



# Blockchain-based crossdomain IIoT identity authentication

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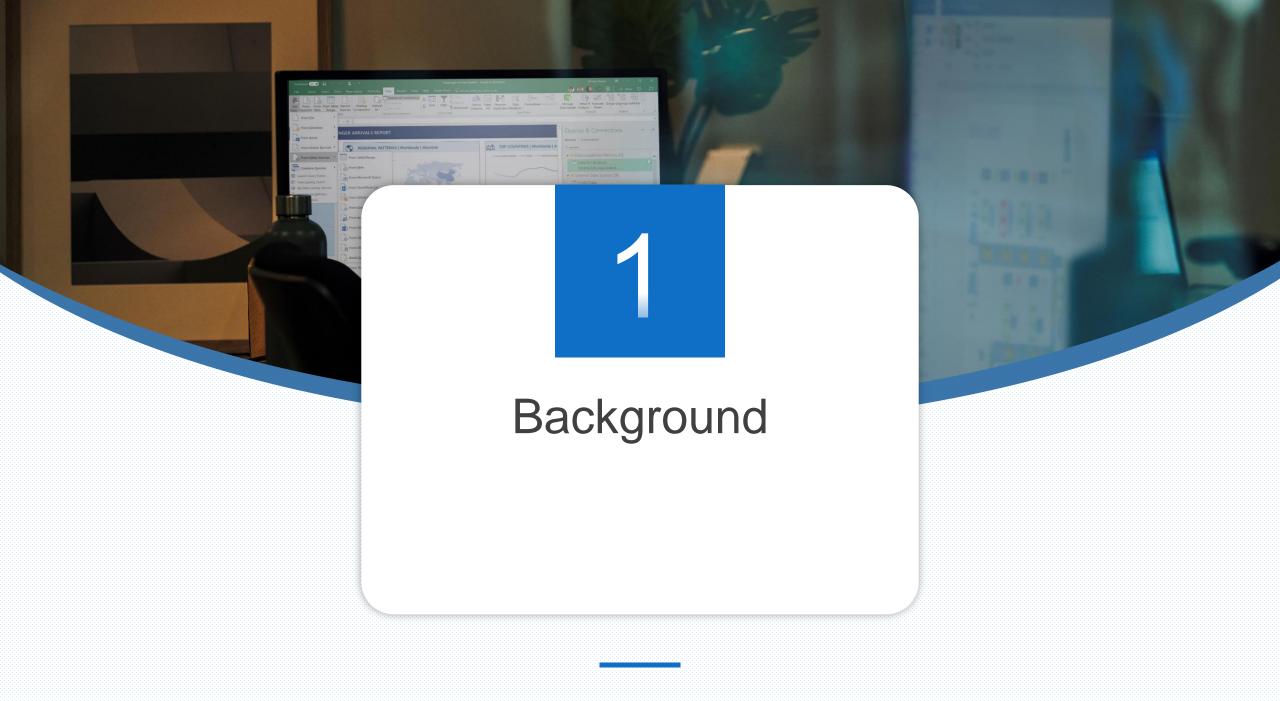




1 Background

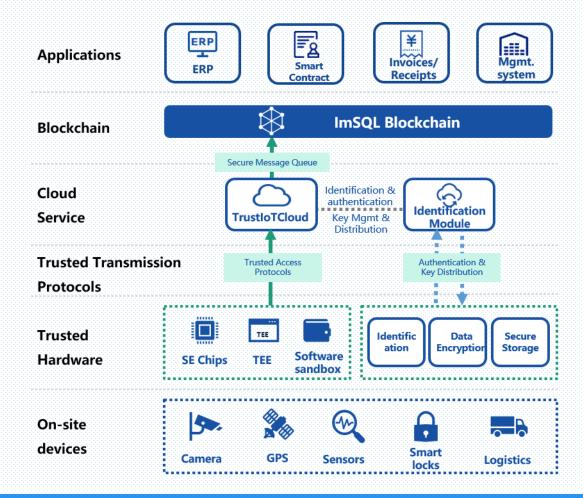
3 Our Solution 2 Related Works

**4** Performance Evaluation



# Ġ Chaincomp - Blockchain of IoT Architecture 🔞 中科物编

## **ImSQL<sup>™</sup> Storage Blockchain, EdgeTrust<sup>™</sup> and TrustloTCloud<sup>™</sup> for Trusted IoT Management**



