

Sander Dorigo, sander.dorigo@fox-it.com

Sources

These are the main sources for information and photos that I used during my SECCON 22 presentation. Each reference is linked at the bottom of this PDF file.

- Fox Crypto website [Crypto(2022)]
- Huawei blocked from core 5G networks of major Dutch providers [Times(2022)]
- Modern quantum computer [Leprince-Ringuet(2021)]
- Shor's algorithm [Shor(1997)]
- Factoring 15 back into 3*5 [Vandersypen et al.(2001)Vandersypen, Steffen, Breyta, Yannoni, Sherwood, and Chuang]
- Post quantum efforts by NIST [NIST(2016)]
- Mosca's theorem [Mosca(2015)]
- Dueling over Dual_EC_DRBG [Kostyuk and Landau(2022)]
- BSI's quantum update from 2020 [BSI(2020)]
- Status of the quantum landscape [Jaques(2021)]
- Quantum Threat Timeline report [Institute(2021)]
- NIST logo [NIST(2007)]
- Results of NIST round 3 [NIST(2022)]
- 3.5 seconds vs 26 nanoseconds [Dridi and Alghassi(2017)]
- Breaking SPHINCS+ [Perlner et al.(2022)Perlner, Kelsey, and Cooper]
- Breaking SIKE [Castryck and Decru(2022)]
- Cloudflare TLS experiment [Kwiatkowski(2019)]

- OpenSSH 9.0 [OpenSSH(2022)]
- Cloudflare experiments in August 2022 [Westerbaan(2022)]
- Signal’s double ratchet protocol [Marlinspike and Perrin(2016)]
- FrodoKEM by Microsoft [Microsoft(2022a)]
- McKinsey’s quantum research [McKinsey(2019)] [McKinsey(2021)] [McKinsey(2022)]
- 1.8 Miljoen voor onderzoek naar quantum veiligheid publieke sleutelinfrastructuur [Welling(2021)]
- 10 million euros awarded for solving cyber security issues [NWO(2021)]
- Post-quantum cryptography according to TNO [TNO(2022)]
- Post-quantum cryptography according to AIVD [AIVD(2021)]
- Post-quantum cryptography according to BSI [BSI(2022)]
- Post-quantum cryptography according to ANSSI [ANSSI(2022)]
- Improving OpenVPN security [van Heesch et al.(2019)van Heesch, van Adrichem, Attema, and Veugen]
- Post Quantum SSH [Microsoft(2022b)]
- Stack Exchange [bbosak(2020)]
- Quantum in chemistry [Lee et al.(2022)Lee, Lee, Zhai, Tong, Dalzell, Kumar, Helms, Gray, Cui, Liu, Kastoryano, Babbush, Preskill, Reichman, Campbell, Valeev, Lin, and Chan]
- The quantum computing bubble [Gourianov(2022)]

Further reading

If you're interested in reading more, check out these links. They refer to single tweets that inspired me, useful groups or pages, or other interesting tidbits.

- <https://twitter.com/sejaques/status/1554482507399237634>
- <https://arstechnica.com/information-technology/2022/08/sike-once-a-post-quantum-encryption-contender-is-koed-in-nist-smackdown/>
- <https://martijn-dekker.medium.com/quantum-technology-is-a-blessing-for-information-security-5b25772618ac>
- <https://openquantumsafe.org/>
- <https://www.sanderdorigo.nl/stream> (kind of an obvious plug)

References

- [AIVD(2021)] AIVD. Bereid je voor op de komst van quantum-computers, 2021. URL https://www.aivd.nl/binaries/aivd_nl/documenten/publicaties/2021/09/23/bereid-je-voor-op-de-dreiging-van-quantumcomputers/Bereid+je+voor+op+de+dreiging+van+quantumcomputers.pdf.
- [ANSSI(2022)] ANSSI. Anssi views on the post-quantum cryptography transition, 2022. URL <https://www.ssi.gouv.fr/en/publication/anssi-views-on-the-post-quantum-cryptography-transition/>.
- [bbosak(2020)] bbosak. Stack exchange - now that quantum computers have been out for a while, has rsa been cracked?, 2020. URL <https://crypto.stackexchange.com/a/439>.
- [BSI(2020)] BSI. Status of quantum computer development, 2020. URL https://www.bsi.bund.de/SharedDocs/Downloads/DE/BSI/Publikationen/Studien/Quantencomputer/P283_QC_Studie-V_1.2.html?nn=459758.

