Aalto University
School of Electrical
Engineering

SOFIE

Combining multiple ledgers for better control

Interledger approaches in IoT

Santeri Paavolainen
Decentralized operation and security in the IoT Space workshop, 18.6.2020

IoT and blockchains
Why Interledger with IoT?
How Interledger?

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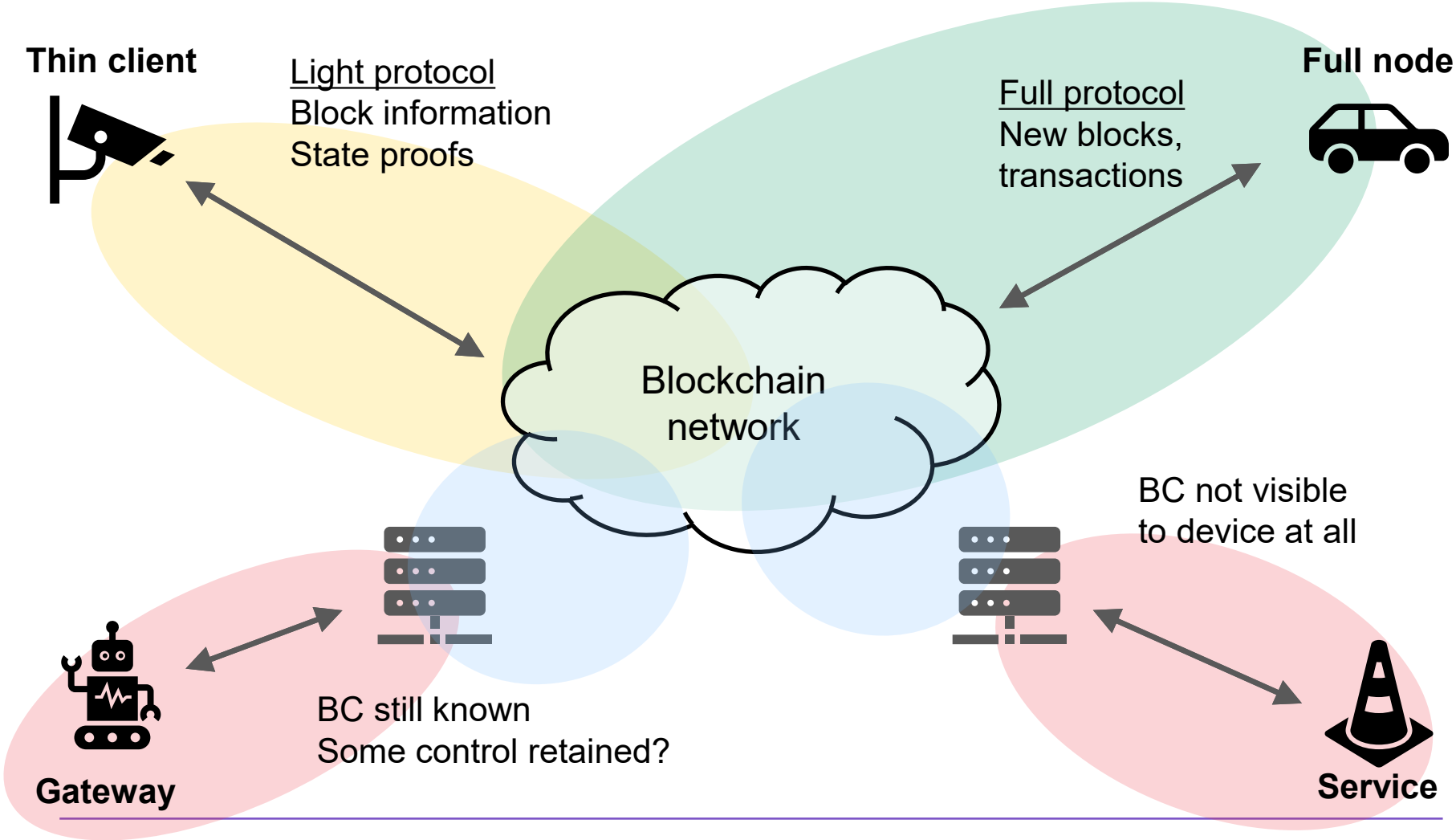
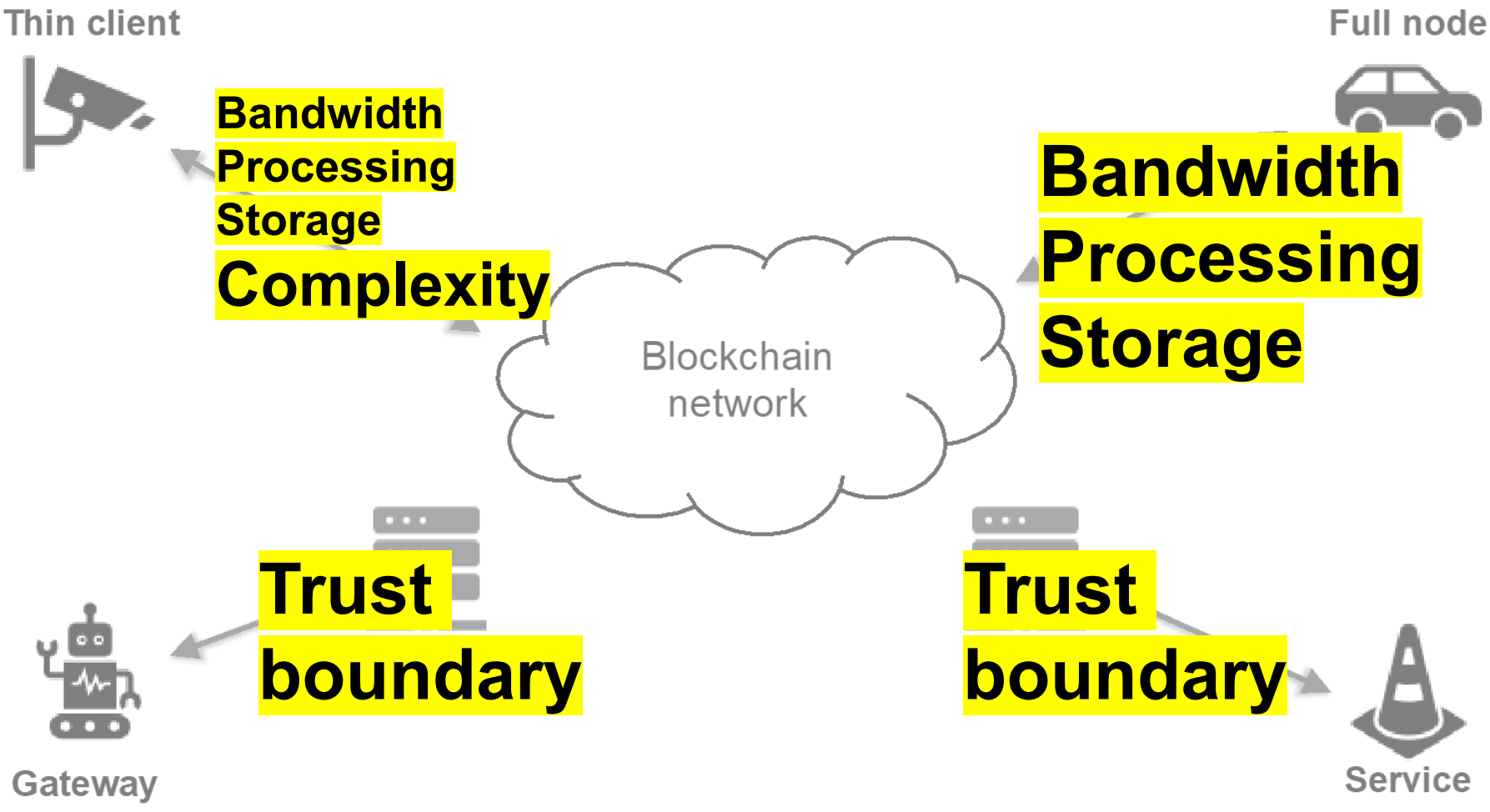
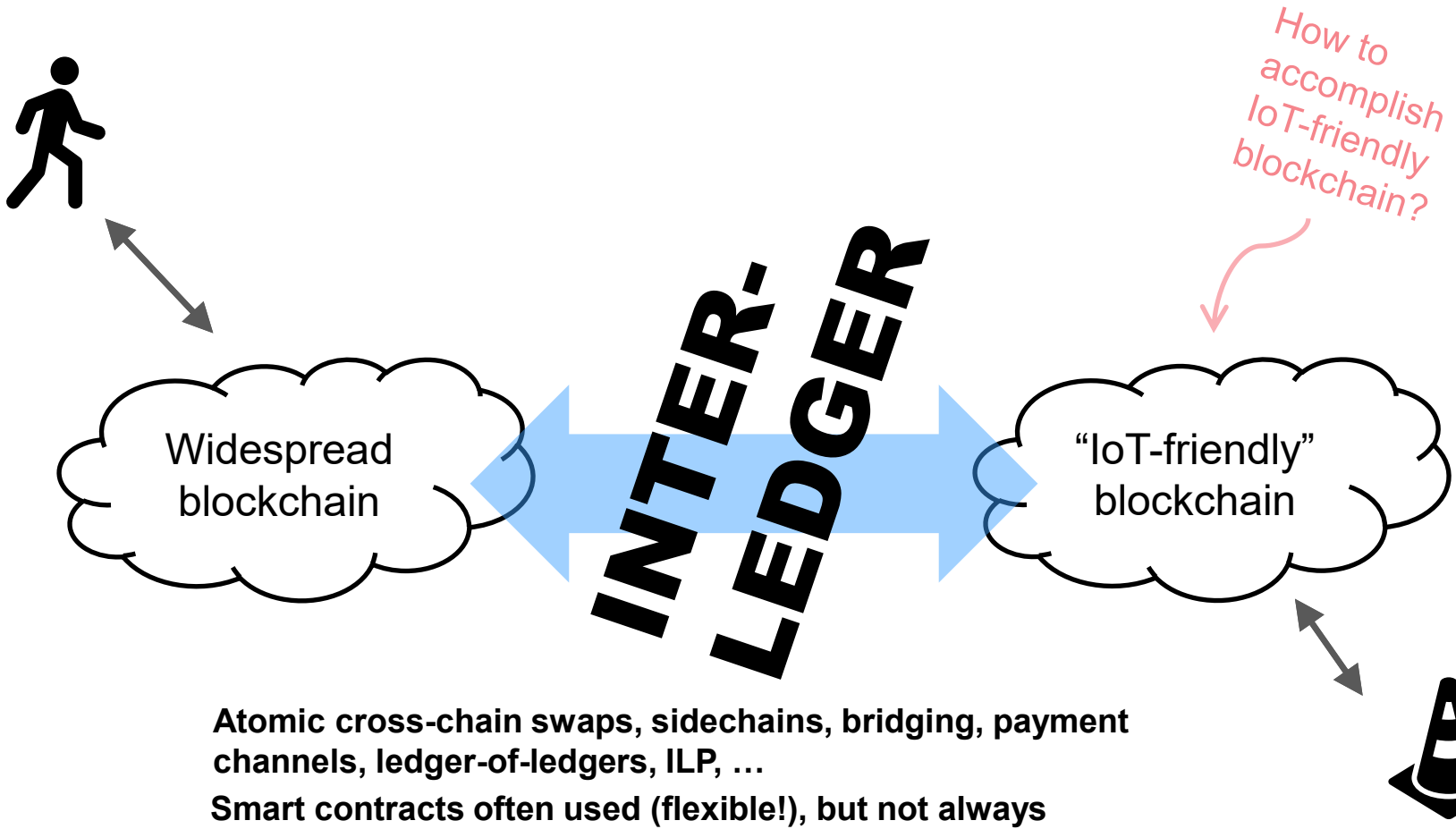
Why IoT and blockchains?

