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qtgroup
Quantum Technologies Group

PROTECTED BY THE LAWS OF NATURE.

Entanglement-based Quantum Communication

Lukas Helm, Head of Sales

05/2025

Quantum Technologies at a Glance

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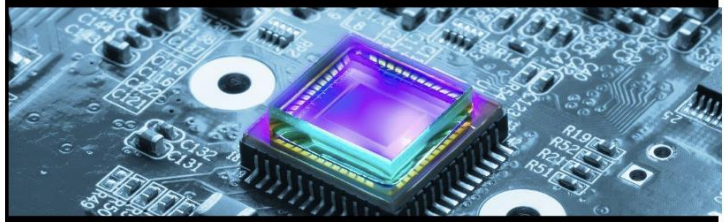
Quantum Computing

… uses quantum bits to perform calculations that are exponentially faster than classical computing. This includes machine learning, drug discovery, financial modelling and hacking of cryptographic systems using e.g. Shor's algorithm.

Quantum Communication

… uses the principles of quantum mechanics to transmit information in a secure and crack-proof way. Major application is Quantum Key Distribution ("QKD")/cryptography.

Quantum Sensing



… aims to measure physical quantities with higher precision and to surpass classical sensors' limits. Applications include imaging, navigation, and environmental monitoring.

Quantum Computer Use Cases

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- **Molecular Simulation**
  (e.g., materials science, drug discovery,…)

- **Optimizing complex systems**
  (e.g., logistics, financial models, traffic shaping)

- **AI & Machine learning acceleration**
  (e.g., faster training for specific models)

Quantum Computing is not a Small Effort

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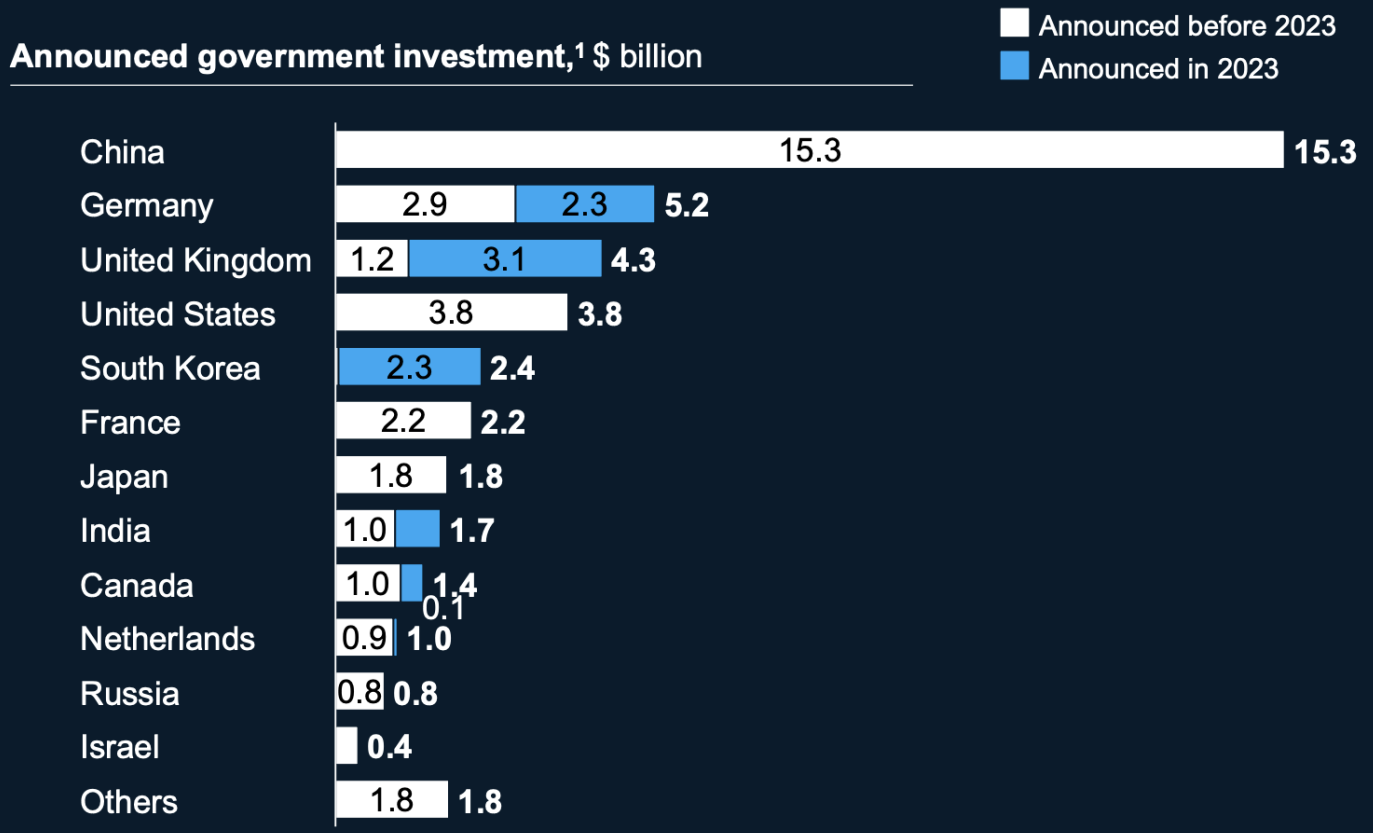
Global public investments in QT reached $42 billion in 2023.