- [BSI(2022)] BSI. Quantum-safe cryptography – fundamentals, current developments and recommendations, 2022. URL <https://www.bsi.bund.de/SharedDocs/Downloads/EN/BSI/Publications/Brochure/quantum-safe-cryptography.html?nn=433196>.
- [Castrick and Decru(2022)] Wouter Castryck and Thomas Decru. An efficient key recovery attack on sidh (preliminary version). Cryptology ePrint Archive, Paper 2022/975, 2022. URL <https://eprint.iacr.org/2022/975>. <https://eprint.iacr.org/2022/975>.
- [Crypto(2022)] Fox Crypto. Fox crypto website, 2022. URL <https://foxcrypto.com>.
- [Dridi and Alghassi(2017)] Raouf Dridi and Hedayat Alghassi. Prime factorization using quantum annealing and computational algebraic geometry. *Scientific Reports*, 7(1), feb 2017. doi: 10.1038/srep43048. URL <https://doi.org/10.1038%2Fsrep43048>.
- [Gourianov(2022)] Dr Nikita Gourianov. The quantum computing bubble, 2022. URL <https://www.ft.com/content/6d2e34ab-f9fd-4041-8a96-91802bab7765>.
- [Institute(2021)] Global Risk Institute. 2021 quantum threat timeline report, 2021. URL <https://globalriskinstitute.org/publications/2021-quantum-threat-timeline-report/>.
- [Jaques(2021)] Samuel Jaques. Landscape of quantum computing in 2021, 2021. URL https://sam-jaques.appspot.com/quantum_landscape.
- [Kostyuk and Landau(2022)] Nadiya Kostyuk and Susan Landau. Dueling over dual_ec_drgb the consequences of corrupting a cryptographic standardization process, 2022. URL https://harvardnsj.org/2022/06/dueling-over-dual_ec_drgb-the-consequences-of-corrupting-a-cryptographic-standardization-process/.
- [Kwiatkowski(2019)] Kris Kwiatkowski. Tls post-quantum experiment, Oct 2019. URL <https://blog.cloudflare.com/the-tls-post-quantum-experiment/>.
- [Lee et al.(2022)] Lee, Lee, Zhai, Tong, Dalzell, Kumar, Helms, Gray, Cui, Liu, Kastoryano, Babbus, Seunghoon Lee, Joonho Lee, Huanchen Zhai, Yu Tong, Alexander M.

- Dalzell, Ashutosh Kumar, Phillip Helms, Johnnie Gray, Zhi-Hao Cui, Wenyuan Liu, Michael Kastoryano, Ryan Babbush, John Preskill, David R. Reichman, Earl T. Campbell, Edward F. Valeev, Lin Lin, and Garnet Kin-Lic Chan. Is there evidence for exponential quantum advantage in quantum chemistry?, 2022. URL <https://arxiv.org/abs/2208.02199>.
- [Leprince-Ringuet(2021)] Daphne Leprince-Ringuet. What is quantum computing? everything you need to know about the strange world of quantum computers, 2021. URL <https://www.zdnet.com/article/what-is-quantum-computing-everything-you-need-to-know-about-the-strange-world-of-quantum-computers/>.
- [Marlinspike and Perrin(2016)] Moxie Marlinspike and Trevor Perrin. Specifications of the double ratchet algorithm, 2016. URL <https://signal.org/docs/specifications/doubleratchet/>.
- [McKinsey(2019)] McKinsey. The next big thing? quantum computing’s potential impact on chemicals, 2019. URL <https://www.mckinsey.com/industries/chemicals/our-insights/the-next-big-thing-quantum-computings-potential-impact-on-chemicals>.
- [McKinsey(2021)] McKinsey. Pharma’s digital rx: Quantum computing in drug research and development, 2021. URL <https://www.mckinsey.com/industries/life-sciences/our-insights/pharmas-digital-rx-quantum-computing-in-drug-research-and-development>.
- [McKinsey(2022)] McKinsey. When - and how - to prepare for post-quantum cryptography, 2022. URL <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/when-and-how-to-prepare-for-post-quantum-cryptography>.
- [Microsoft(2022a)] Microsoft. Frodokem: Learning with errors key encapsulation, 2022a. URL <https://github.com/microsoft/PQCrypto-LWEKE>.
- [Microsoft(2022b)] Microsoft. Post-quantum ssh, 2022b. URL <https://www.microsoft.com/en-us/research/project/post-quantum-ssh/>.
- [Mosca(2015)] Michele Mosca. Cybersecurity in a quantum world: will we be ready?, 2015. URL <https://csrc.nist.gov/csrc/media/events/workshop->

