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Pioneering the Future of Space and Terrestrial Networks

Post-Quantum SIM-Less Authentication: Scalable and Secure Solutions for FutureG IoT Networks

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5G as the default communication method for IoT

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Maintaining and changing physical SIMs is inconvenient because it requires manual access to each device.

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5G
SIM 1
SIM 2

Why SIM-Less?

Flexibility: No physical SIM provisioning

Agility: Supports revocation and short-lived credentials

Interoperability: Works across operators

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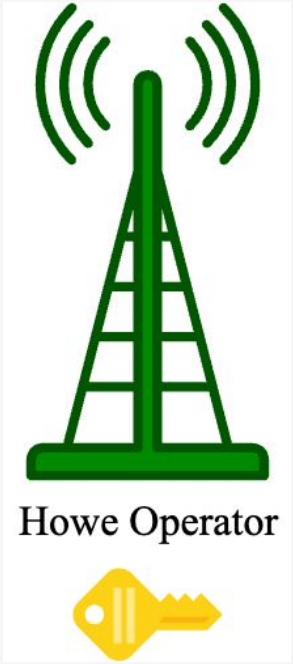
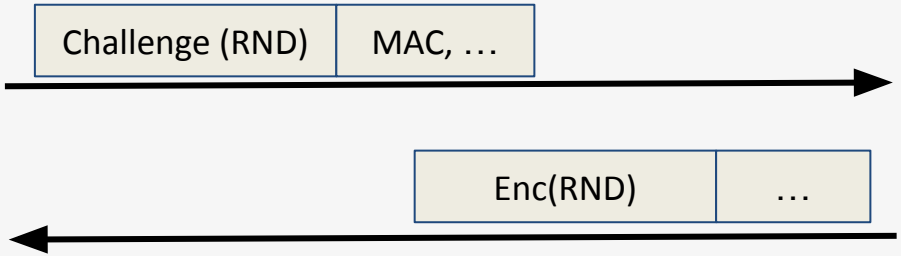
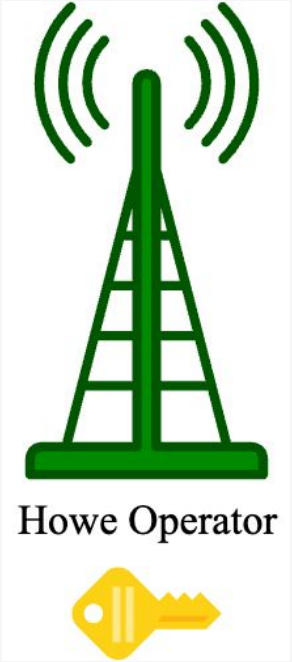
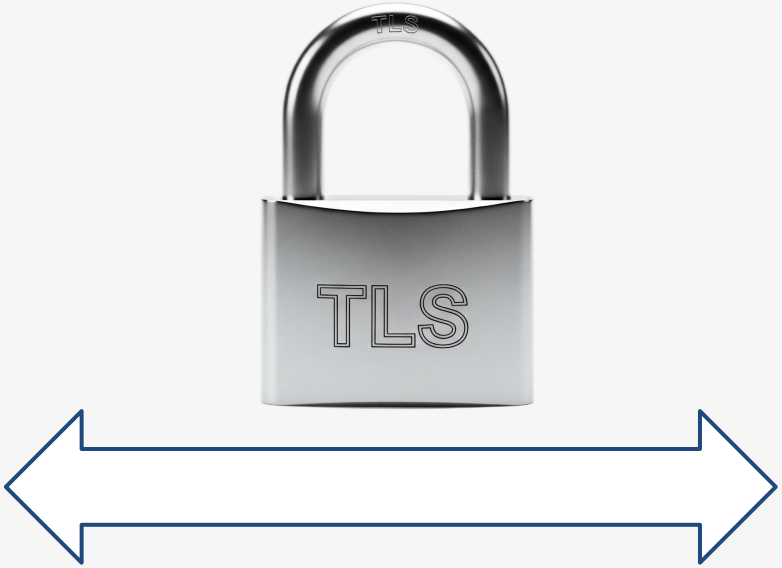
AKA ⟶ AUTHENTICATE