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	user-gate-way-pr	rod 🔍 👼						
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	内存占用率	0.25%	内存占用率	0.25%	内存占用率	0.23%	内容占用率	0.21%
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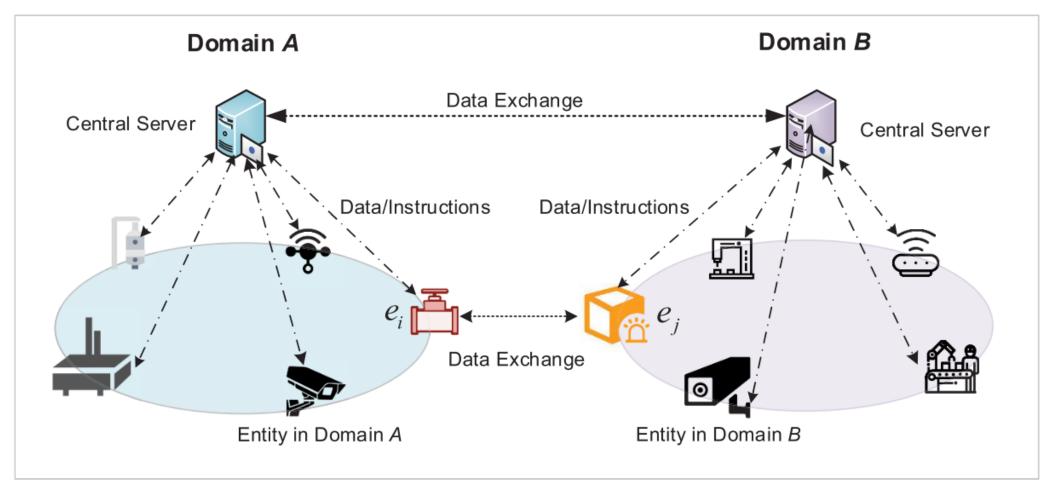
Trusted IoT Module



# Background – Industrial IoT Application



### Cross-domain identity authentication



# 🔄 Background – Public Key Systems



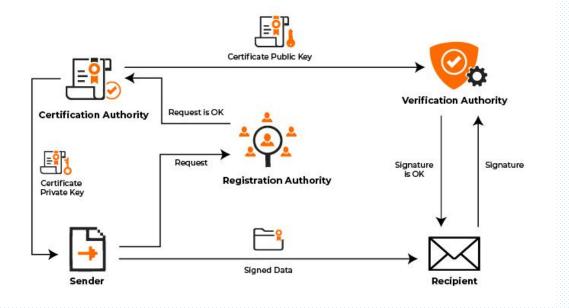
Signer(ID)

Sign:

 $\sigma = PH(ID) + H(M,...)$ 

PKI (Public Key Infrastructure)

ID PKC (Identity-based public key cryptography)



- Bandwidth Overhead
- Verification Time Overhead
- Storage Space
- Energy Consumption
- Centralized CA attacks



KGC

"master" public key

master-private key

Require private-key

Return master private-key(ID)

