Public Key Cryptography

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University of Oxford

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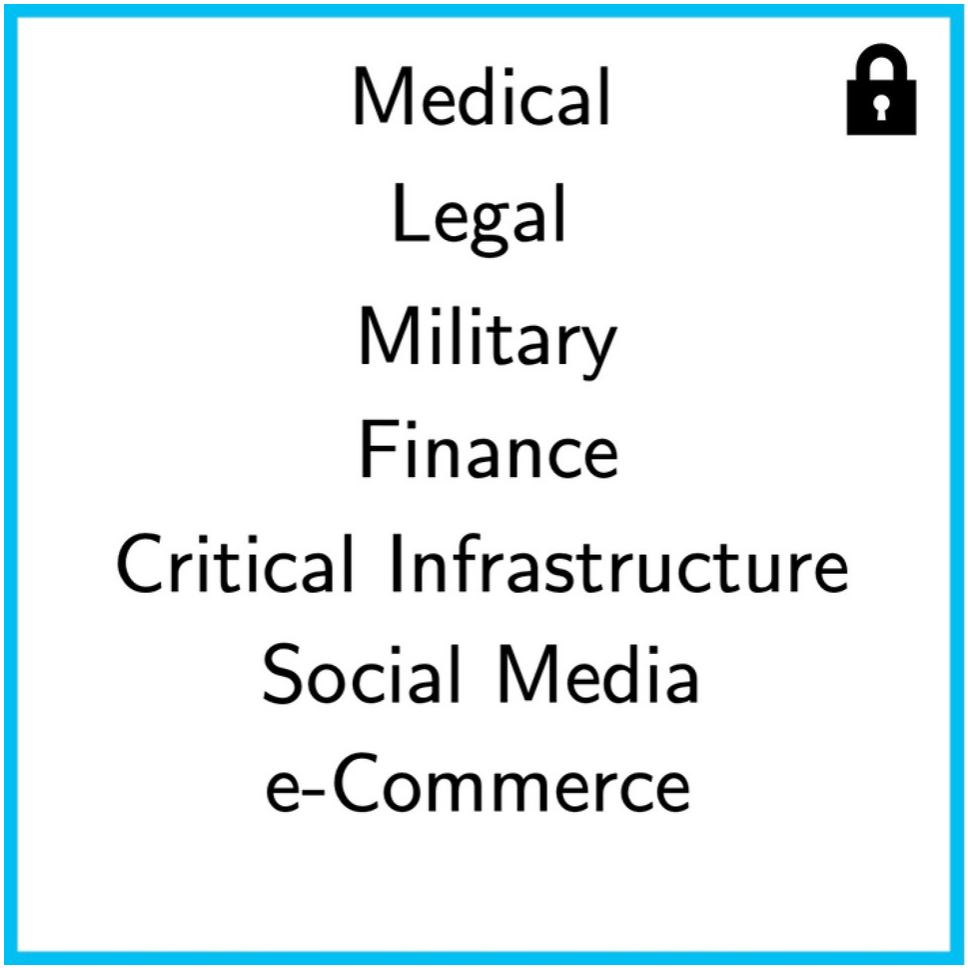
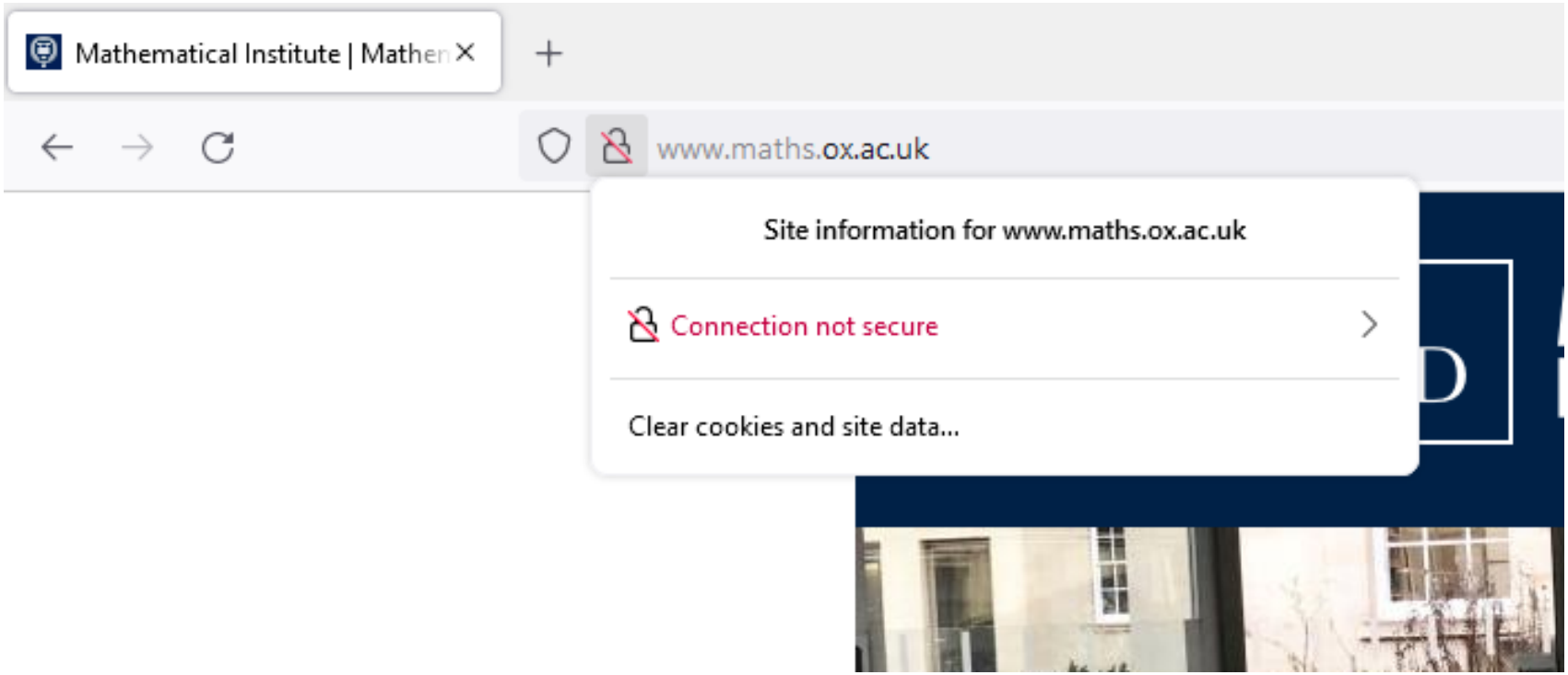
Remember Patrick's talk...



