qChat - Post Quantum P2P Chat

Miles Strässle, Svenja Sutter

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Motivation

Ensure secure messaging in post-quantum era ...

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State of the Art

Briar

Pros:

- P2P
- Tor
- Offline communication

Cons:

- No PQC

Signal

Pros:

- P2P
- PQC

Cons:

- Phone number for registration

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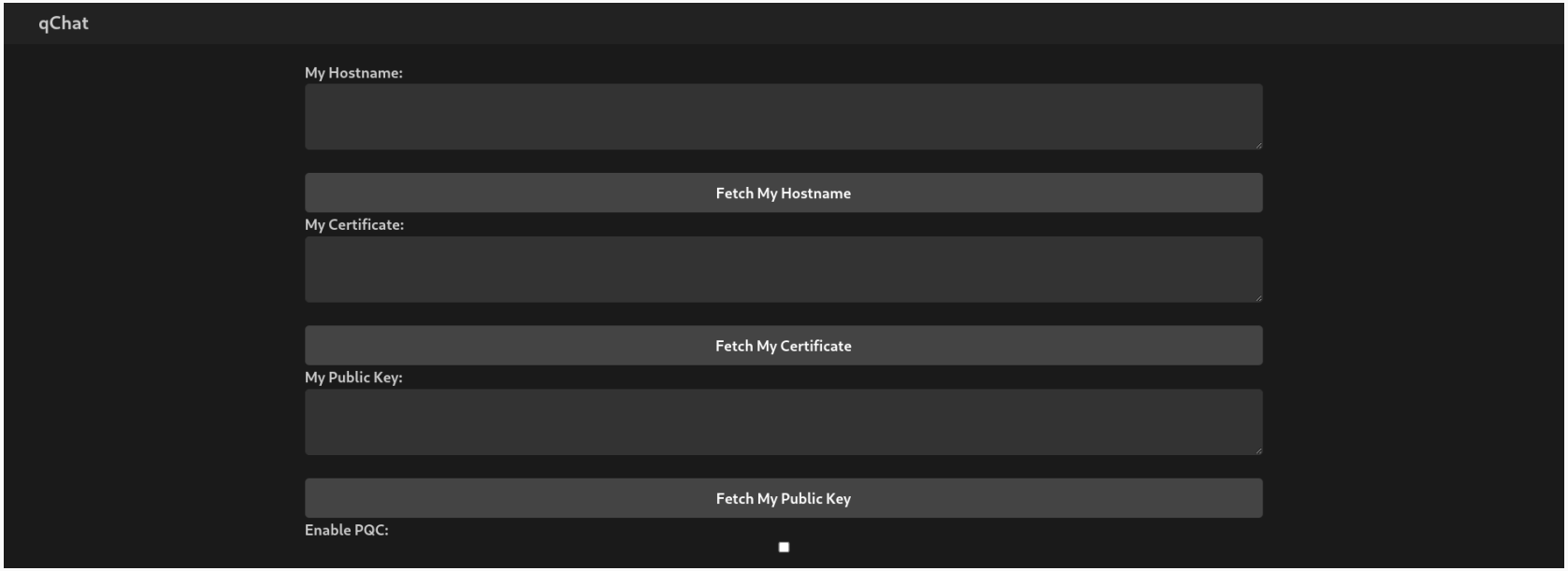
Application - User Information



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Application - Registration Friend