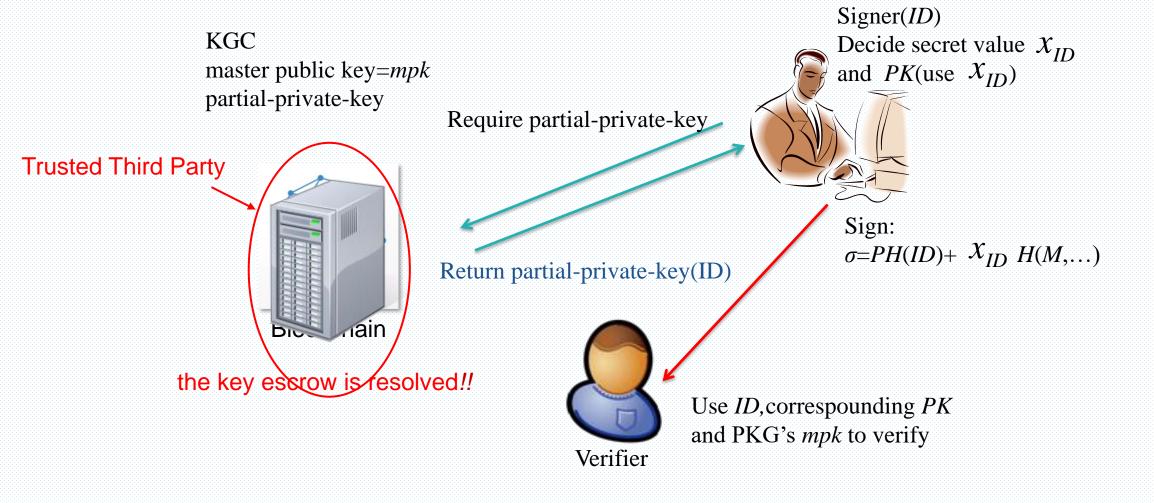
Assume the KGC completely trusted!!

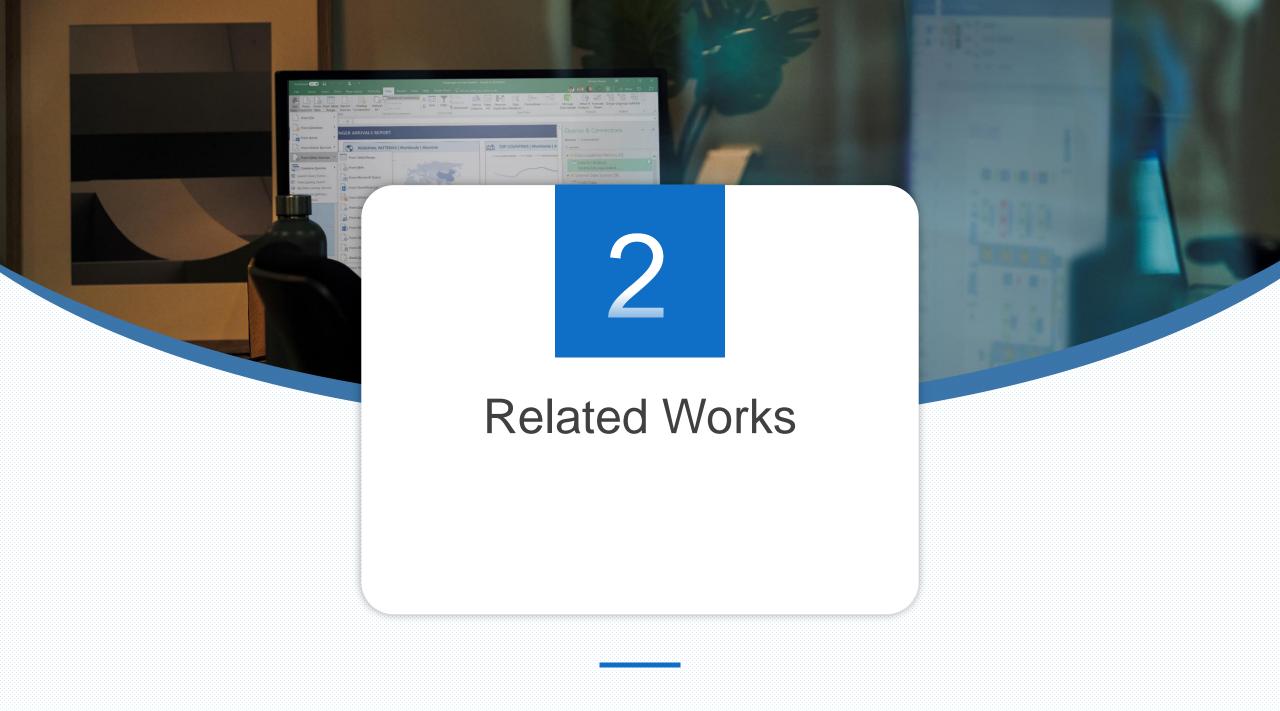
Use *ID* and PKG's *public key* to check Verifier