Where do we encounter cryptography?



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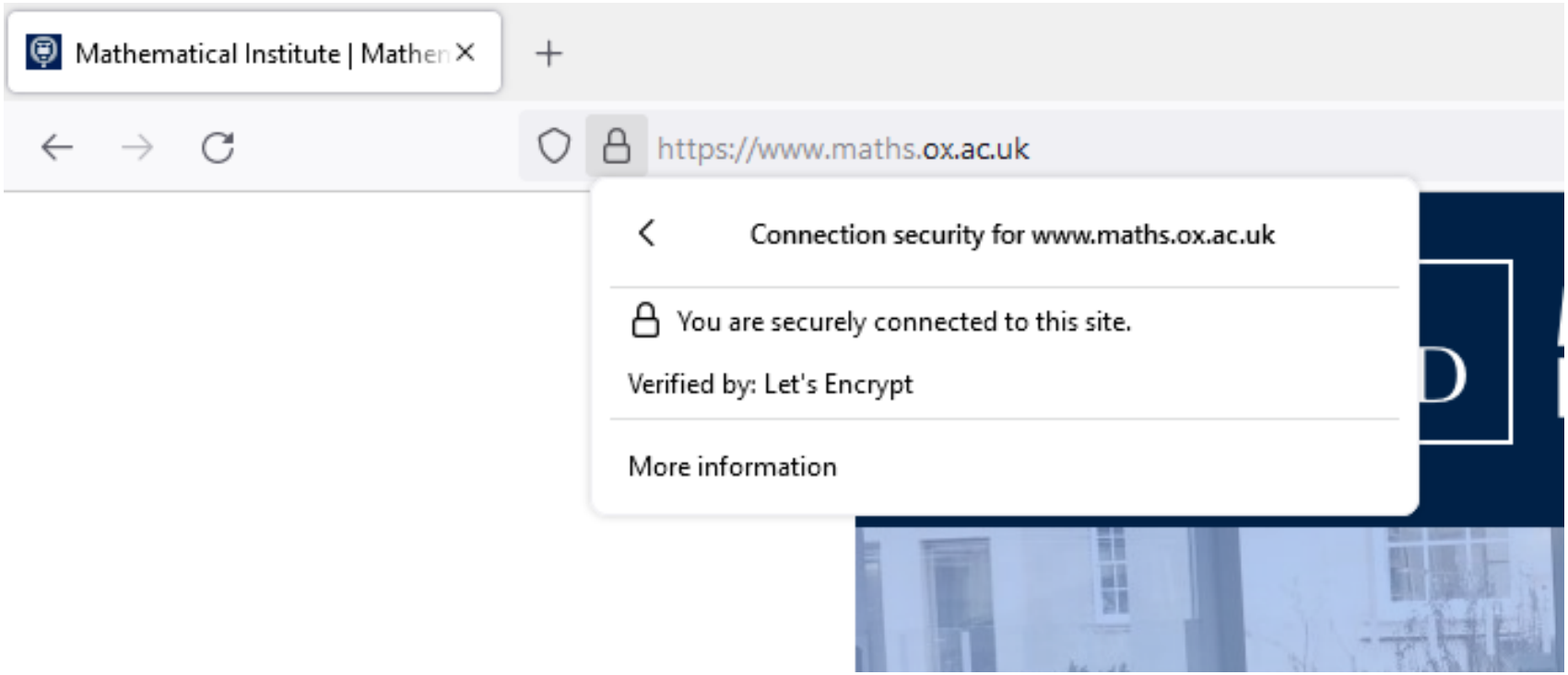

