ЕВРОПЕЙСКИ СЪЮЗ
ЕВРОПЕЙСКИ СТРУКТУРНИ И ИНВЕСТИЦИОННИ ФОНДОВЕ

CENTER OF COMPETENCE QUASAR

ОПЕРАТИВНА ПРОГРАМА НАУКА И ОБРАЗОВАНИЕ ЗА ИНТЕЛИГЕНТЕН РАСТЕЖ

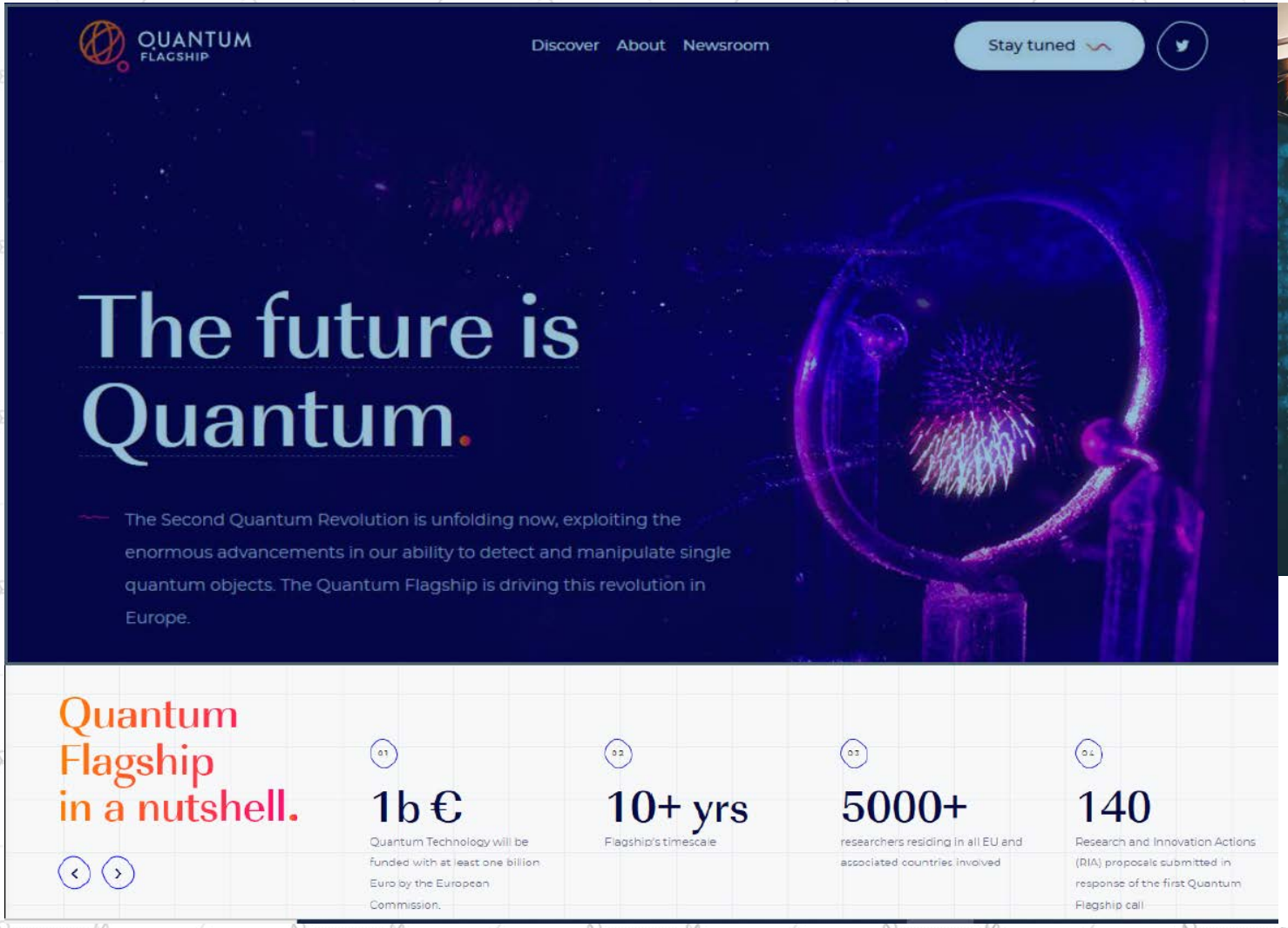
Quantum Communication Networks: Revolutionising the Future of Technology