- Bandwidth Overhead
- Verification Time Overhead
- Storage Space
- Energy Consumption
- Centralized CA attacks

# 合 Background – Public Key Systems (Cont.)

CL-PKC(Certificateless public key cryptography)

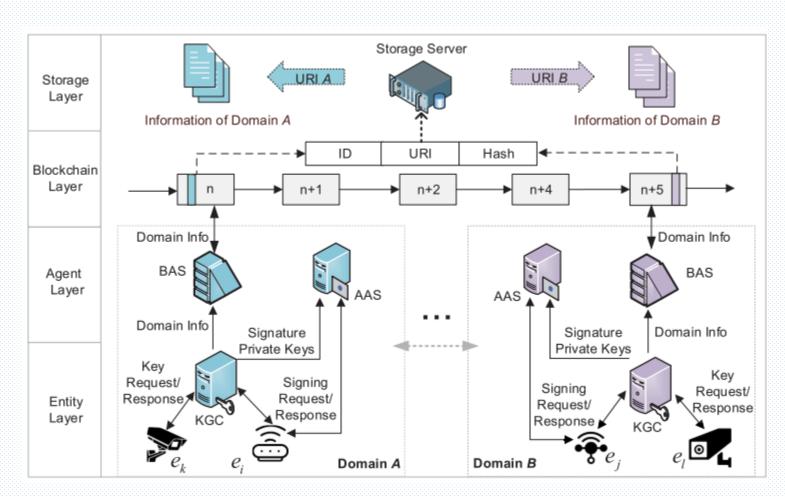








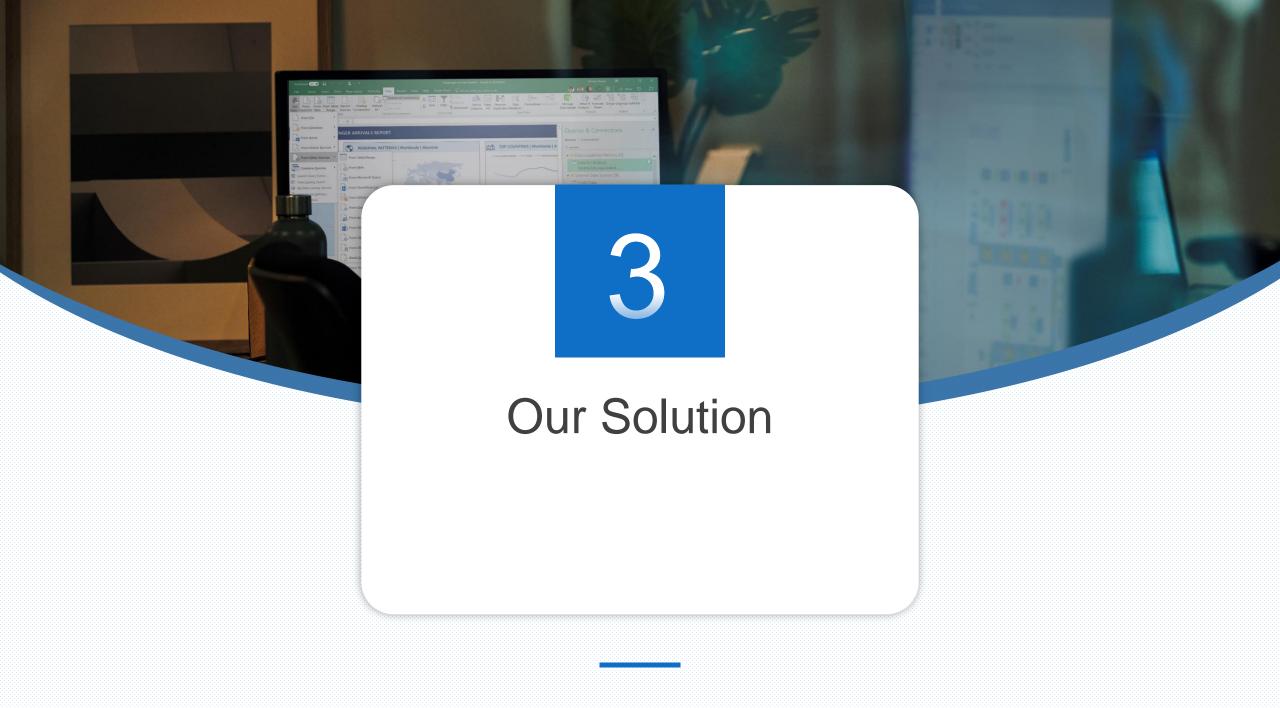
M. Shen, H. Liu, L. Zhu, K. Xu, H. Yu, X. Du, and M. Guizani, "Blockchainassisted secure device authentication for cross-domain industrial iot," IEEE Journal on Selected Areas in Communications, vol. 38, no. 5, pp. 942–954, 2020.







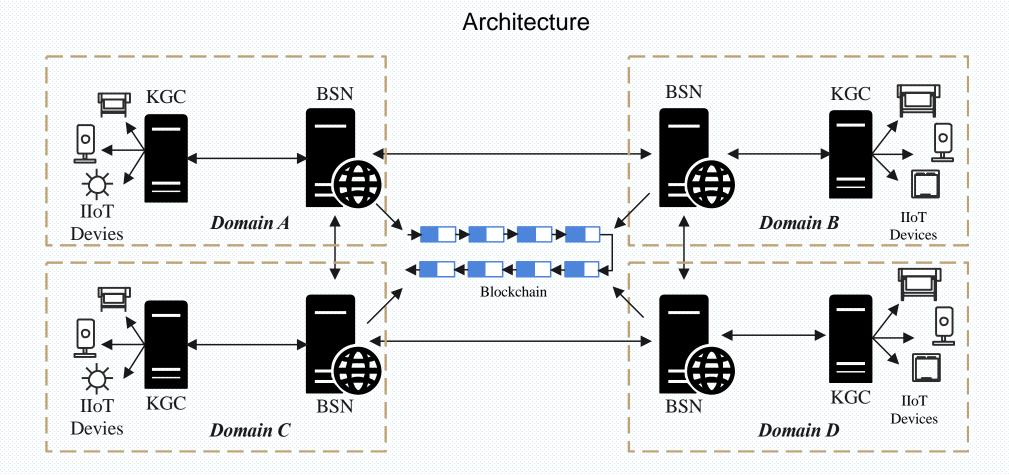
Internet Z. Cui, X. Fei, S. Zhang, X. Cai, Y. Cao, W. Zhang, and J. Chen, "A hybrid WSN<sub>n</sub> blockchain-based identity authentication scheme for multi-... WSN wsn," IEEE Transactions on Services Computing, vol. 13, no. 2, pp. 241–251, 2020. Link 4 \_ink Link2 Link3 I cluster head node 🐵 :Base station 🛄 :End user Crdinary node Ordinary node A Local blockchain Public blockchain Cluster head B OID Ordinary node B Cluster head A OID End user Base station Request\_of\_Registration Verify by smart WSN WSN 3 Local Local contract and store Allow access to local block chains Request\_of\_Registration Blockchain 4 Blockchain 3 node information erify timeliness Trigger smart contract Verify by smart contract and store low access to cluster network node information Request\_of\_Connection Public Trigger smart contract and select Blockchain blockchain for verification -----Message of Confirm Credential of Authentication, Signed, Verify Verify Local Credential of Authentication<sub>B</sub>,Sighed<sub>b</sub> Local Blockchain1 Blockchain 2 Establishing secure communication WSN 2 WSN Ask for permission Permission Request of Connection Message of Confirm Message of Confirm Cluster node Base Station Credential of Authenticationuser, Signeduc Verify Credential of Authentication<sub>B</sub>,Signed<sub>B</sub> Verify Establishing secure communication



