# PQC Wireguard as a new VPN

Wireguard + Rosenpass

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## **ABSTRACT**

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## **CCS CONCEPTS**

• Security and privacy  $\rightarrow$  Key management; Digital signatures; Public key encryption.

## **KEYWORDS**

Post-quantum cryptography, Key-Encapsulation Method, Rosenpass, Wireguard, Crystals-Kyber, NIST

#### **ACM Reference Format:**

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## **REFERENCES**

- $[1] \ [n.d.]. \ . \ https://www.ndss-symposium.org/ndss2017/ndss-2017-programme/wireguard-next-generation-kernel-network-tunnel/$
- [2] [n.d.]. https://rosenpass.eu/whitepaper.pdf
- [3] [n.d.]. https://www.openssl.org/docs/man3.2/man3/EVP\_EncryptInit\_ex.html
- $\label{eq:composition} \begin{tabular}{ll} [1.d.] \hline [n.d.]. & https://arstechnica.com/information-technology/2022/08/sike-once-a-post-quantum-encryption-contender-is-koed-in-nist-smackdown/ \\ \hline \end{tabular}$
- [5] [n. d.]. https://csrc.nist.gov/Projects/post-quantum-cryptography/post-quantum-cryptography-standardization
- [6] Wouter Castryck and Thomas Decru. 2022. An efficient key recovery attack on SIDH. Cryptology ePrint Archive, Paper 2022/975. https://eprint.iacr.org/2022/975 https://eprint.iacr.org/2022/975.
- [7] Diana Ghinea, Fabian Kaczmarczyck, Jennifer Pullman, Julien Cretin, Stefan Kölbl, Rafael Misoczki, Jean-Michel Picod, Luca Invernizzi, and Elie Bursztein. 2022. Hybrid Post-Quantum Signatures in Hardware Security Keys. Cryptology ePrint Archive, Paper 2022/1225. https://eprint.iacr.org/2022/1225 https://eprint.iacr.org/2022/1225

[8] Andreas Hülsing, Kai-Chun Ning, Peter Schwabe, Fiona Johanna Weber, and Philip R. Zimmermann. 2020. Post-quantum WireGuard. Cryptology ePrint Archive, Paper 2020/379. https://eprint.iacr.org/2020/379 https://eprint.iacr.org/ 2020/379.

[9] Douglas Stebila and Michele Mosca. 2016. Post-Quantum Key Exchange for the Internet and the Open Quantum Safe Project. Cryptology ePrint Archive, Paper 2016/1017. https://eprint.iacr.org/2016/1017 https://eprint.iacr.org/2016/1017.

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