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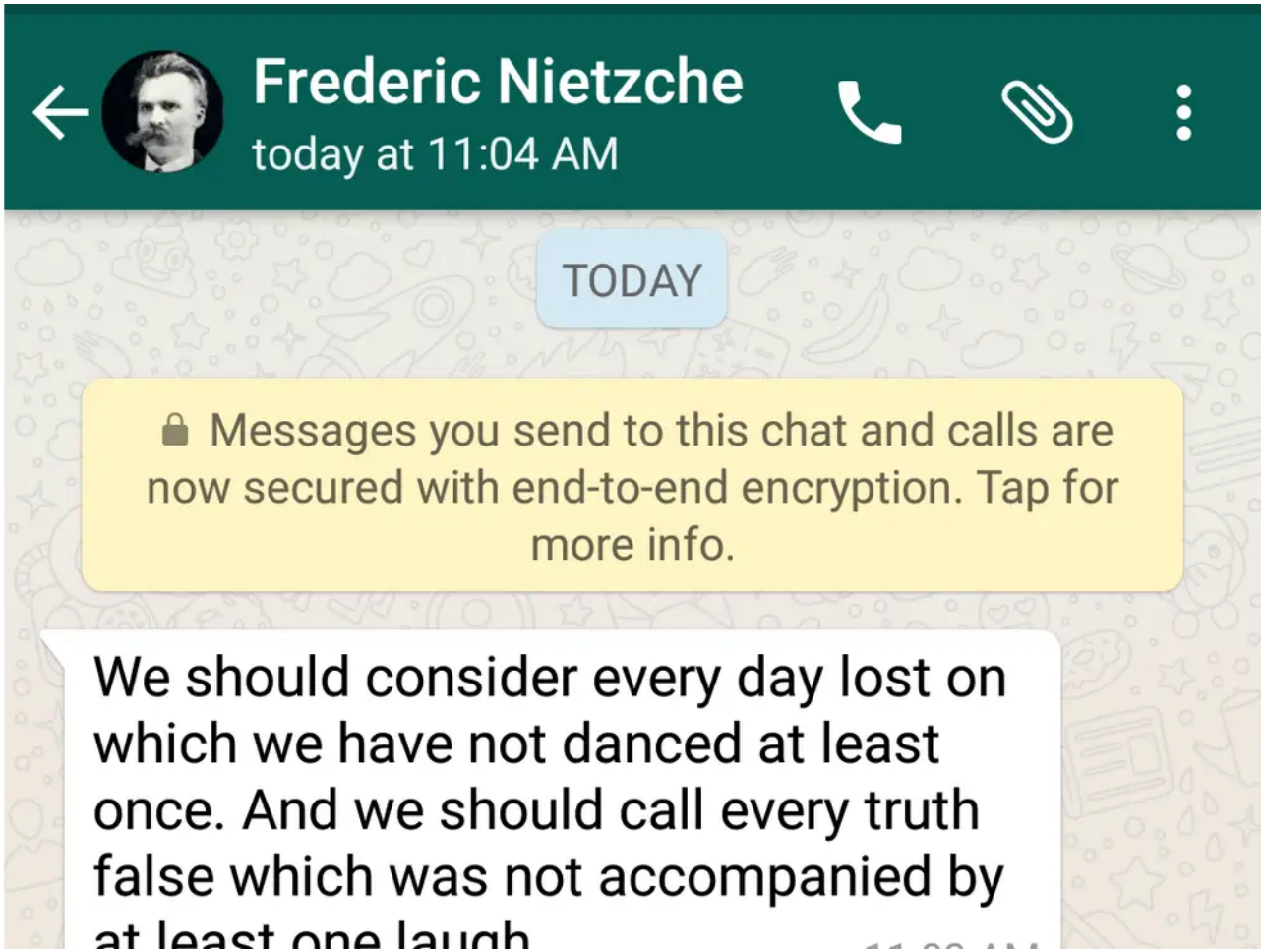