Not exhaustive



Key insights

- While China and the United States previously dominated QT public investment, new announcements from Germany, the United Kingdom, South Korea, and India created a more diverse global QT development landscape in 2023
- While all 2023 announcements nearly doubled public funding for each country, South Korea and the United Kingdom significantly increased their funding levels
- Many public funding announcements included plans to attract private investment as part of overall program goals

[1]Total historic announced investment; timelines for investment vary by country.

Source: McKinsey analysis

Quantum Computing is not a Small Effort (2)

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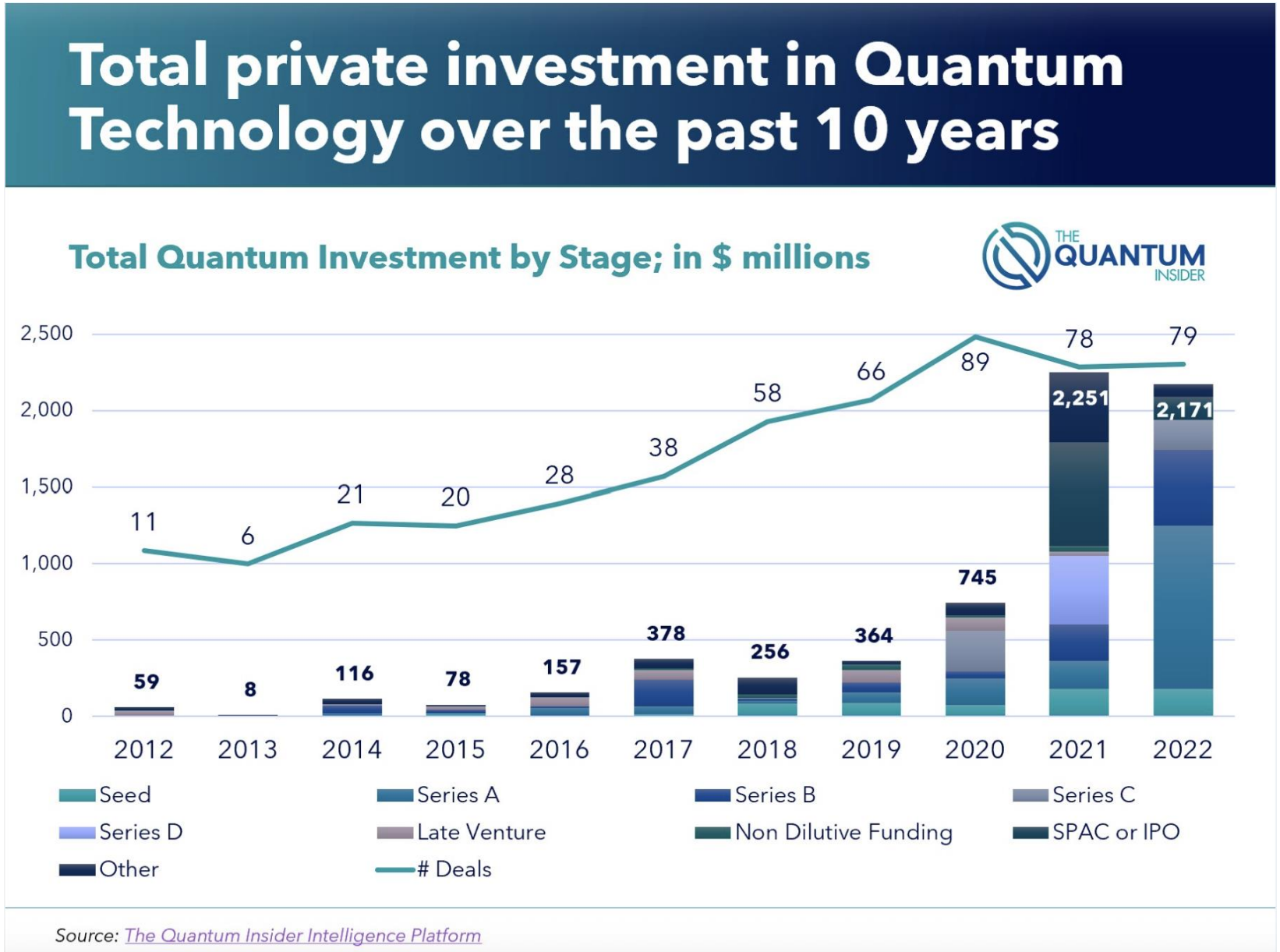
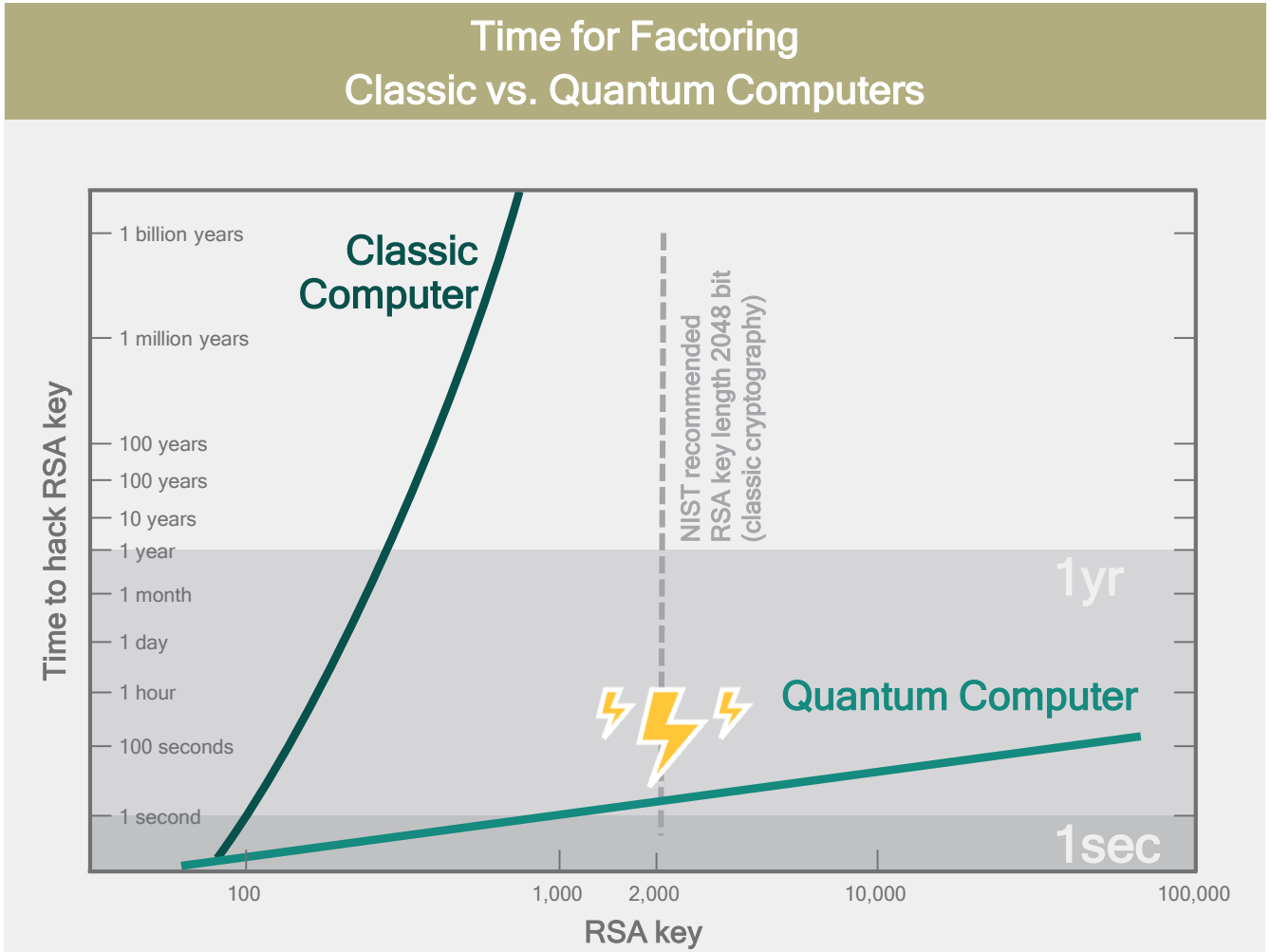