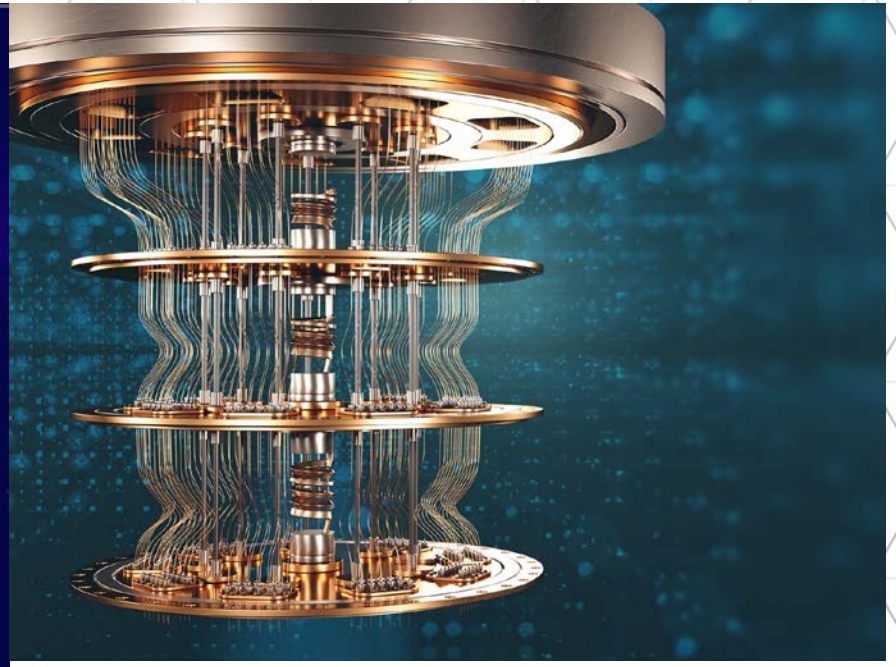
The Bulgarian National Plan

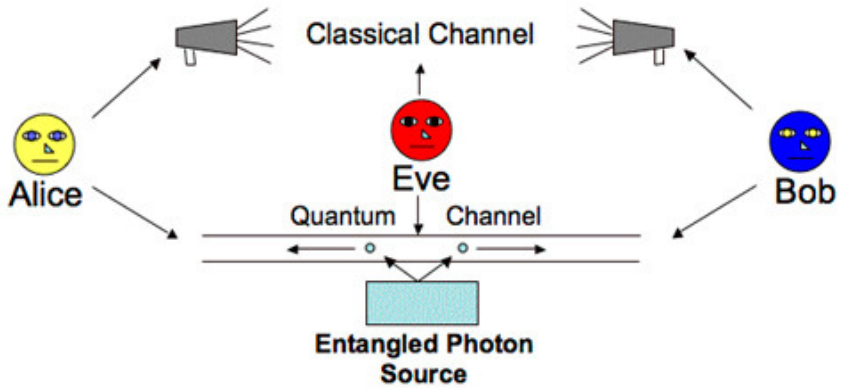
Assoc. Prof. Lachezar Georgiev
The Bulgarian Representative in the EuroQCI Board