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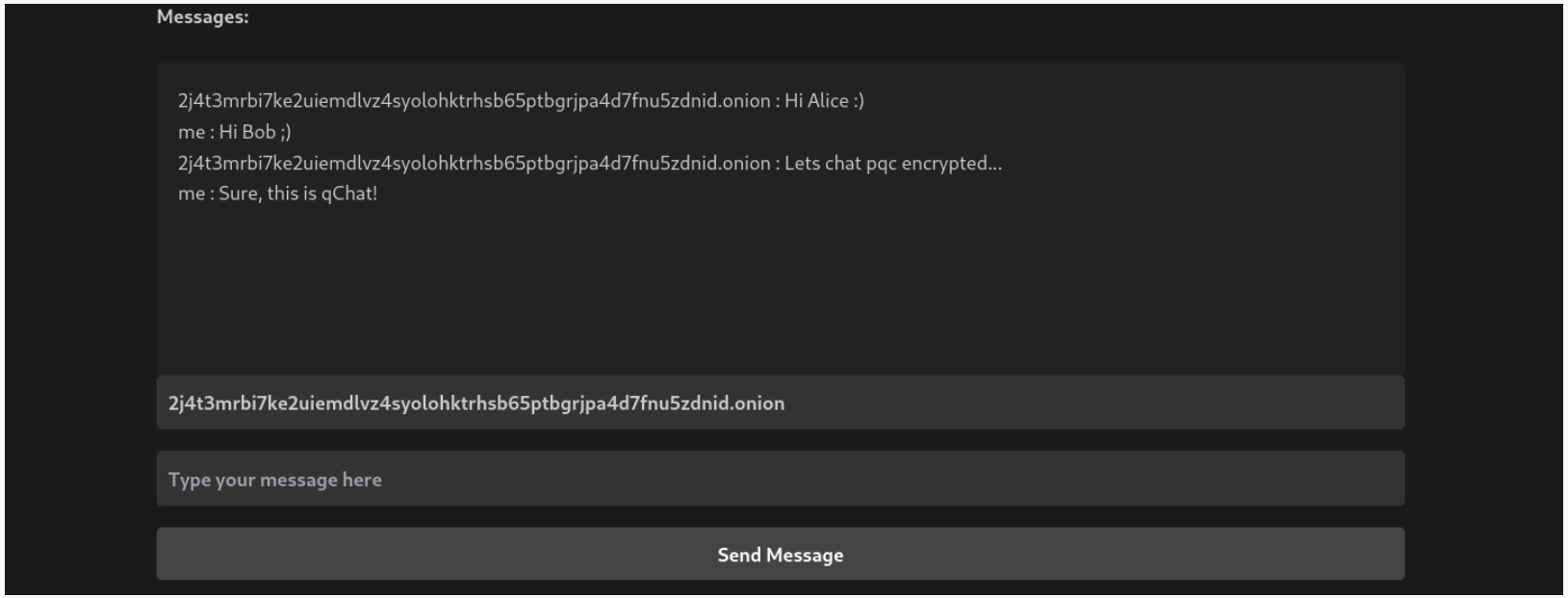
Application - Send Messages



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PQC: Post Quantum Cryptography

- National Institute of Standards and Technology
- Round 3 - Crystals-Kyber (KEM)
  - kyber-768 parameter set
  - shared library
  - structured lattices

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Lattice-based Cryptography

- BQP (complexity)
- LWE Problem (reduction CVP/SVP Problem)
- Encapsulates symmetric AES-256 key
- Keysize
  - secret key: 2400 Bytes
  - public key: 1184 Bytes

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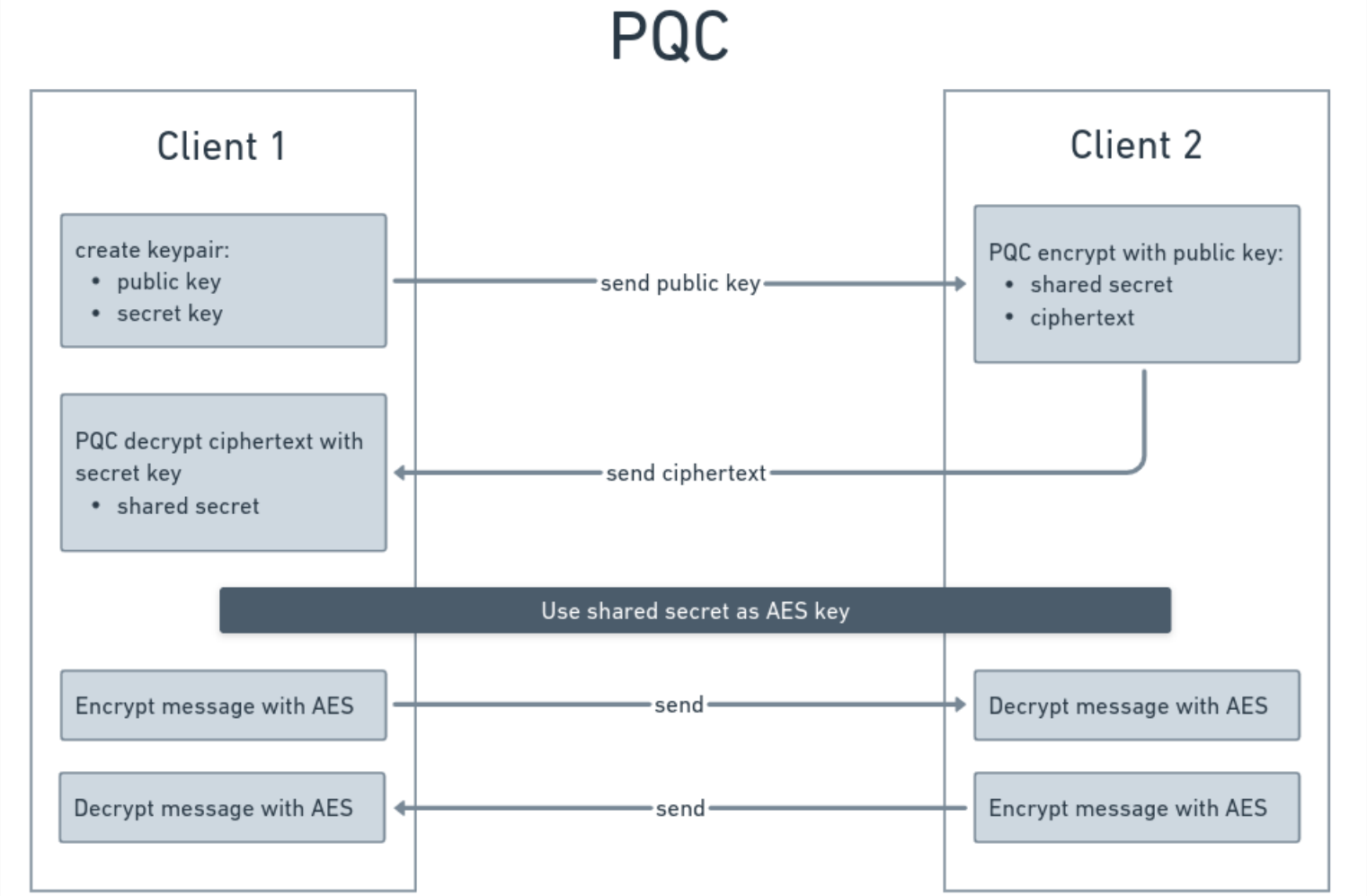
CRYSTALS-KYBER