The Quantum Threat



Source: QI, Association for Computing Machinery

As soon as the first Quantum Computer is functional, RSA encrypted online data communication can be decrypted in real time.

Required: 4000 Qubits

Available 2025: ~100 Qubits

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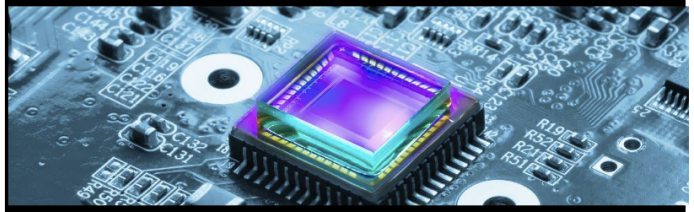

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The History of Cybersecurity

There is awlays a message and a key involved

500 BC – Greek cipher wheel

1944 AC – “Navajo Code Talker”

Algorithms are just a Temporary Patch, says Science

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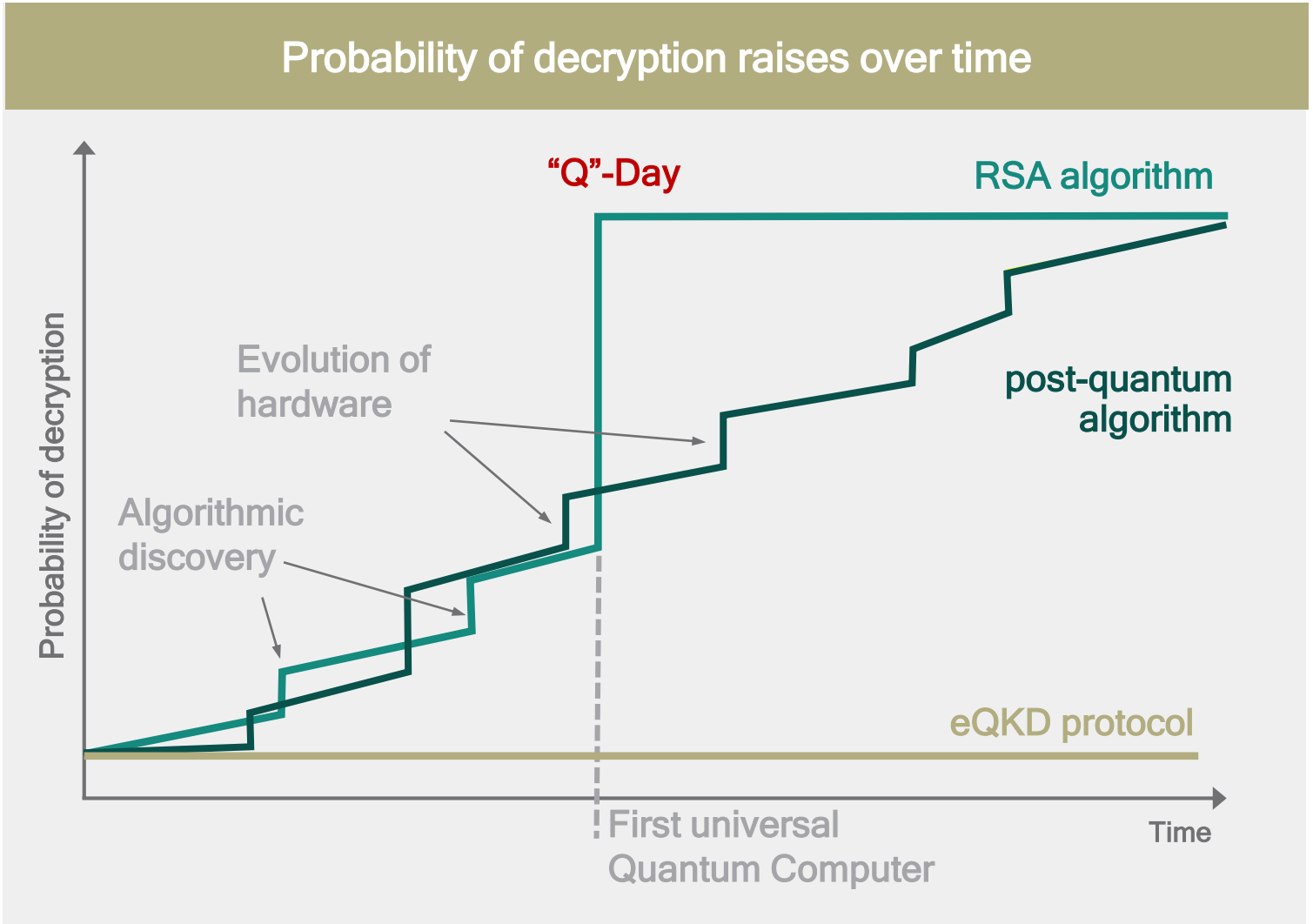

Science teaches us that only eQKD is

"UNTOUCHABLE"

Source: arXiv:2206.04078 [quant-ph]