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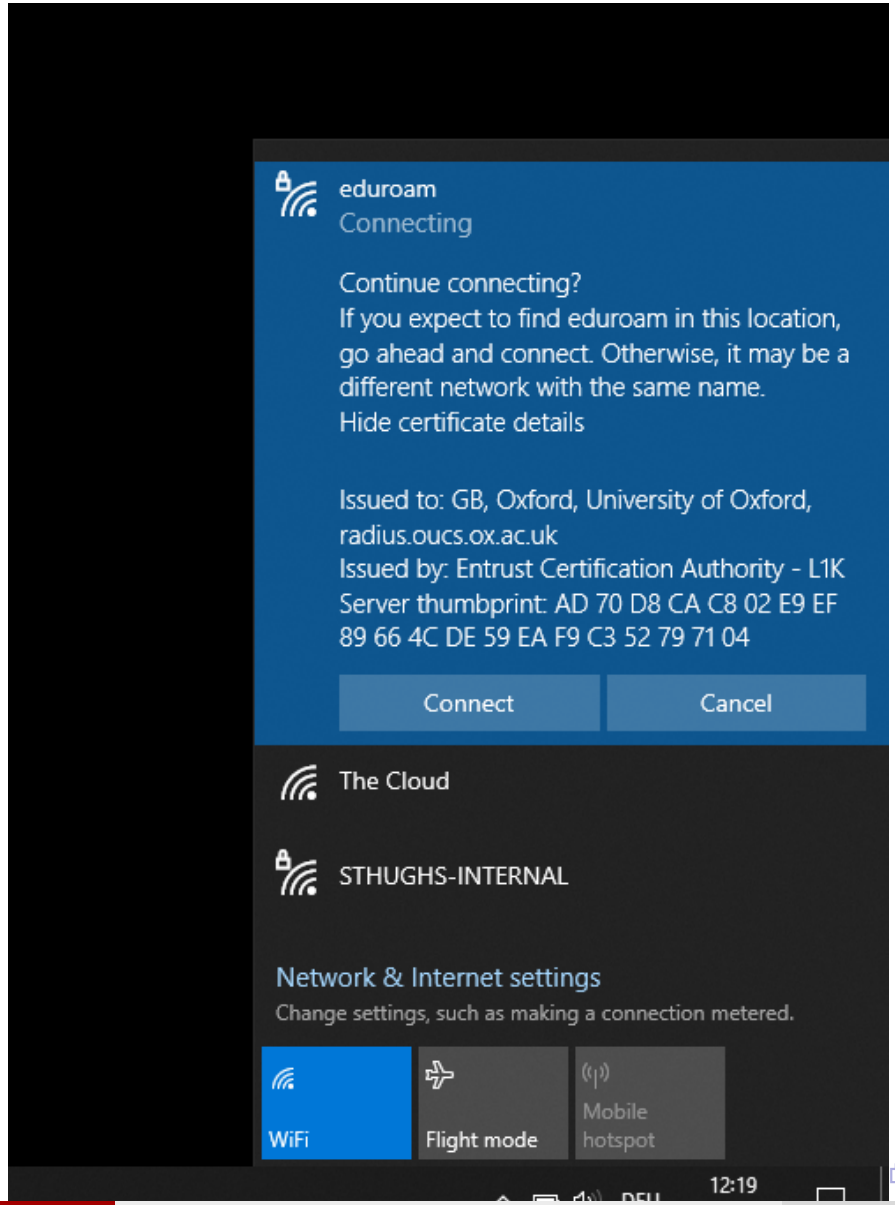
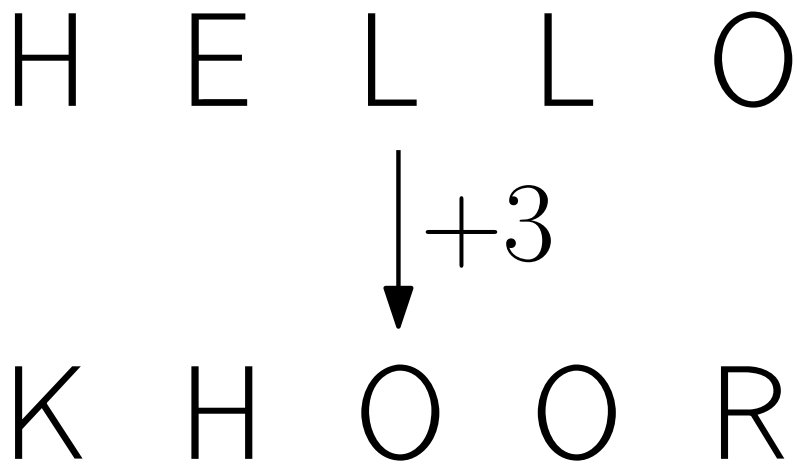


Beginnings of cryptography

Caesar's cipher



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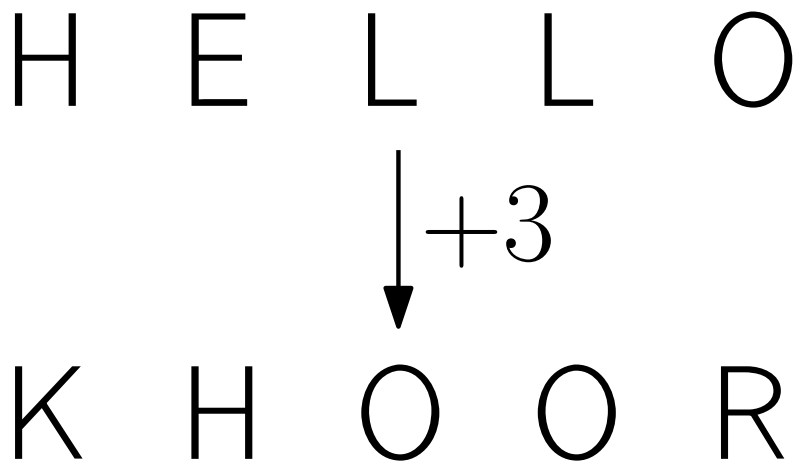