11 January 2024, Sofia, Bulgaria

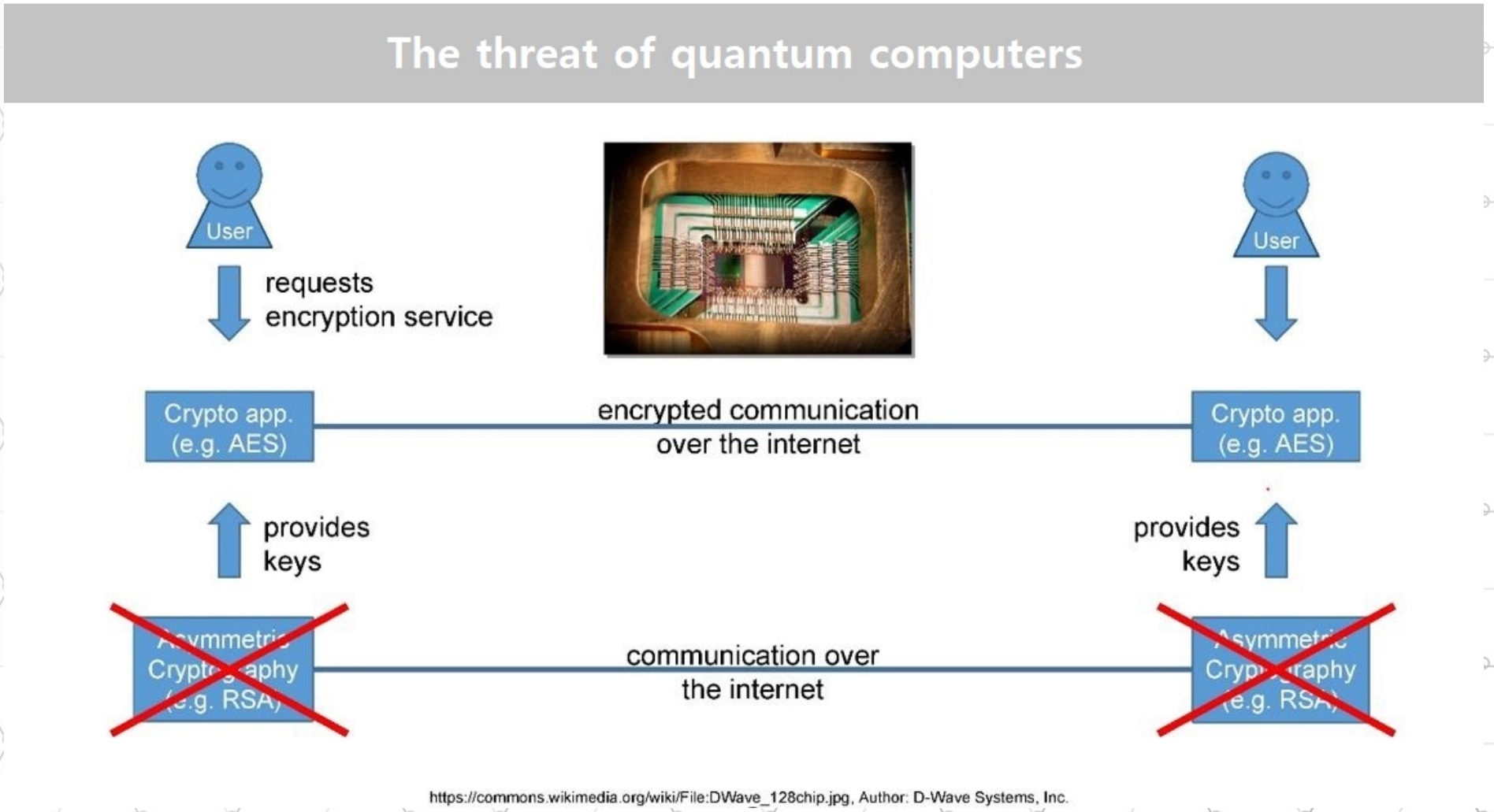
The Second Quantum Revolution







What is Quantum communication?