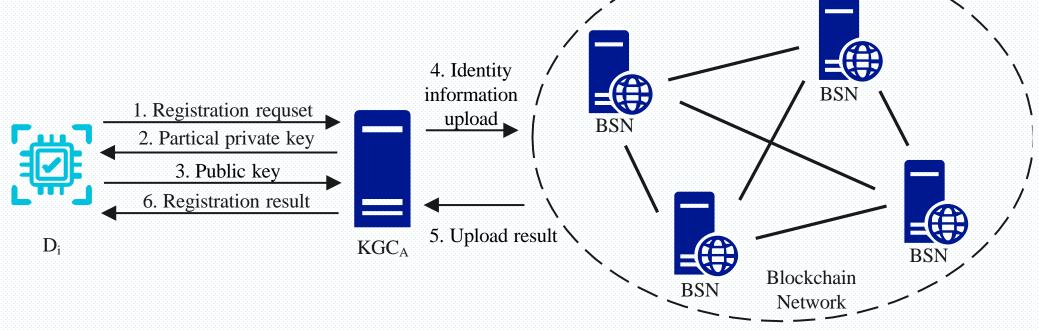
# 合 Blockchain-based IIoT Identity



## Authentication



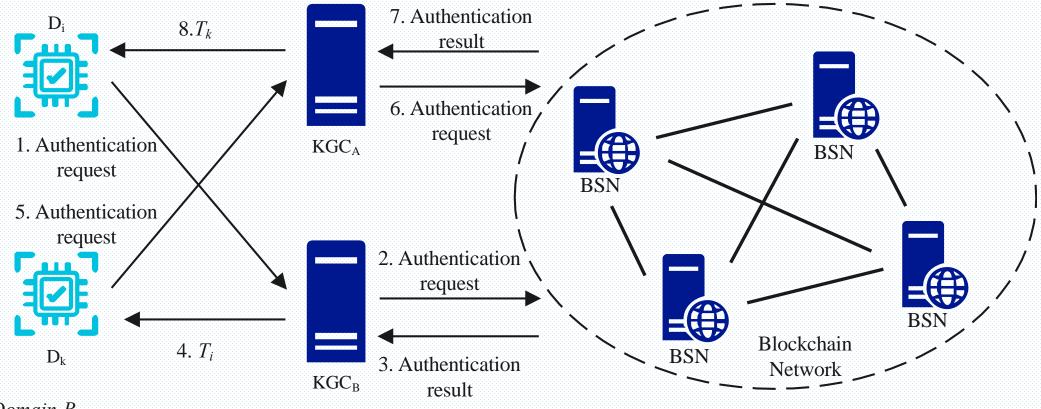
# Initialization and Registration Process