From Entanglement to a Symmetric Key

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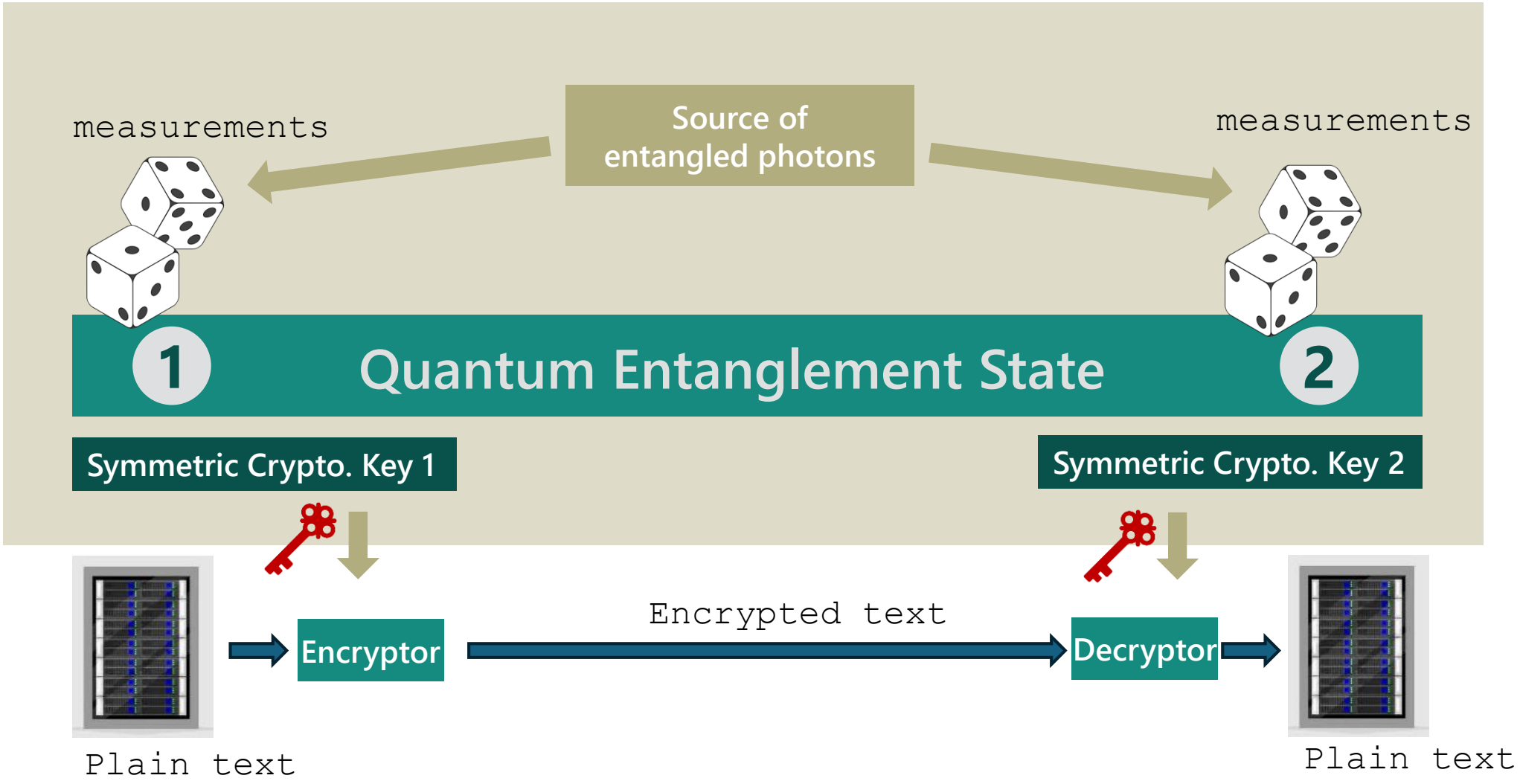
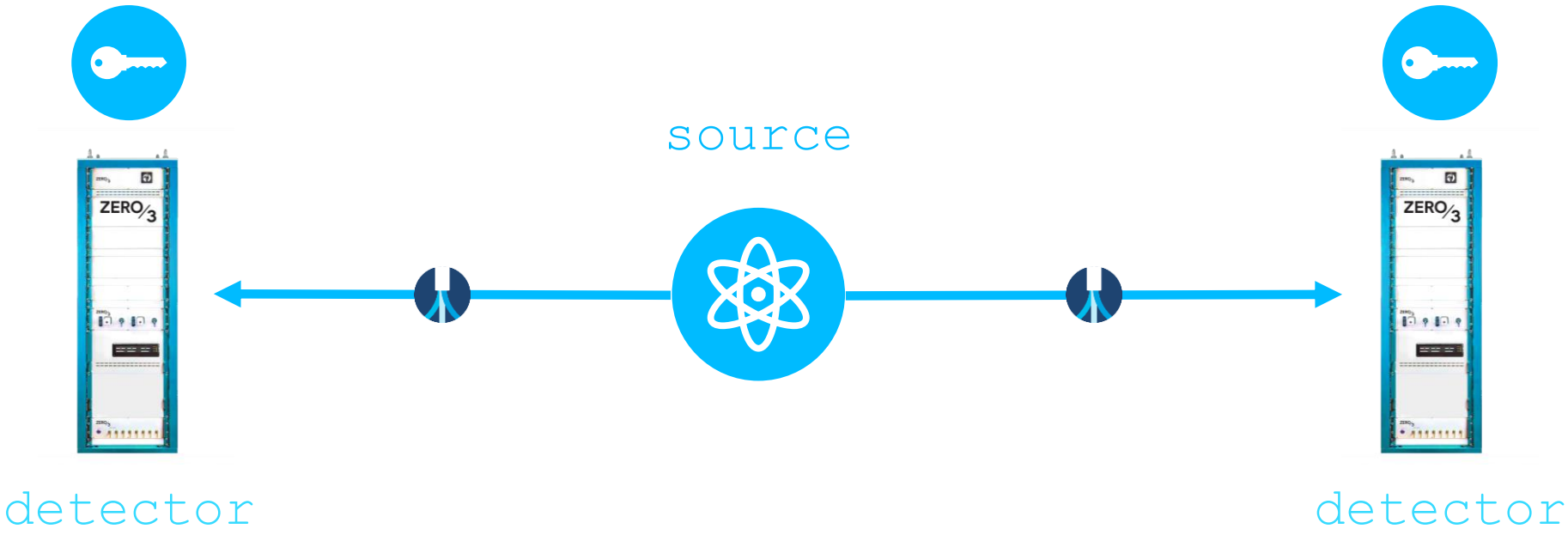