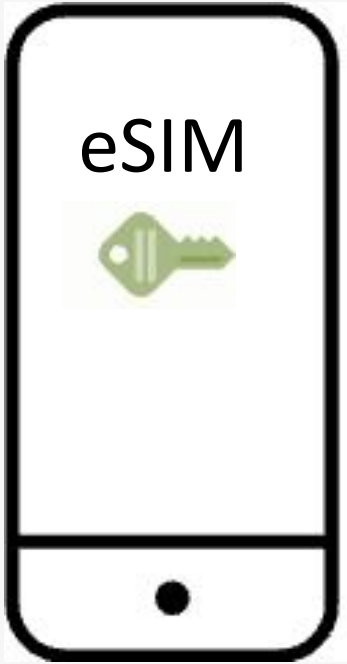




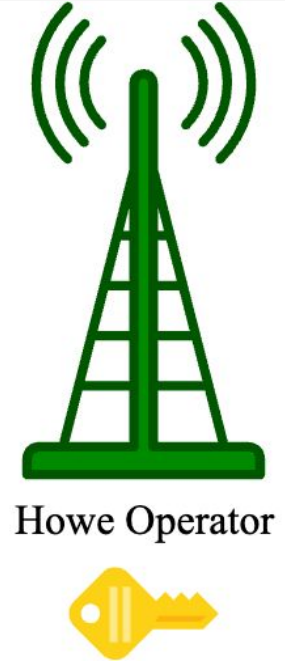
How the Key is Shared in eSIM?

