Quantum-resistant digital signatures schemes for low-power IoT

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Introduction

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Motivation

- sufficiently sized Quantum Computers (explained later) on the horizon
- They can break most of the cryptography in current use
    - RSA
    - ECDSA / ECDH
    - $\rightarrow$ Signal, WhatsApp, PGP, SSH, TLS/HTTPS, . . .
- not everything equally effected
    - schemes in standardization to replace current crypto
    - some are rather computationally intense

- ▶ Quantum Computers operate on Qubits instead of normal Bits
- ▶ Qubits are Quantum-Mechanical
  - ▶ using spin of an electrons
  - ▶ Entanglement and Superposition
- ▶ Algorithms can leverage those mechanics
  - ▶ up to exponential speed up in some cases
  - ▶ Shors algorithm completely breaks common Encryption
    - ▶ everythink based on Number-Theory (like RSA, ECDSA, ..)
    - ▶ (Qubits are currently rather unstable $\rightarrow$ not broken yet)

- ▶ There are a few proposed solutions
- ▶ mostly based on Lattice-Based hard Problems
    - ▶ Frodo-Kem (Encryption)
    - ▶ FALCON (Signature)
- ▶ IOT also needs to be secured
    - ▶ additional challenge of beeing low power/memory

▶ Introduction
▶ Internet of Things
▶ Quantum Resistant Security
  ▶ Quantum Computing
  ▶ QR Algorithms
    ▶ Performance Metrics
    ▶ Encryption
    ▶ Signatures
▶ QR Signatures in IoT
  ▶ Performance Metrics in IoT
  ▶ Failed Signatures
    ▶ WalnutDSA
    ▶ qTESLA
  ▶ FALCON
▶ Conclusion

- Skimming multiple Quantum Resistant (QR) algorithms [15, 1] that focus on IoT [6, 12, 10, 5, 8]
- Deeper reserach about signature Schemes [16]
- and having a slightly more detailed look at two failed sschemes [3, 14, 2, 7]

- having a deeper look at a NIST QR finalist with the most compact implementation:
  FALCON [9, 13, 11]
- maybe having an outlook in the end on a Hardware-Accelerated QR chip [4]

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Outline

- 7.5. : skim breadth coverage literature
- 15.5.: write until signatures (at least bullet point comments)
- 30.5.: finish breadth (at least bullet point comments)
- α: skim and bullet point Depth
- 30.6.: finish