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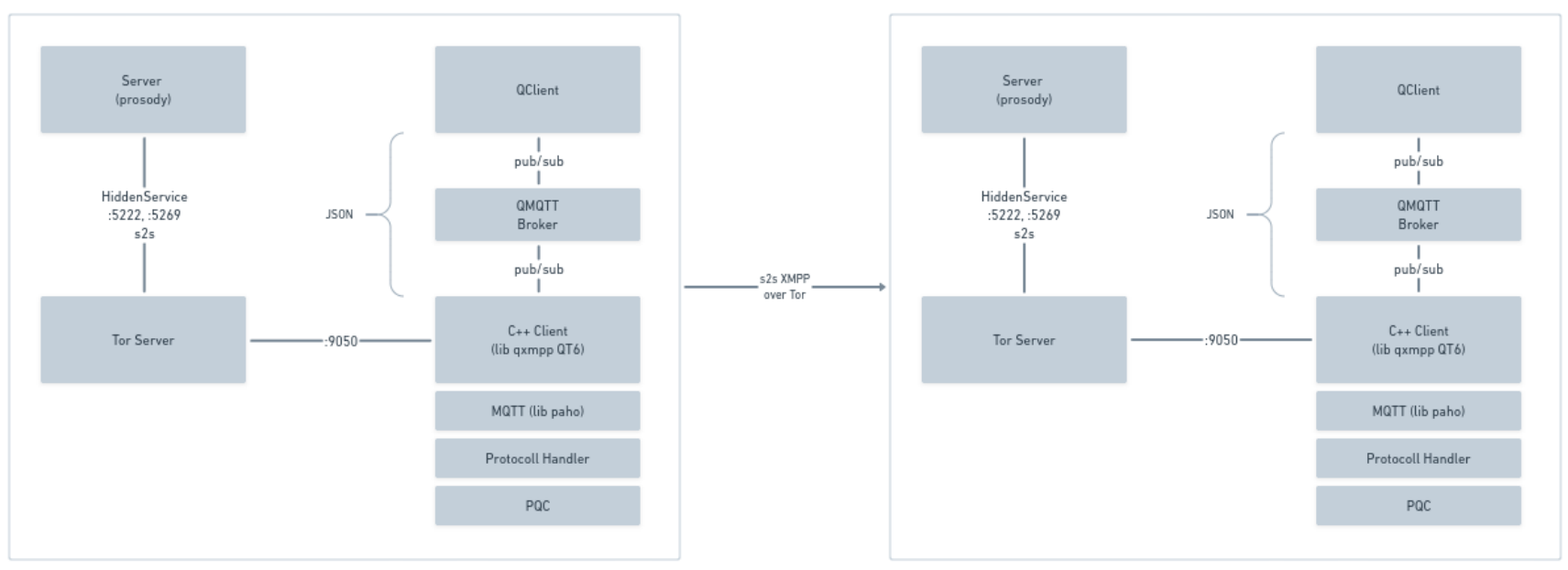
Architecture



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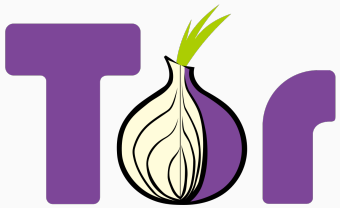
Design Decisions

Why Tor?