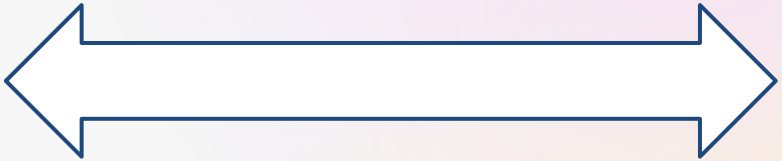


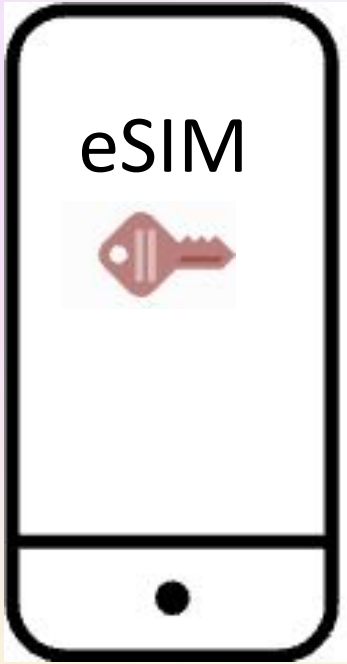




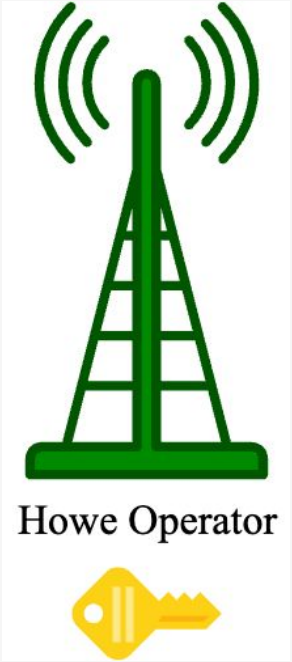
Post-Quantum Threats

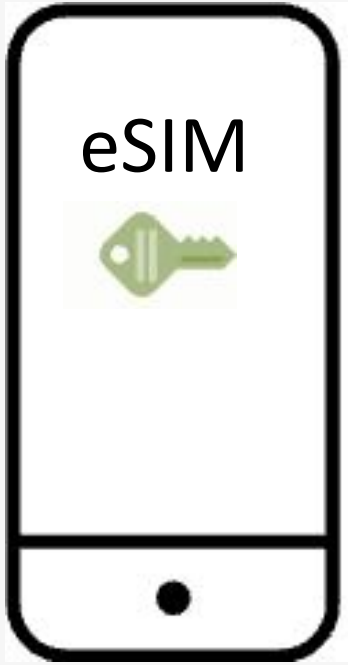




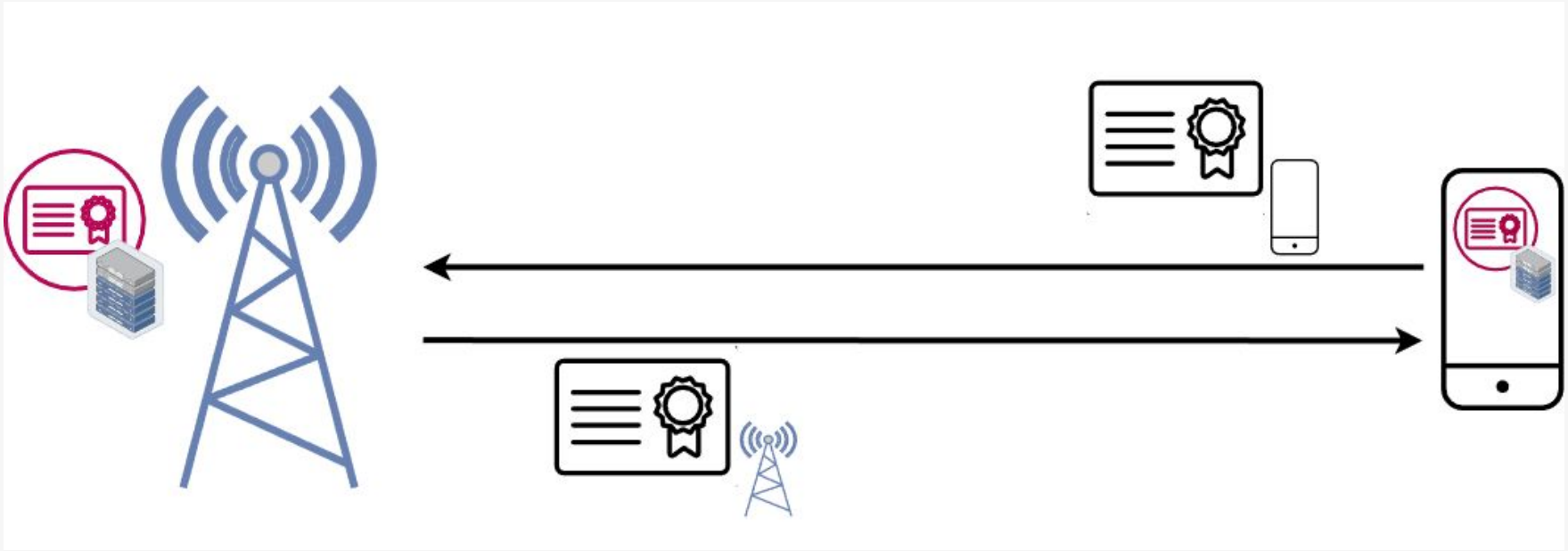


Post Quantum Cryptography





Direct Sim-less Authenticate using PQC



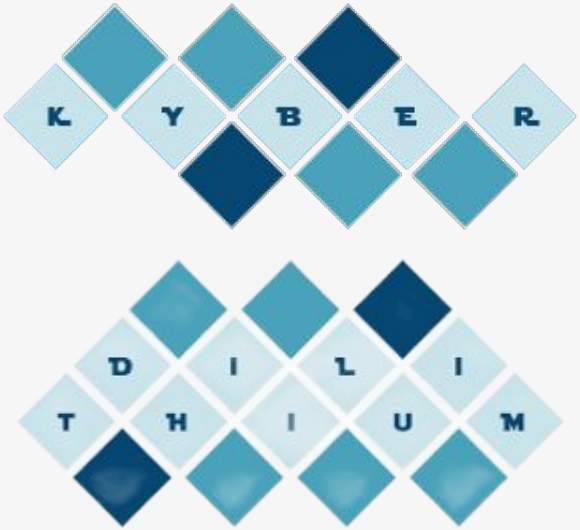