Entanglement-Based Quantum Key Distribution (eQKD) System



Photon Source and Detector Devices

Source S10:
19'', 2RU
<15kg
<100W

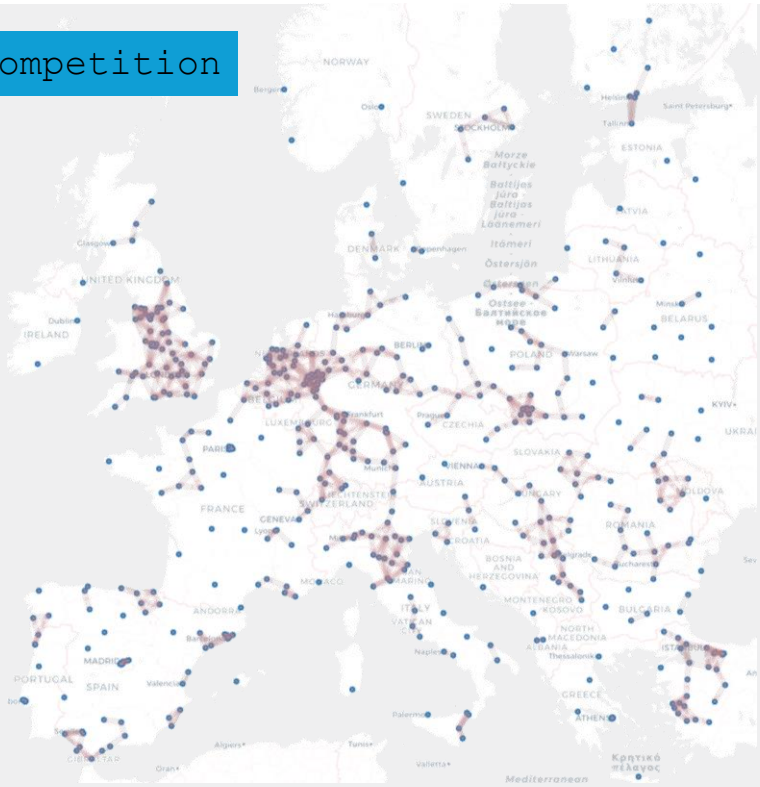
Detector D11:
19'', 20RU
<140kg
<2kW

Server C10:
19'', 1RU
<15kg
<100W

eQKD enables European Network at Long Distances

Link (max. 230km beeline)

zerothird can build a fully redundant network connecting major European cities using 1,258 links



Link (max. 100km beeline)

Competitors would need 678 additional secured points-of-trust to create the same network

Q-Crit (Quantum-Safe Critical Infrastructure) for Austria

Demonstrating **QKD** and **Data Encryption** over a **230 km** pilot line in the **Operational Infrastructure** of **ÖBB Infra.**

Q-CRIT AUSTRIA

Operational Technology Integration

- Seamless with existing Telco & IT infrastructure

Availability

- High uptime during 3-month pilot

Geographically Distributed Assets

- QKD technology optimized for long-distance links

Implementation Security

- Ultra-secure, entanglement-based QKD

IT Security & Threat Protection

- Threat modelling, System Hardening & Crisis Resilience

qtlabs Quantum Technology Laboratories · ZERO/3 · ÖBB INFRA

Team

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THANK YOU!

Lukas Helm
Head of Sales
lukas.helm@zerothird.com