- Very insecure (even if shift is unknown)
- Symmetric cipher

Symmetric cryptography

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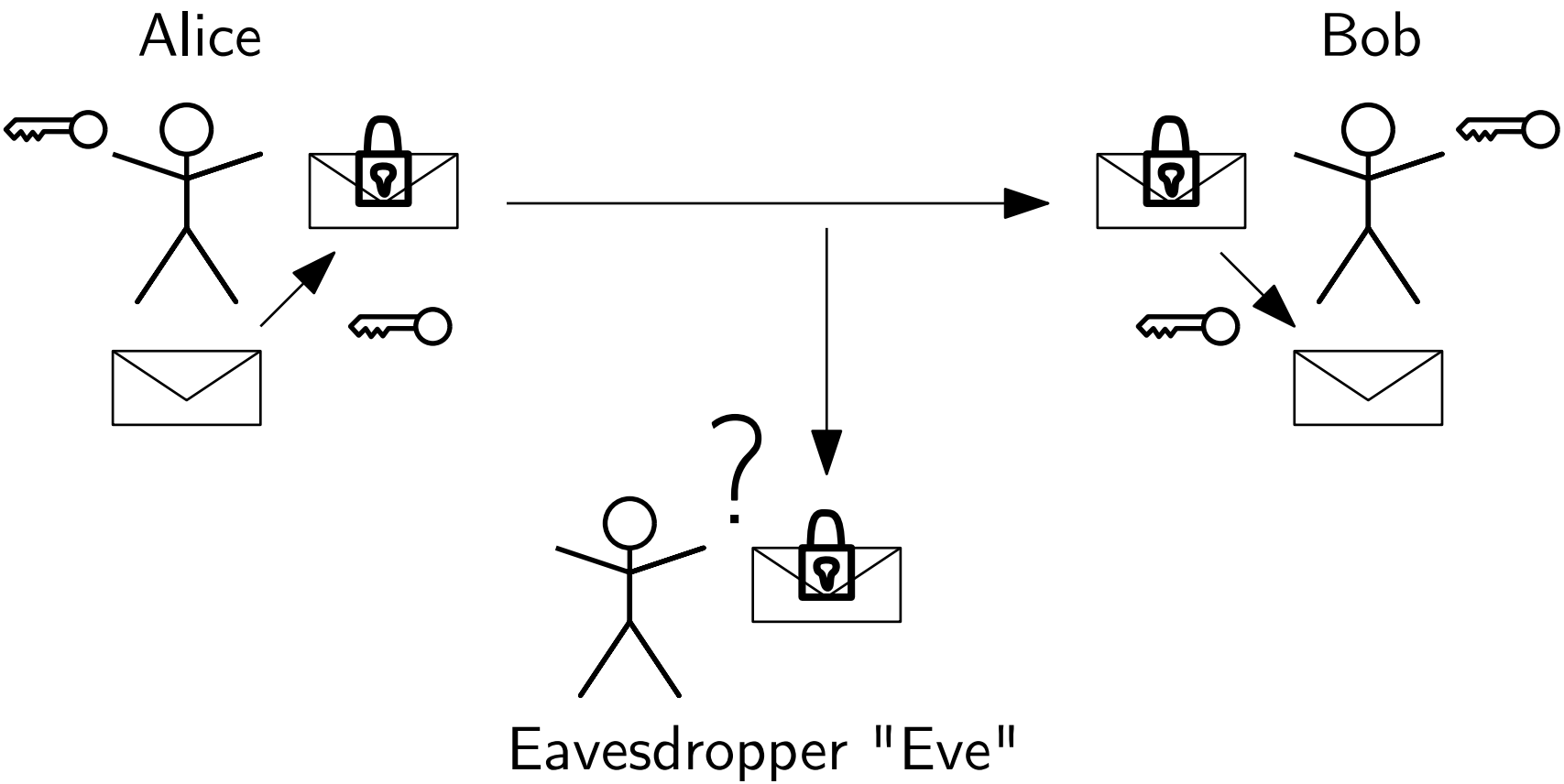
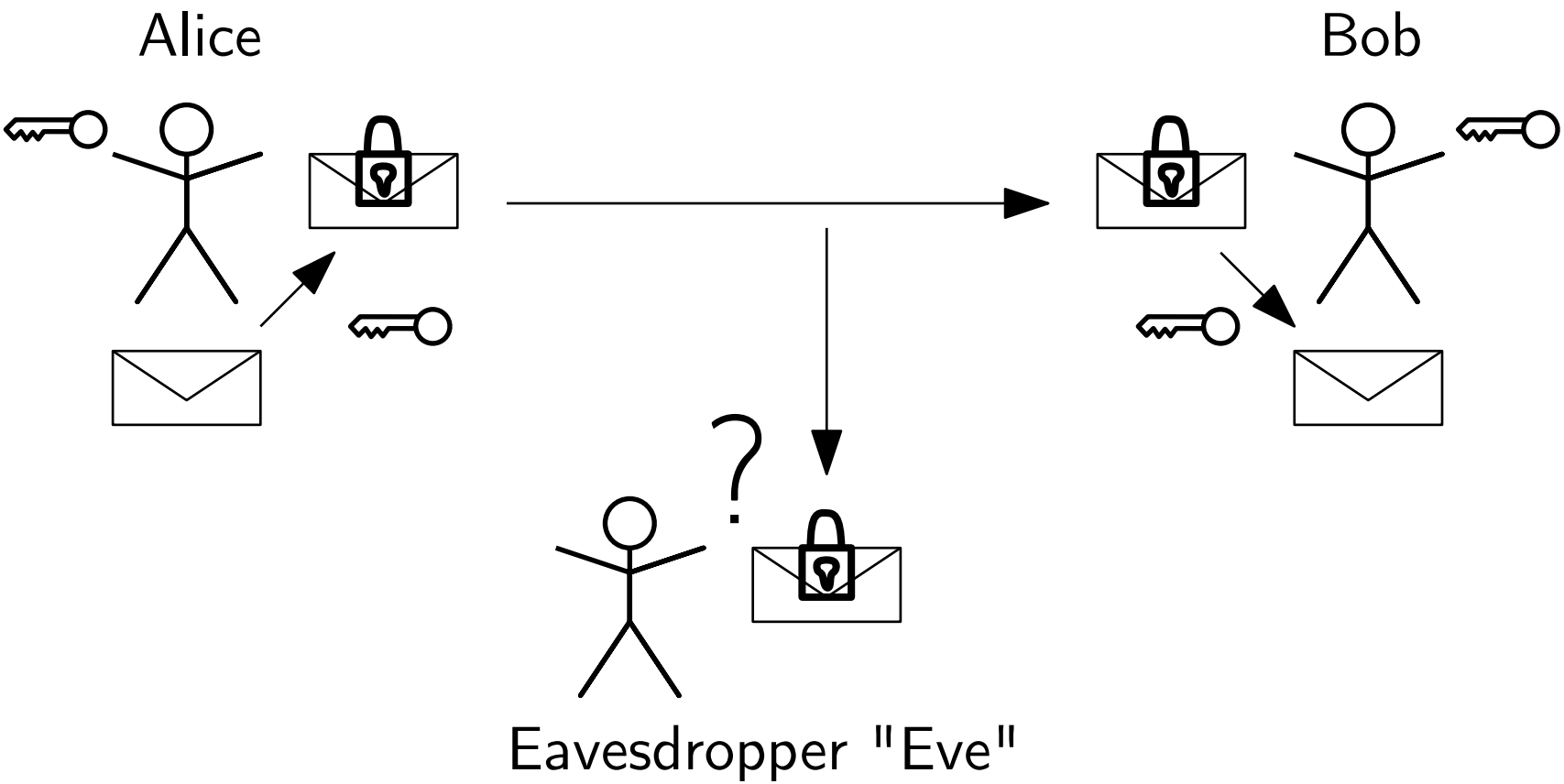


