Transitioning to post-quantum cryptography

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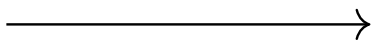
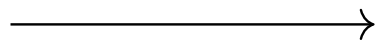
University of Bristol

29th June 2022

What is this all about?

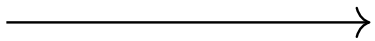
Cryptography

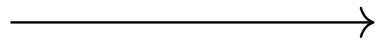




Sender Channel with eavesdropper ‘Eve’ Receiver

Cryptography





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Problems:

- Communication channels store and spy on our data
- Communication channels are modifying our data

Cryptography

Sender — Channel with eavesdropper 'Eve' — Receiver

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Goals:

- Confidentiality despite Eve's espionage.
- Integrity: recognising Eve's espionage.

Post-quantum cryptography

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- Eve has a quantum computer.
- Harry and Meghan don’t have a quantum computer.

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Post-quantum cryptography $\neq$ quantum cryptography

- In quantum cryptography, Harry and Meghan also have access to quantum technology.

Why does Eve need a quantum computer?

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Main goal: replace the use of the discrete logarithm problem in asymmetric cryptography with something quantum-resistant.

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- Multivariate signatures: based on solving simulateneous multivariate equations.
  Short signatures, large public keys, slow.

What can we do?

We have:

- KEM/Encryption and signatures*
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- NIST may re-open submissions for signature schemes.

What next?

Exciting research directions in 2022:

- How to transition to post-quantum in the real world?
- New ideas for signature schemes?
- Hertzbleed: Effect on each post-quantum *and* classical scheme?
- Lattices: How much structure is too much?
- Isogenies: What more can we do? Are they really secure?
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Thank you!