Post-Quantum transition: Prepare to changes

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Who am I

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Maintain: OpenSSL, OpenSSH

OpenSSL Technical Committee member since 2021

Current work: Post-Quantum transition in Red Hat

Why Post Quantum transition?

There is a consensus that Quantum Computers will break traditional cryptography

Including deciphering pre-recorded communication

There are world-wide efforts to design and implement Quantum-resistant algorithms

PQ transition challenges - I

We can’t trust classical algorithms

We can’t trust new algorithms

Hybrid solutions: combinations of classical and new algorithms

PQ transition challenges - II

Big keys/signatures

- RSA-3072: 387/384 bytes
- Dilithium2: 1312/2420 bytes

Performance problems

Compatibility problems

Network: TCP/UDP Fragmentation (DNSSec), amplification attacks

PQC: Standard bodies

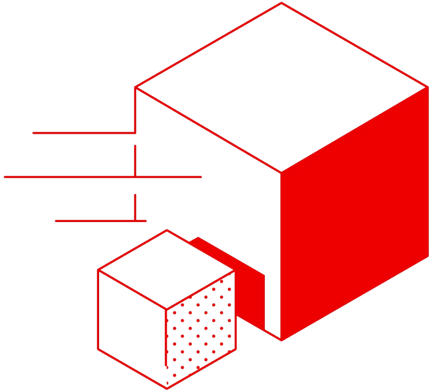
Algorithms: NIST

Kyber, Dilithium, SPHINX+

Protocols: IETF

PKCS#11: OASIS group

Fedora for PQ experiments



Our choice

Liboqs project

Low-level implementations

A group of projects: OpenSSL provider, OpenSSH

Fedora 39

OpenSSL 3.1, liboqs 0.8, oqsprovider 0.5.1

PQ demo: make it yourself

```
$ yum install oqs-provider

$ openssl ecparam -out p256.pem -name P-256

$ openssl req -x509 -newkey ec:p256.pem -keyout root.key -out root.crt -subj
/CN=localhost -batch -nodes -days 36500 -sha256

$ openssl s_server -key root.key -cert root.crt -trace -provider oqsprovider -groups
x25519_kyber768:p384_kyber768

$ openssl s_client -connect localhost:4433 -tls1_3 -trace -provider oqsprovider -groups
x25519_kyber768:p384_kyber768
```

PQ demo: use nginx

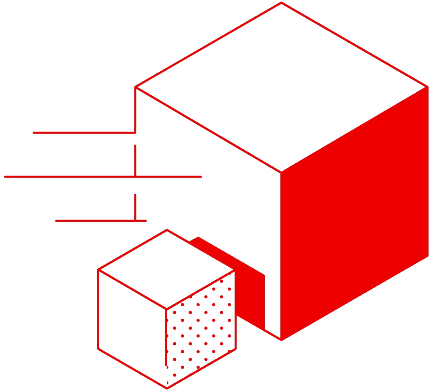
```
$ vim /etc/pki/tls/openssl.cnf
[provider_sect]
default = default_sect
oqsprovider = oqs_sect

[default_sect]
activate = 1
[oqs_sect]
activate = 1
```

```
$ vim /etc/nginx/nginx.conf
ssl_ecdh_curve x25519_kyber768:p384_kyber768;
```

```
$ curl --curves x25519_kyber768:p384_kyber768 --cacert root.crt https://myserver/
```

Future plans



Container

No more do-it-yourself

Fedora rawhide

Recent versions of OpenSSL, liboqs, oqsprovider

Crypto policy: subpolicy for PQ algorithms

Upstream work

OpenSSL, NSS, GnuTLS

SSH: opportunities

OpenSSH implements PQ algorithms

...non-standard PQ algorithms

...to be standardized (IETF)

NIST PQ algorithms: no specifications

OQS-OpenSSH: many PQ algorithms, no contributors

Thank you

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