Symmetric cryptography



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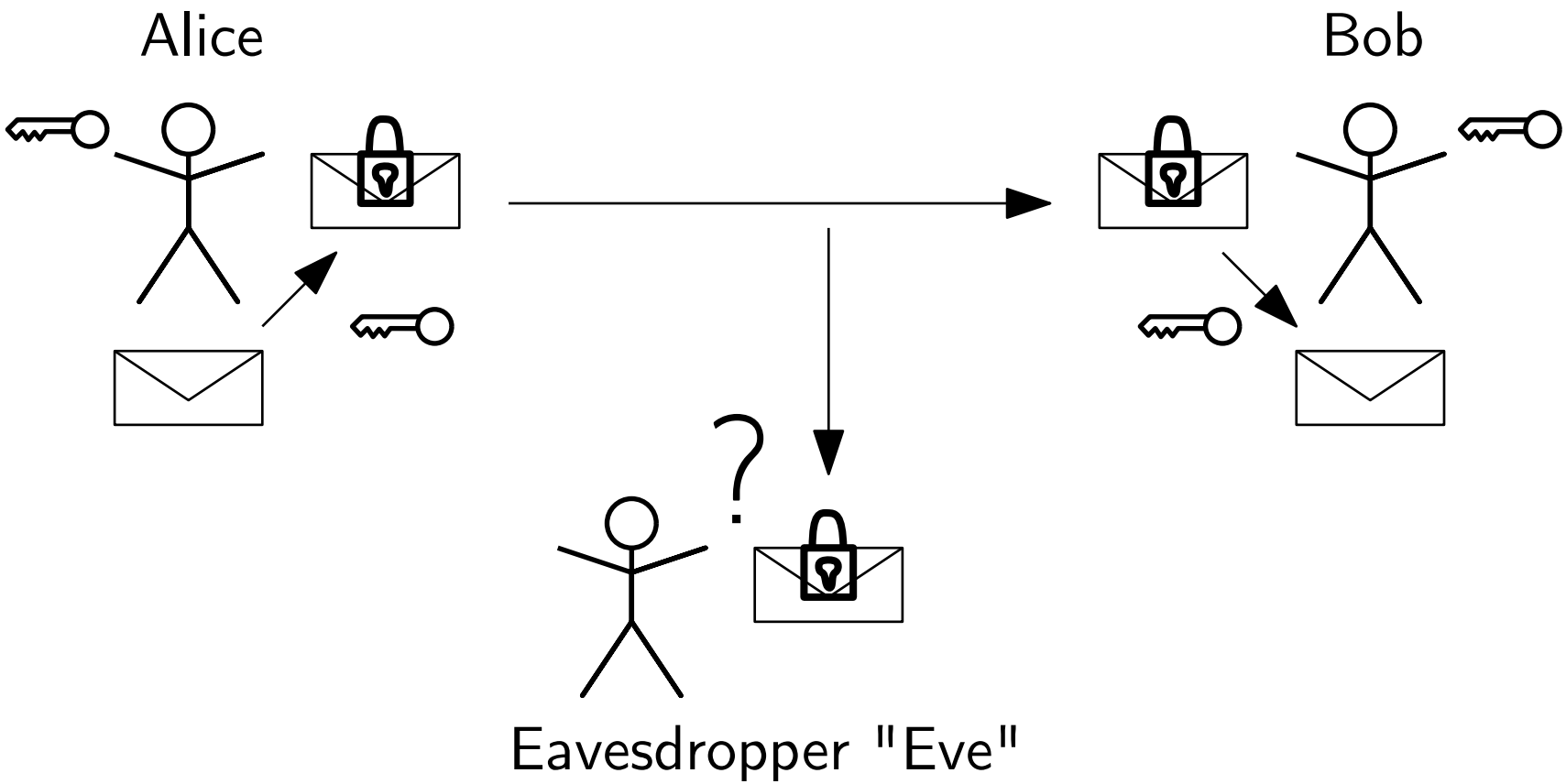
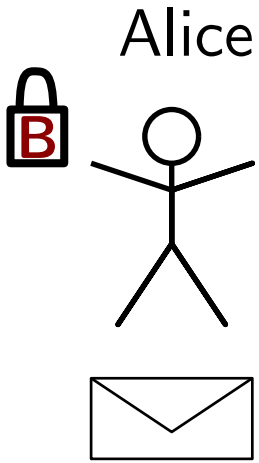
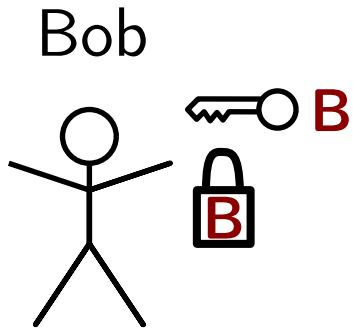