Sim-Less PQC Challenges

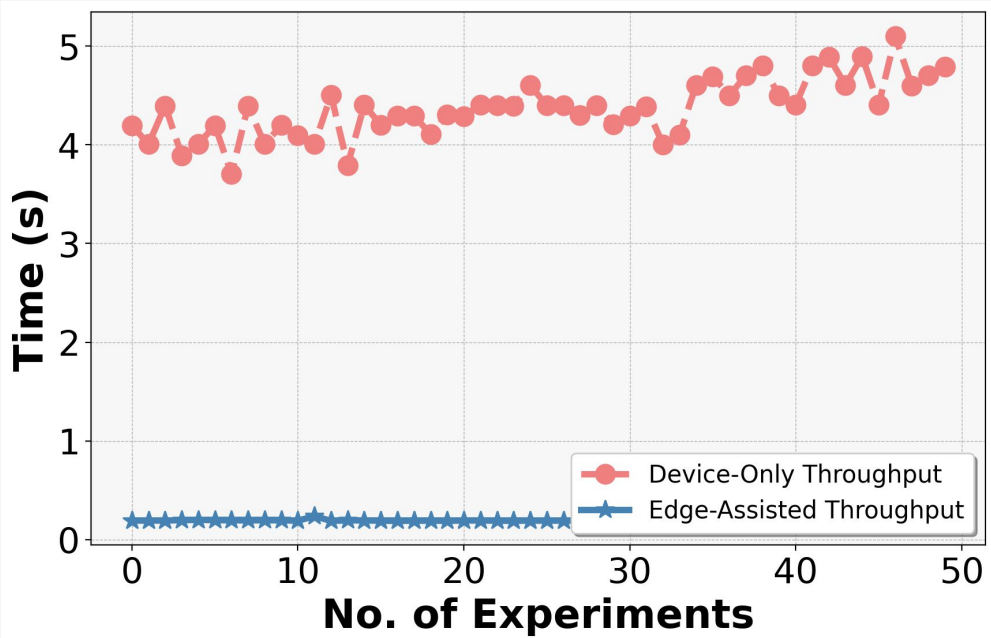
- Computationally heavy
- 10x larger

	Public Key (bytes)	Signature (bytes)
RSA-2048	**256**	**256**
Dilithium-2	**1,312**	**2,420**

Sim-Less PQC Simulation for IoT

Configuration	CPU Cores	Memory	Description
IoT Device	1 core	256 MB	constrained profile
Edge Server	4 cores	4 GB	operator edge node