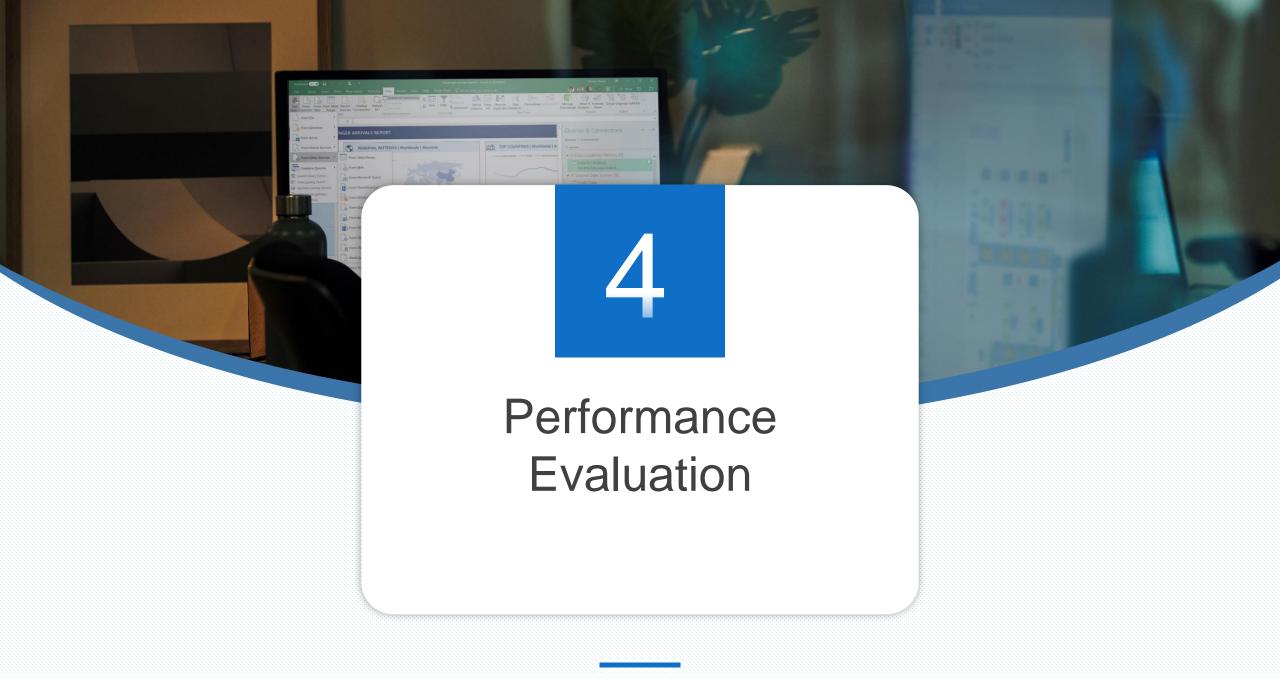
# Identity Authentication Process



Domain A

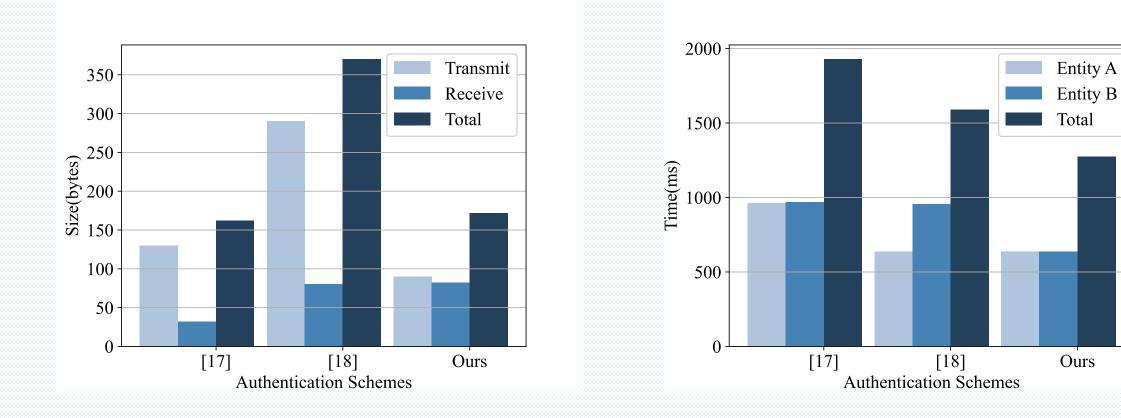






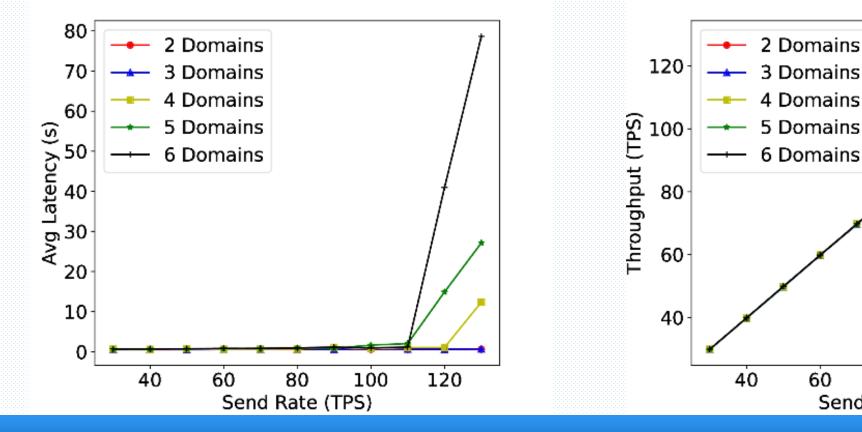


- The cost of completing an identity authentication and key agreement is about 150 bytes
- The total delay of the process is about 1200ms.



# Performance Evaluation

- When the rate of authentication requests is **below 100TPS**, the delay is close ZERO. ٠
- As TPS increases, the delay and throughput performance are constrained by the ٠ performance of the underlying blockchain.