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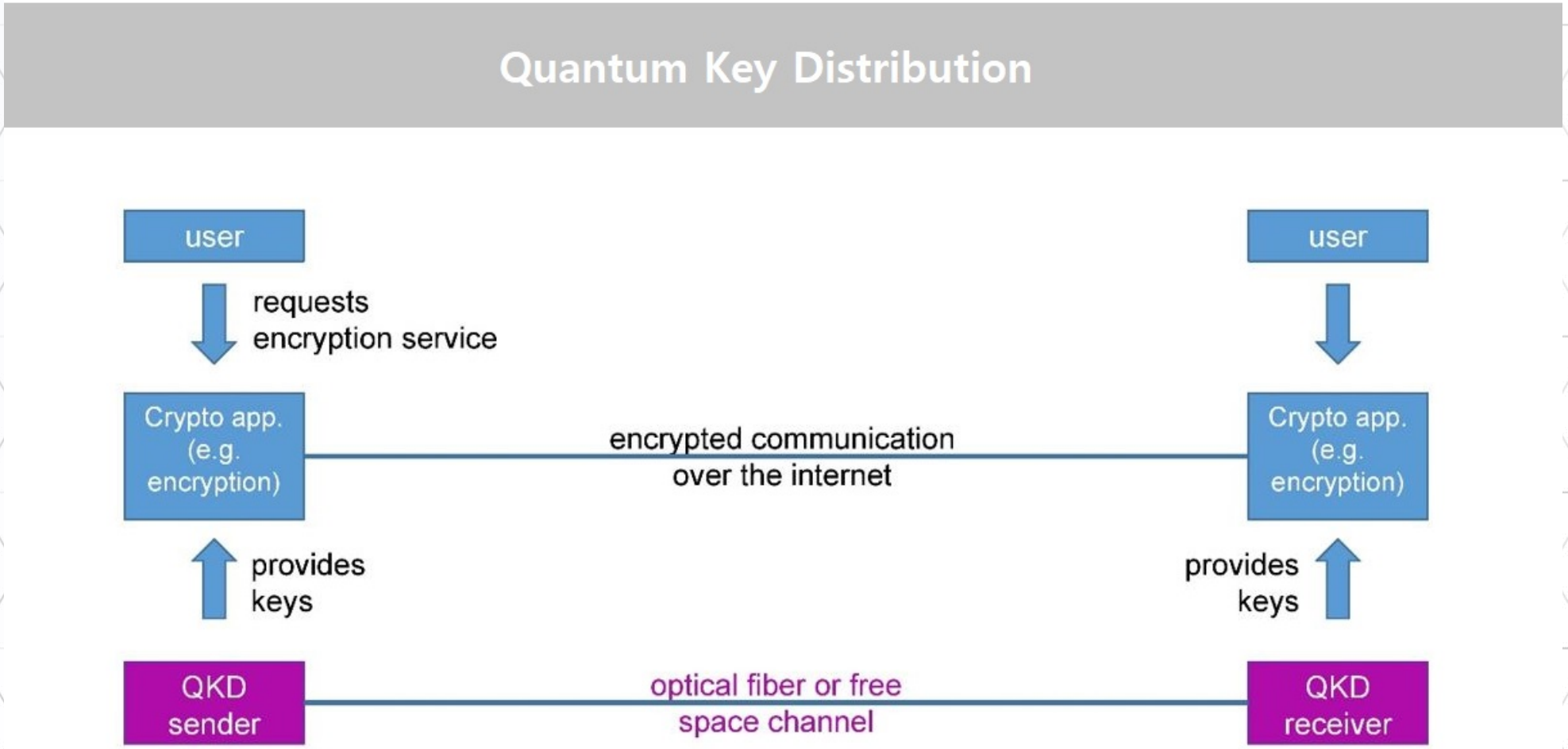
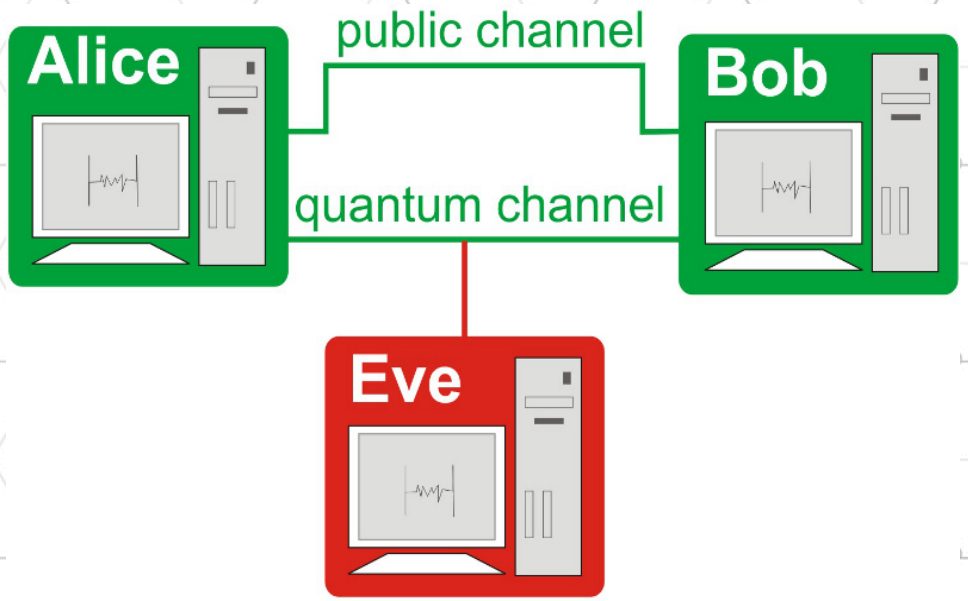


Quantum communication

New generation of communication infrastructure

- ✓Sharing of quantum keys is secure against quantum computers
- ✓Unhackable data transmission with eavesdropping disturbance detection
- ✓Uses quantum uncertainty relations, quantum entanglement and superposition for information encoding and transmission
- ✓Unprecedented security of information transmission



Why build QCI[1]?