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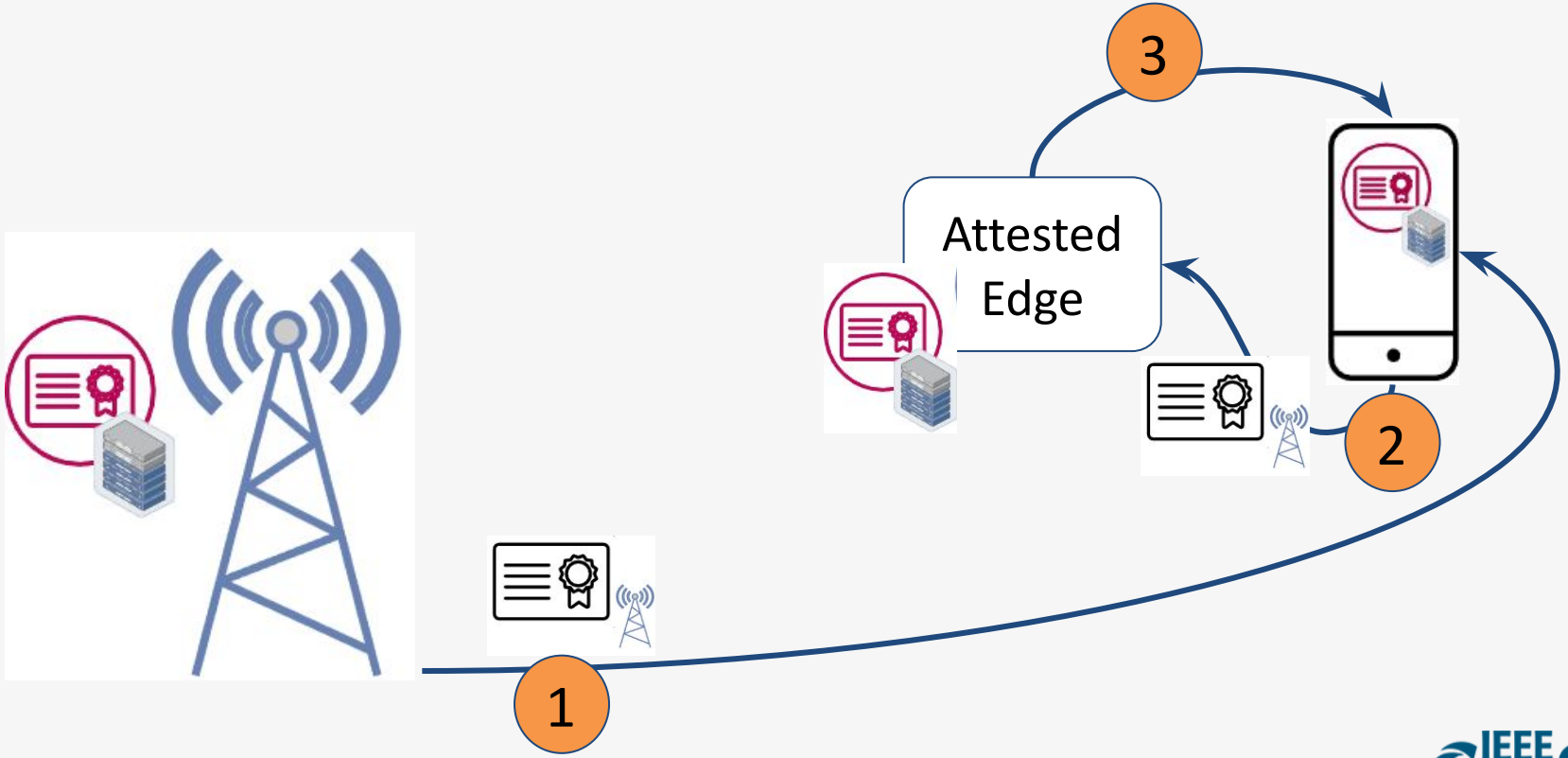
Our Proposed Sim-less PQC Scheme

- **Offload heavy crypto** ops to attested edge servers

- Attested edge servers could also help with **certificate storage**

Edge Assisted Sim-less PQC



Edge Assisted Improvements

Latency: 3.48s → 0.12s (96% reduction)

Resource Use: ≈0 MB extra memory

Scalability: Horizontal edge scaling supports ~182k devices/hour

Key takeaways

- Future is Sim-Less direct mutual authentication
- PQC could be computationally heavy
- Necessity of edge for PQ Sim-Less authentication
- Rigorous security analysis for attested edge servers

From SIM to Post-Quantum Sim-Less Authentication