Problem: Key Exchange!

Asymmetric cryptography

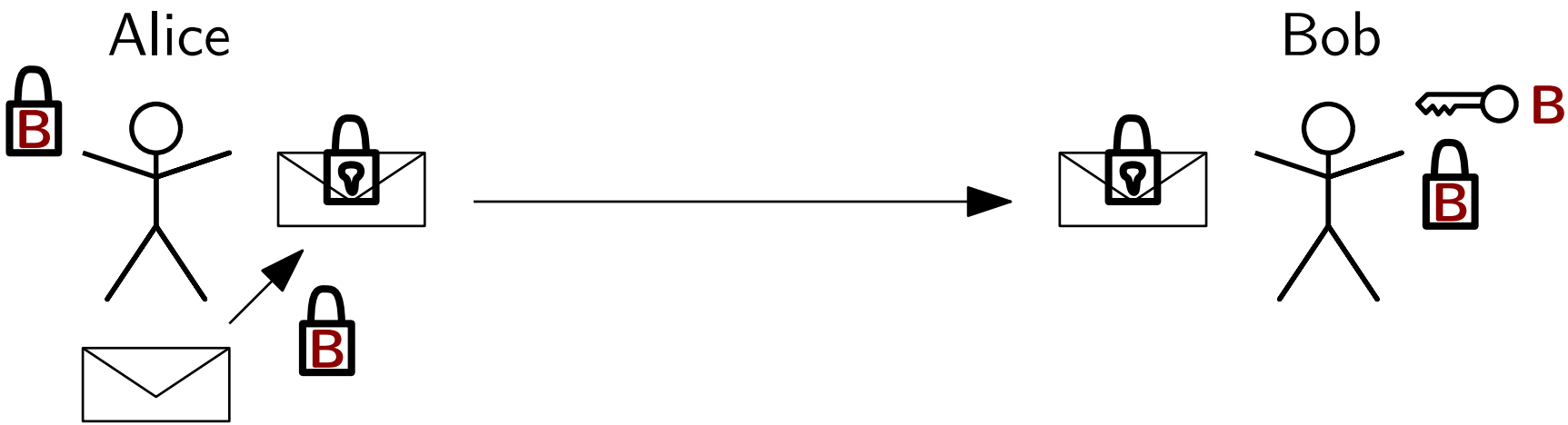




Private Key

Public Key (or "Lock")

Asymmetric cryptography



B Private Key

B Public Key (or "Lock")

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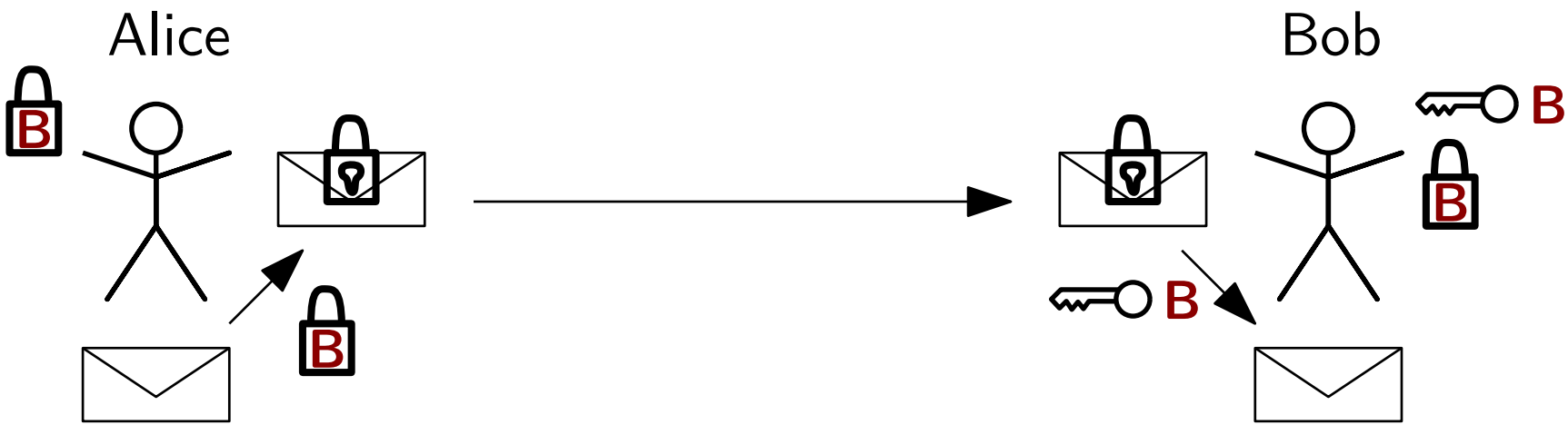