The threat to our cybersecurity from quantum computers is real !

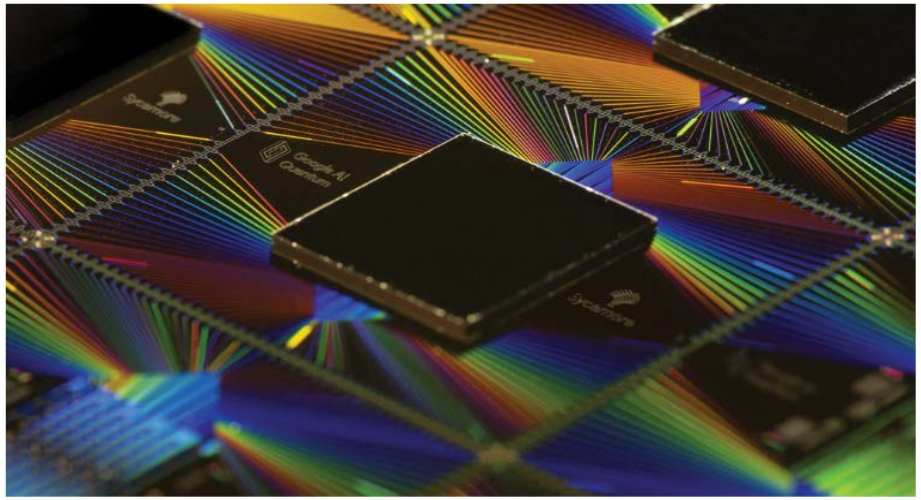
In 2019 Google performed a quantum calculation within 200 seconds which would take a supercomputer 10 000 years.

In December 2020 a Chinese quantum computer demonstrated supremacy of 10^{14} times compared to a classical supercomputer.

YEAR IN REVIEW QUANTUM PHYSICS

Google claimed quantum supremacy in 2019 — and sparked controversy

Competitors questioned whether the milestone had truly been achieved



Google's quantum computer Sycamore performed a calculation that would take thousands of years with a classical supercomputer, researchers claimed in 2019. An array of quantum computer chips is shown.

GOOGLE

Source: ScienceNews.org

[1]Quantum Communications Infrastructure

Why build QCI[1]?

The threat to our cybersecurity from quantum computers is real !

In Dec 2022 researchers from China claim to have found a way to break 48-bit RSA encryption using a 10 qubit quantum computer.

372 qubits are needed to break 2048-bit RSA (by 2025?)

Time needed on classical supercomputer = Age of the Universe

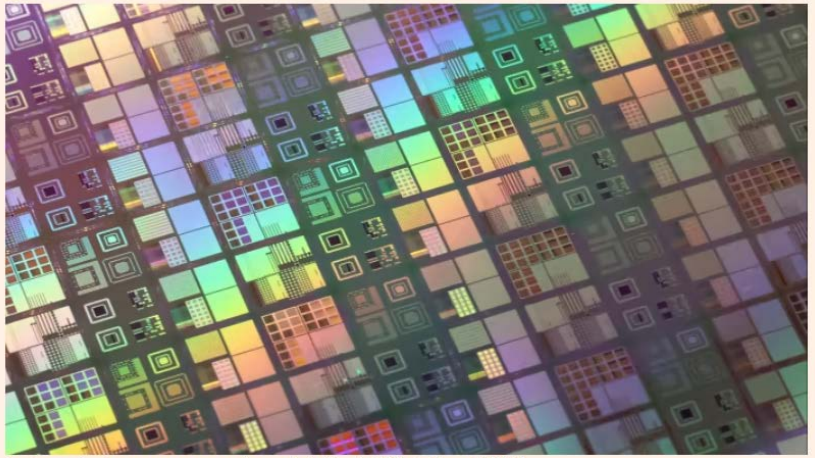
On quantum computer (Shor's algorithm) = hours or days

Title: "Factoring integers with sublinear resources on a superconducting quantum processor"

Quantum technologies + Add to myFT

Chinese researchers claim to find way to break encryption using quantum computers

Experts assess whether method outlined in scientific paper could be a sooner-than-expected turning point in the technology



A silicon wafer of quantum computer chips made by Hitachi © Yoshio Tsunoda/AFLO

Richard Waters JANUARY 5 2023 143

Source: arxiv.org, ft.com

[1]Quantum Communications Infrastructure

QKD sceptics: “Isn’t it too early?”

