Bundesamt
für Sicherheit in der
Informationstechnik

Status Quo of Quantum Computing

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Information security

If a universal quantum computer pops up tomorrow.

Renders all currently deployed public-key cryptography useless

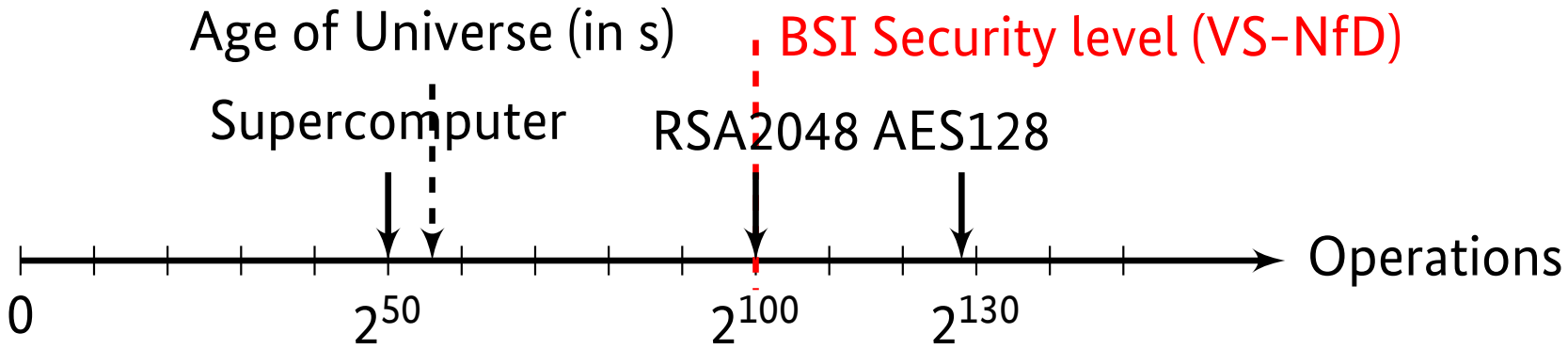
- RSA (’76), Diffie-Hellman (’76), ElGamal (’85), ECIES (2000)
- DSA (1991)
- ECC (since 1980s)

Nothing of the following remains

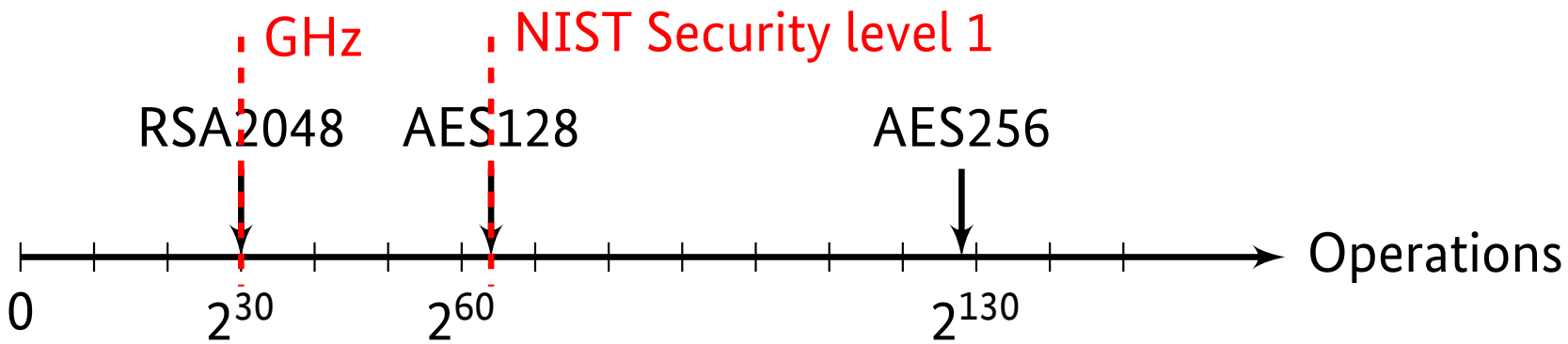
- Key exchange – „Store now decrypt later“
- Digital Signature
- Public-Key Encryption

Security level

Digital Computer



Quantum computer



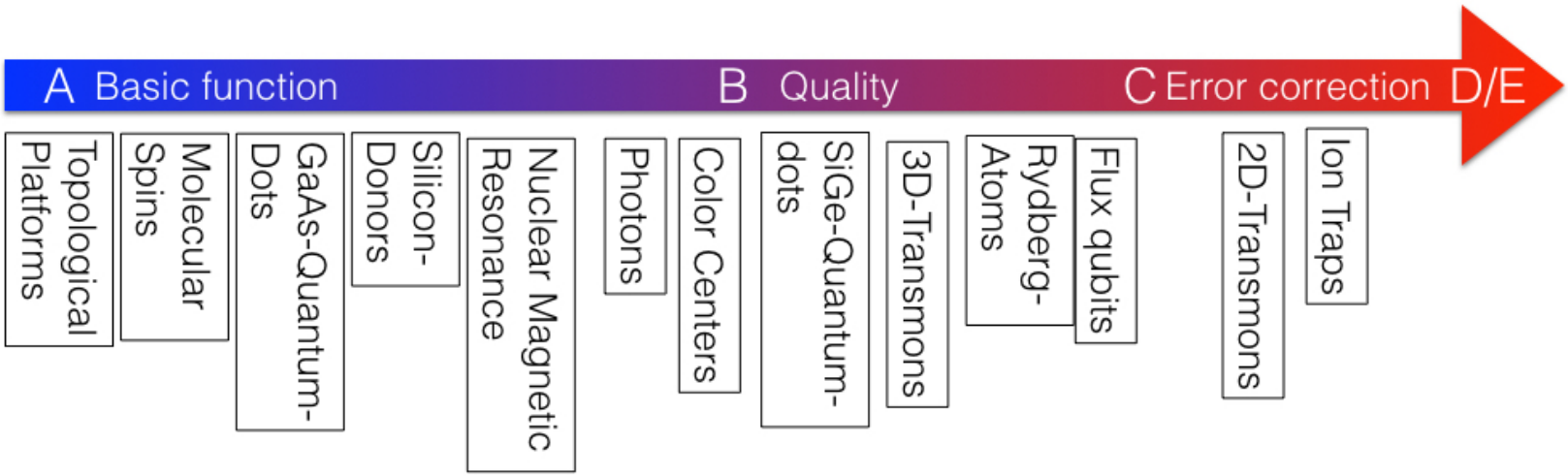
To the point

Central question

Do we expect a quantum computer that – including overhead coming from error correction – can solve a GHz problem?

Development status of quantum computers

A BSI funded study: Available under www.bsi.bund.de/qcstudie



Extrapolation (2D-Transmons + Quantum error correction):

Quantum (elementary) operations für RSA2048 $\approx 10^{15} \approx 2^{30} \cdot 10^{6}$

It’s alive!

Quantum as a Service (QaaS)

- Amazon Braket
- Azure Quantum
- IBM Quantum (Experience), e.g. 65 Qubit ibmq_manhattan (NISQ-Device)

BSI's positions

- Working hypothesis for high security applications:
  Cryptographically relevant Quantum Computers early 2030s
- Portfolio (BSI TR-02102-1):
  FrodoKEM, Classic McEliece, Hash-based Signatures
- Quantum Key Distribution:
  Only in hybrid mode with Post-Quantum Cryptography
- BSI-Recommendations "Migration zu Post-Quanten-Kryptografie'

Contact

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