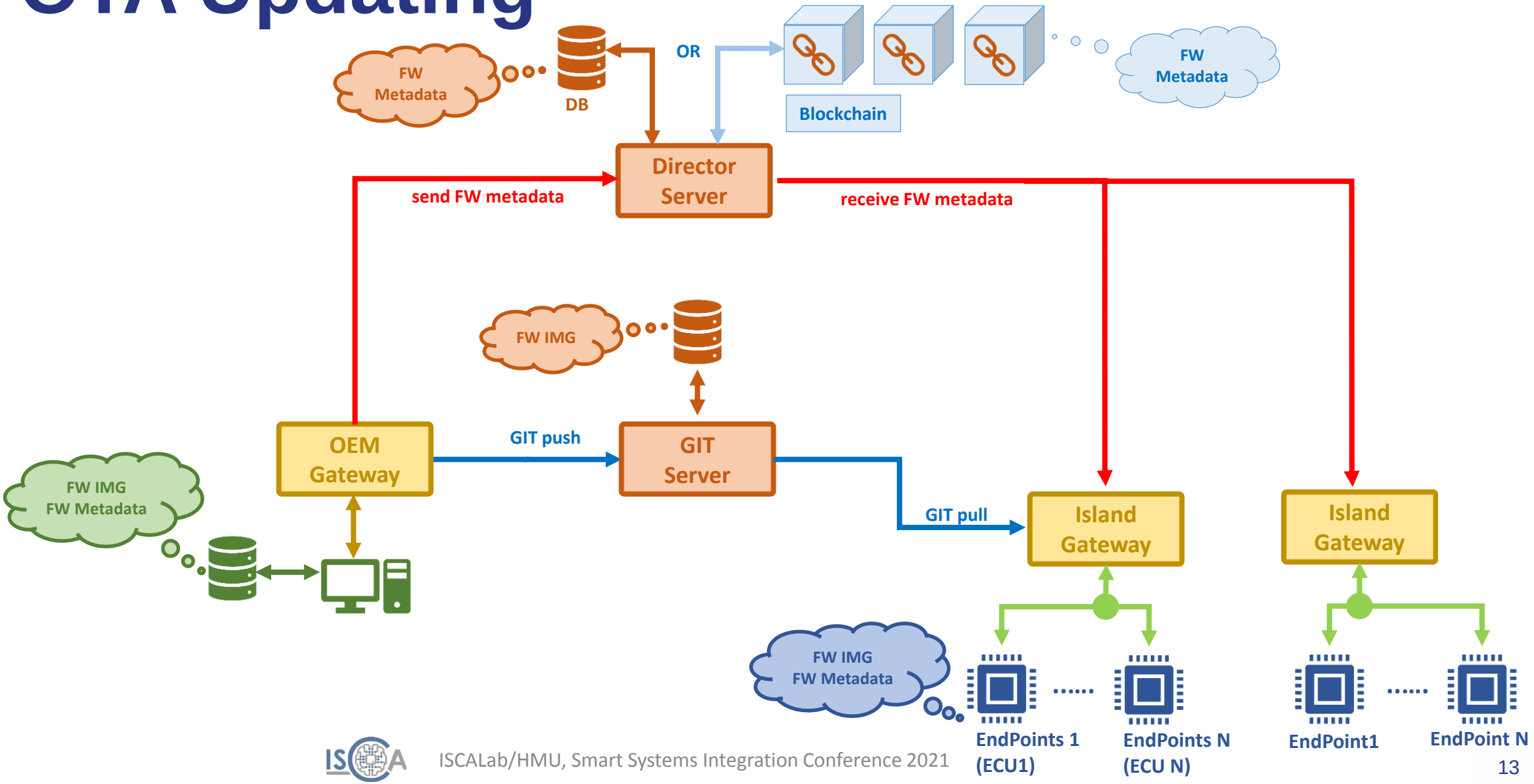
- Automation Monitoring and Maintenance in Manufacturing
  - Access and manage IoT devices/data in an industrial environment (IIoT)
    - Trusted monitoring of IoT device data (e.g., sensor values) at the ledger
  - Management of IIoT device lifecycle by using firmware updates
    - Record update information metadata at the ledger that can be used to manage the firmware update procedure of IoT devices