Tests carried out on Fabric Implementation

80

Send Rate (TPS)

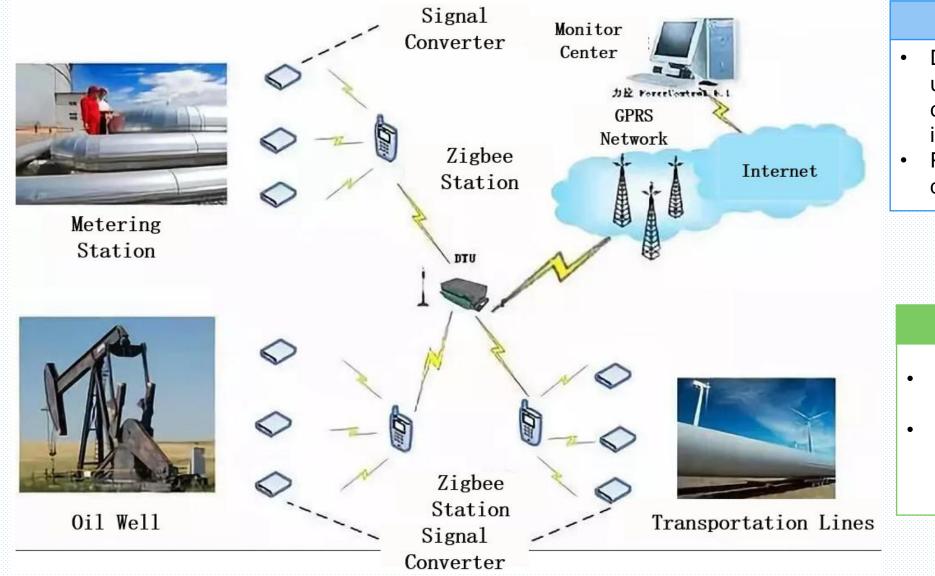
100

120

60

## Implementation in Oil Field





#### **Before**

- Different departments unwilling to adopt centralized IoT node identity hosting
- Possible fraudulent device identification

### After

- Fraudulent free identity of IoT nodes
- Trusted data management along oil filed production



# Thanks!

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