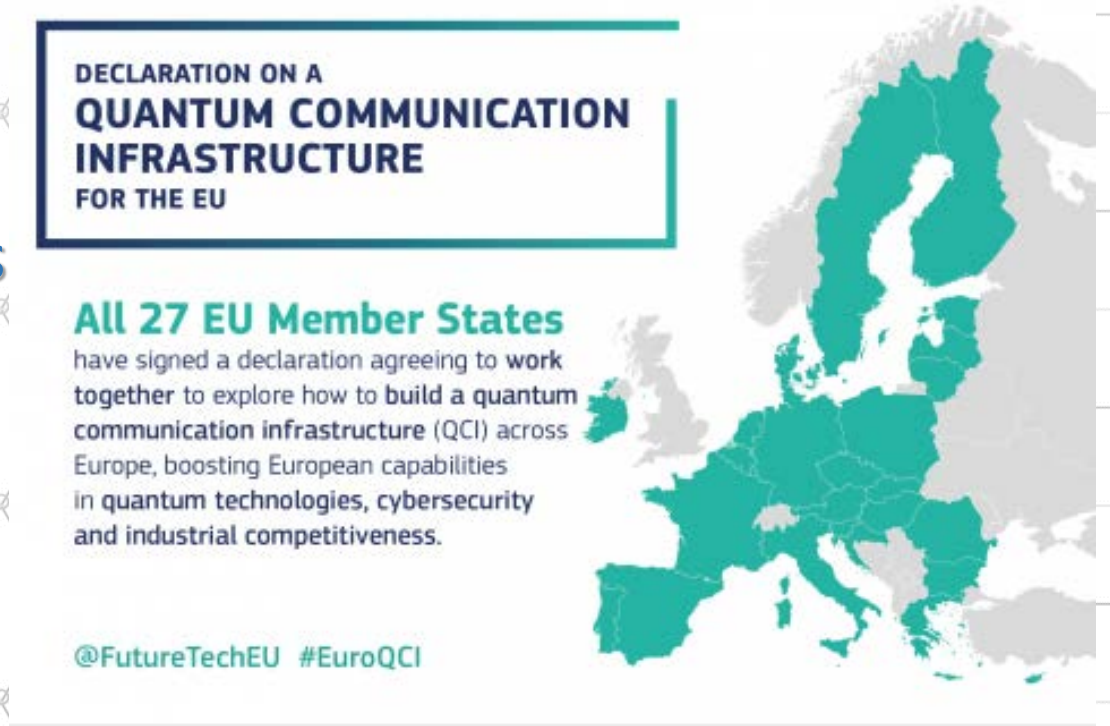
HNDL attack

Harvest Now, Decrypt Later (HNDL) attack

What is EuroQCI[1]?

A pan-EU initiative to build quantum internet within EU

- ✓The declaration is signed by all member states
- ✓To span across all EU territories
- ✓Integration of terrestrial and space QCI segments
- ✓All systems and components to be build in EU
- ✓Full readiness by 2027