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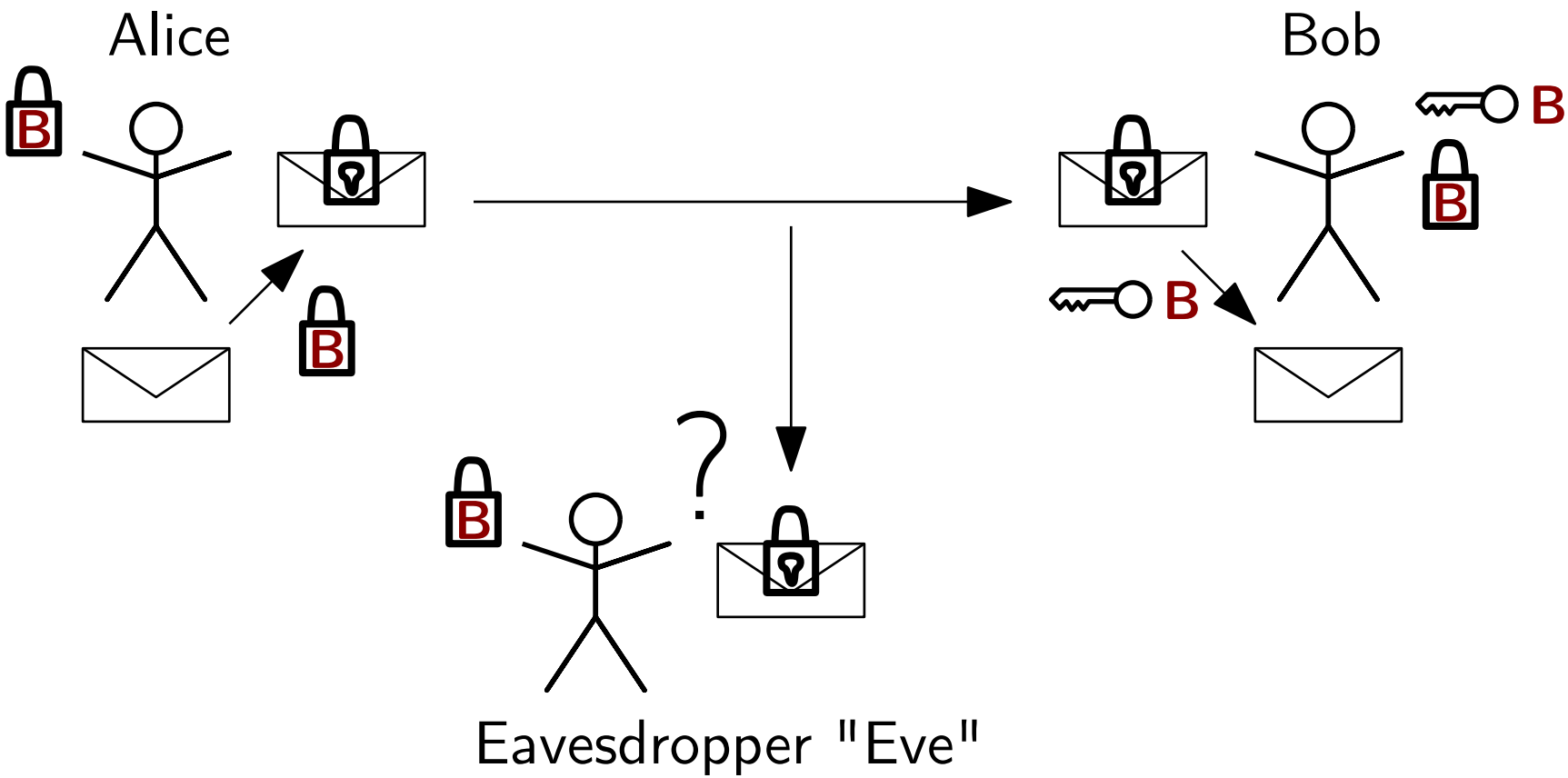

An issue in Public Key Crypto

- Symmetric cryptography can (in principle) be "perfectly secure"
- Asymmetric cryptography cannot

For all possible messages do

- Encrypt the message using the public key
- If the result matches the cipher, we are done

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e.g. all 1000-character sequences

there are $9.4 \cdot 10^{1414}$ *of them*

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- Usually problems with mathematical structure
- Currently: Prime factorization and discrete logarithm
- In the future: Quantum-computer safe problems