- *Circumvent NAT*
- *Anonymity*
- *Security (E2E in Tor v3)*

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Why XMPP?

- *Well established P2P Protocol*
- *Customizable Server Settings (prosody)*
- *Lightweight*
- *Maintained Libraries for our client (qxmpp)*
- *Suited for our client/server design*

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Why MQTT?

- *Simple communication between back- and frontend*
- *Efficient*

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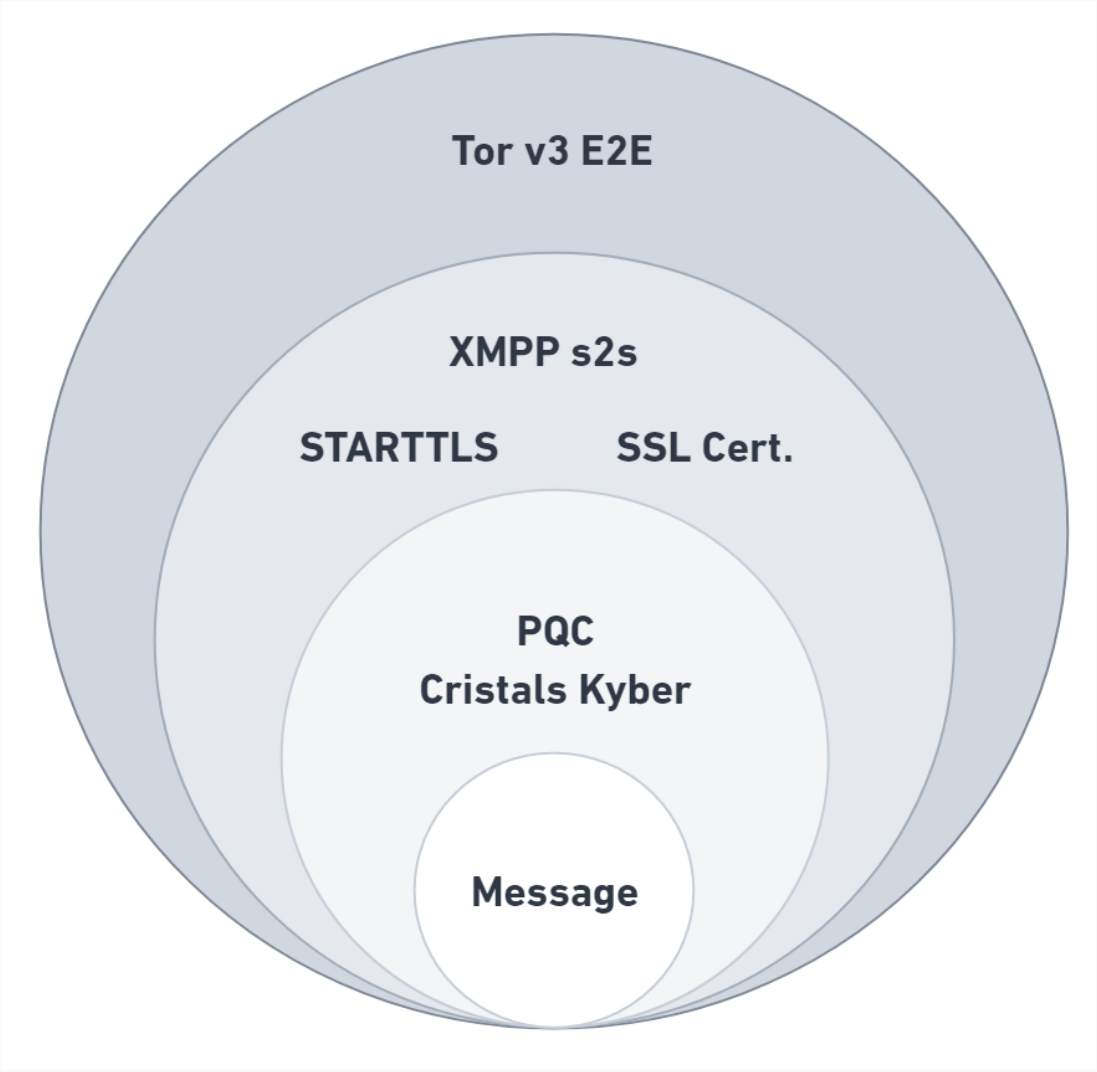
Security Layers



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Demo

Questions