[1]European Quantum Communications Infrastructure

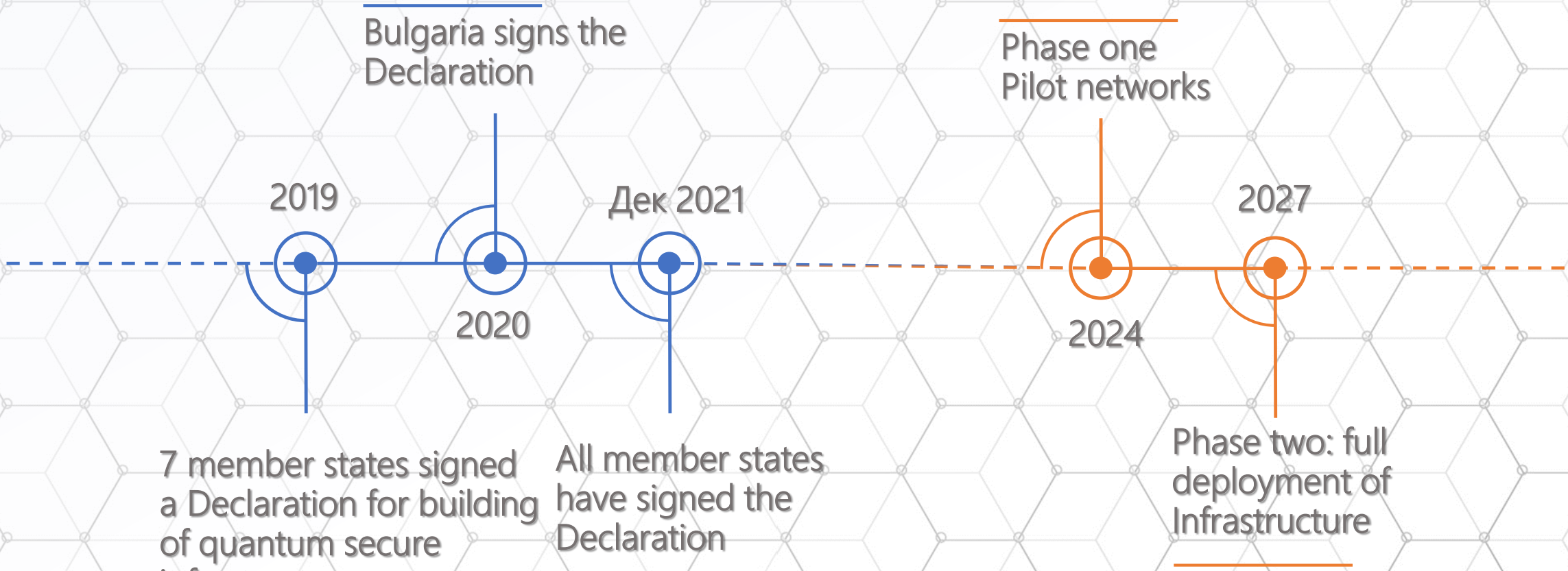
Centre of Competence QUASAR
the national coordinator within EuroQCI

In 2020 Centre of Competence QUASAR is officially selected to represent Bulgaria within the EuroQCI initiative by the Bulgarian government and the European commission

Centre QUASAR is currently implementing phase one of the Bulgarian national plan (2023 – 2025)

Signing by the Deputy Minister of Education and Science in 2020 Karina Angelieva and EU Commissioner Thierry Breton

The EuroQCI initiative - Timeline



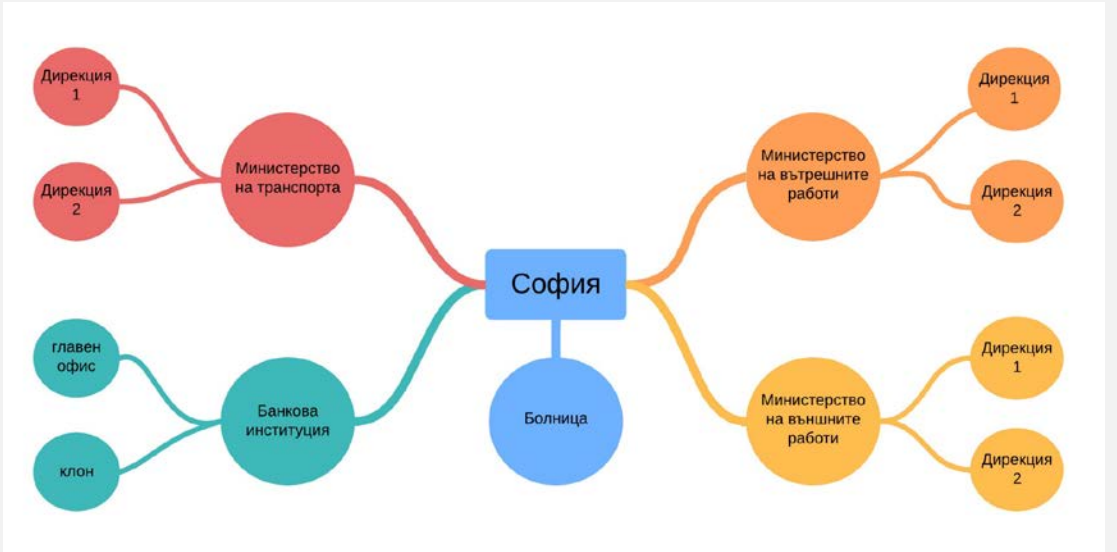
First phase (2023-2025) in Bulgaria

Requirements: Pilot quantum communication networks combining the best of classical and quantum technologies