on-cybersecurity-in-a-post-quantum-world/documents/presentations/
session8-mosca-michele.pdf.

[NIST(2007)] NIST. Nist logo, 2007. URL https://commons.wikimedia.org/wiki/File:NIST_logo.svg.

[NIST(2016)] NIST. Announcing request for nominations for public-key post-quantum cryptographic algorithms, 2016. URL <https://csrc.nist.gov/news/2016/public-key-post-quantum-cryptographic-algorithms>.

[NIST(2022)] NIST. Round 3 submissions - post-quantum cryptography: Csrc, 2022. URL <https://csrc.nist.gov/Projects/post-quantum-cryptography/post-quantum-cryptography-standardization/round-3-submissions>.

[NWO(2021)] NWO. 10 million euros awarded for solving cyber security issues, Apr 2021. URL <https://www.nwo.nl/en/news/10-million-euros-awarded-solving-cyber-security-issues>.

[OpenSSH(2022)] OpenSSH. Openssh 9.0 release notes, 2022. URL <https://www.openssh.com/txt/release-9.0>.

[Perlner et al.(2022)Perlner, Kelsey, and Cooper] Ray Perlner, John Kelsey, and David Cooper. Breaking category five sphincs+ with sha-256. Cryptology ePrint Archive, Paper 2022/1061, 2022. URL <https://eprint.iacr.org/2022/1061>. <https://eprint.iacr.org/2022/1061>.

[Shor(1997)] Peter W. Shor. Polynomial-time algorithms for prime factorization and discrete logarithms on a quantum computer. *SIAM Journal on Computing*, 26(5):1484–1509, oct 1997. doi: 10.1137/s0097539795293172. URL <https://doi.org/10.1137%2Fs0097539795293172>.

[Times(2022)] NL Times. Huawei blocked from core 5g networks of major dutch providers, 2022. URL <https://nltimes.nl/2021/05/21/huawei-blocked-core-5g-networks-major-dutch-providers>.

[TNO(2022)] TNO. Well-prepared for the quantum age, 2022. URL <https://www.tno.nl/en/focus-areas/information-communication-technology/roadmaps/trusted-ict/quantum/quantum-safe-crypto/>.

- [van Heesch et al.(2019)van Heesch, van Adrichem, Attema, and Veugen]
 Maran van Heesch, Niels van Adrichem, Thomas Attema, and Thijs Veugen. Towards quantum-safe vpns and internet. Cryptology ePrint Archive, Paper 2019/1277, 2019. URL <https://eprint.iacr.org/2019/1277>. <https://eprint.iacr.org/2019/1277>.
- [Vandersypen et al.(2001)Vandersypen, Steffen, Breyta, Yannoni, Sherwood, and Chuang]
 Lieven M. K. Vandersypen, Matthias Steffen, Gregory Breyta, Costantino S. Yannoni, Mark H. Sherwood, and Isaac L. Chuang. Experimental realization of shor's quantum factoring algorithm using nuclear magnetic resonance. *Nature*, 414(6866):883–887, dec 2001. doi: 10.1038/414883a. URL <https://doi.org/10.1038%2F414883a>.
- [Welling(2021)] Rogier Welling. 1.8 miljoen voor onderzoek naar quantum veiligheid publieke sleutelinfrastructuur, Nov 2021. URL <https://zynyo.com/blog-nieuws/hapkido-quantum-veiligheid/>.
- [Westerbaan(2022)] Bas Westerbaan. Experiment with post-quantum cryptography today, Aug 2022. URL <https://blog.cloudflare.com/experiment-with-pq/>.