- **Let's just assume there's a reason**
  - Data exchange (uni/bidirectional)
  - Control information
  - Payment

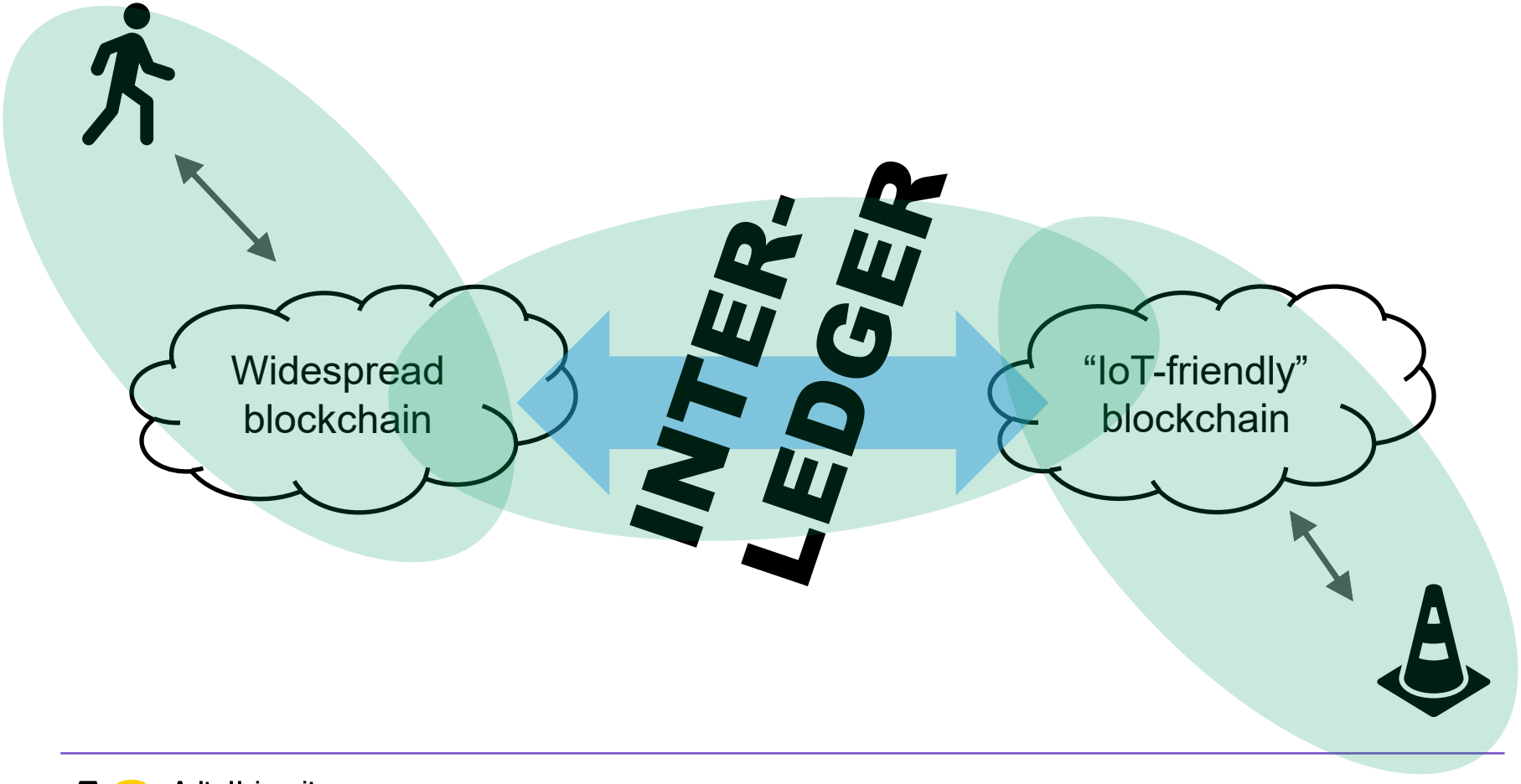

Thin client
Light protocol
Block information
State proofs
Full protocol
New blocks,
transactions
Full node
Blockchain
network
BC not visible
to device at all
BC still known
Some control retained?
Gateway
Service


Thin client
Full node
Bandwidth
Processing
Storage
Complexity
Bandwidth
Processing
Storage
Blockchain
network
Trust
boundary
Trust
boundary
Gateway
Service



Atomic cross-chain swaps, sidechains, bridging, payment channels, ledger-of-ledgers, ILP, …

Smart contracts often used (flexible!), but not always


Widespread blockchain
INTER-LEDGER
“IoT-friendly” blockchain

Pros

- **”IoT chain” more flexible**
  - Use-case specific tradeoffs
  - Easier governance models
  - Lower cost, better latency, privacy (GDPR!)
- **Trust and security concerns often scoped**
  - Interledger allows narrow focus on IoT BC

Cons

- **Cross-ledger operations still young**
  - No mature standards or widespread solutions
- **Trust can be difficult**
  - Gateways can be opaque
  - Federated gateways?
  - Auditability, Trust & Verify

Summary

- **Direct IoT ⇔ blockchain integration difficult**

- **Interledger techniques can help bridge a trust gap**
  - Plus additional benefits

References

- **Interledger projects**
  - Cosmos https://cosmos.network/
  - PolkaDot https://polkadot.network/
  - ILP https://interledger.org/rfcs/0027-interledger-protocol-4/
- **Research**
  - V. A. Siris, P. Nikander, S. Voulgaris, N. Fotiou, D. Lagutin, and G. C. Polyzos, “Interledger Approaches,” IEEE Access, pp. 1–1, 2019, doi: 10.1109/ACCESS.2019.2926880.
  - P. Nikander, J. Autiosalo, and S. Paavolainen, “Interledger for the Industrial Internet of Things,” in 2019 IEEE 17th International Conference on Industrial Informatics (INDIN), Jul. 2019, vol. 1, pp. 908–915, doi: 10.1109/INDIN41052.2019.8972167.
  - S. Paavolainen and C. Carr, “Security Properties of Light Clients on the Ethereum Blockchain,” IEEE Access, p. 20, 2020 (Accepted).