1. Pilot networks in 3 public bodies:
   3 ministries
   1 banking institution

2. Quantum secure link between Sofia and the border point with Greece – Kulata which is a distance of 280km. (Trusted Nodes)

The Bulgarian national plan:



Second phase (2024-2027) – goals

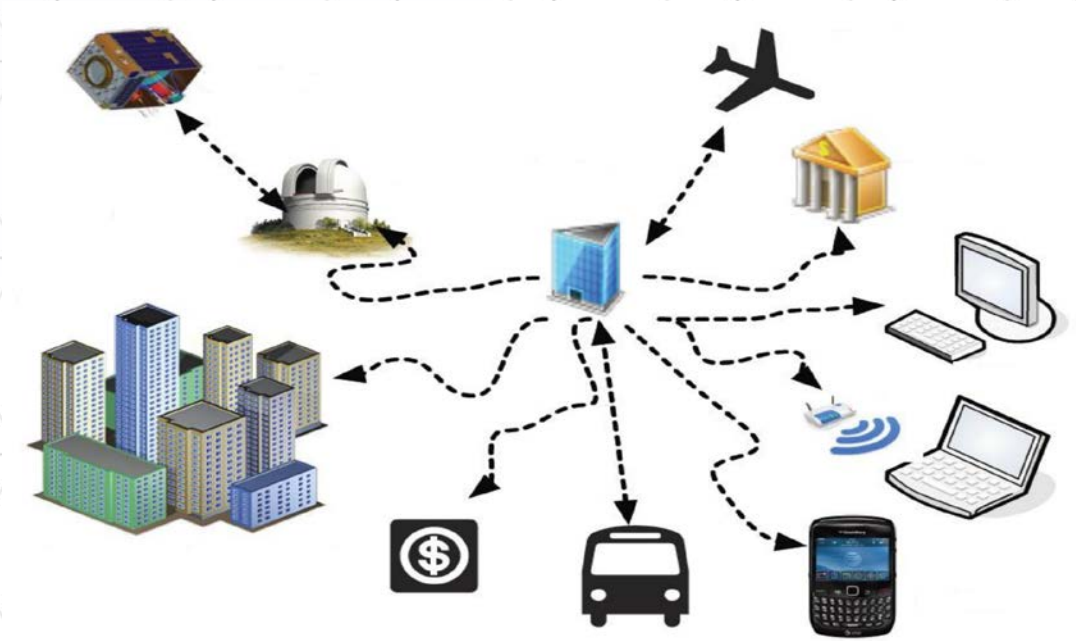
Full deployment of terrestrial and space quantum communication infrastructure and internet across EU

Aims for a successful second phase:

1. Full deployment of terrestrial segment of EuroQCI including the optical ground stations (OGS) which are the connections to the space segment
2. Deployment of the first generation space segment with Low Earth Orbit (LEO) satellites and Security Operational Centre for testing and validation of orbital systems
3. Deployment of the second generation of the space segment in 2025-2026 incl. MEO and GEO satellites and their interconnectors with LEO satellites and the EDRS relay system

Why is the EuroQCI initiative important for Bulgaria?

- Quantum communications is a new technology which requires adaptation of our public institutions, industry and the business
- Being part of EuroQCI gives us access to the European Space Agency QCI satellites and to the latest knowledge of our EU partners
- EuroQCI initiative guarantees the sovereignty and strategic autonomy of the EU and Bulgaria in the field of communications



Threatened and defended sectors

1. E-government
2. Interior and Exterior security
3. Electricity supply
4. Transport
5. Healthcare
6. Financial services
7. Insurance
8. Telecom operators
9. Public and private sectors which store and deal with sensitive information

Personal information

The banking system

Healthcare patient data/genome

Military infrastructure and communication

Electricity supply/distribution system

Critical infrastructure

Public institutions

Classified information in segregated QCI networks

Corporate secrets and information

The Bulgarian National Plan - training

During the first phase:

- ✓ Training for up to 120 people from public and private institutions
- ✓ The industry to participate in demonstrations, conferences and webinars
- ✓ Development of a National Roadmap for Quantum-Communication Infrastructure 2024 – 2027

Focus of the training courses:

Introduction of the new technology
Building QKD awareness
Implementation and support of such networks
Improve research capabilities

Applying for the courses:

Follows us on: www.news-quasar.bg
Applications to be opened in second part of 2023

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Thank you for your attention

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