Industrial Monitoring (power, gas)

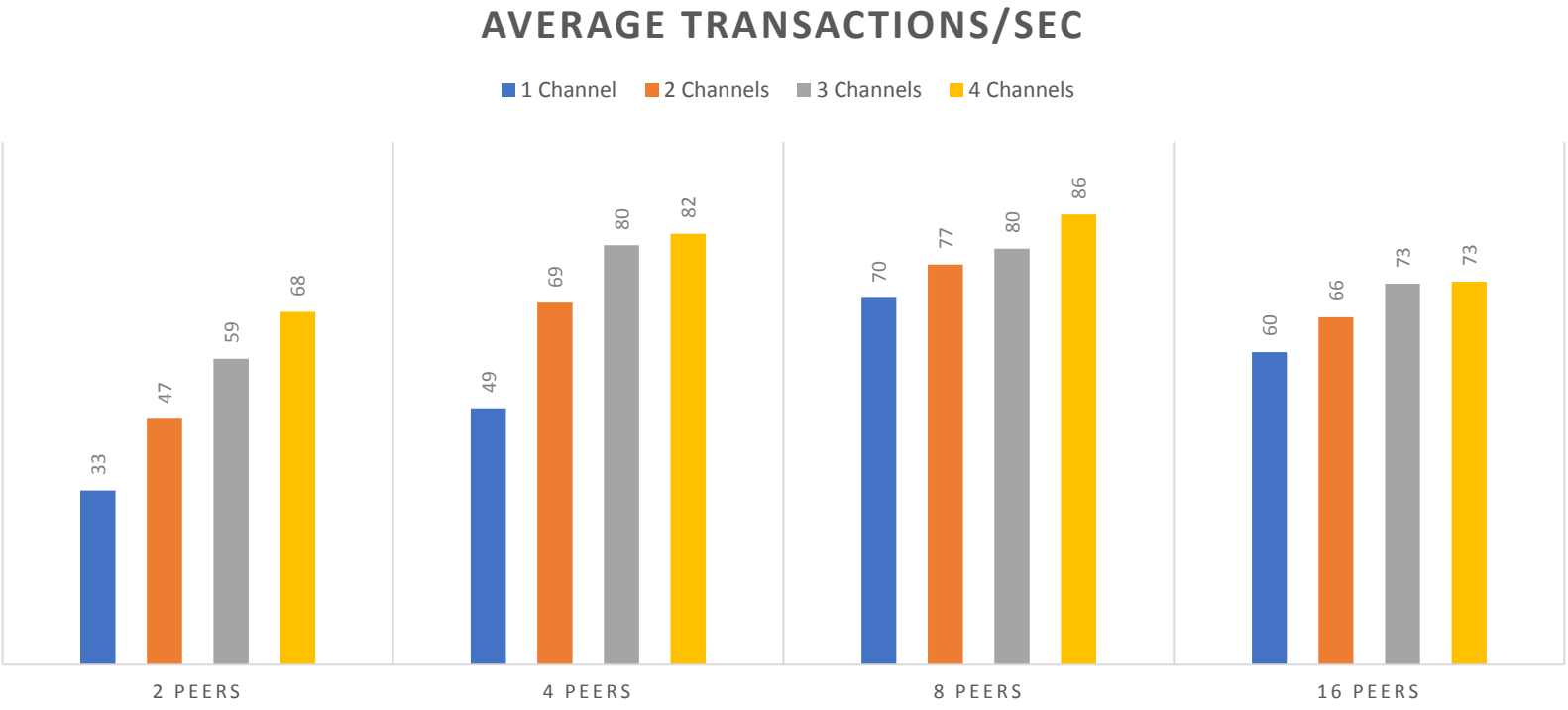


Chronograph Visualization

FOTA Updating



Hyperledger Fabric Evaluation



- Different Fabric network configurations based on the number of organizations, peers and channels
- Benchmark client application per peer invokes 2000 transactions sequentially for each available channel

Summary

- A combination of IoT device authentication via hardware/software methods and decentralized integrity assurance framework
- Isthmos secure bridging of IoT data over LoRaWAN with Hyperledger Fabric
- Investigation on performance and scalability when partioning Fabric Ledgers in the scope of different channels

Thank you for your attention!

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