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Post Quantum Cryptography and Trust services

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Agenda

- What is Post Quantum Cryptography
- What challenges do we face
- Services and solutions will be affected
- What are the consequences
- How can we prepare
- Impact on business

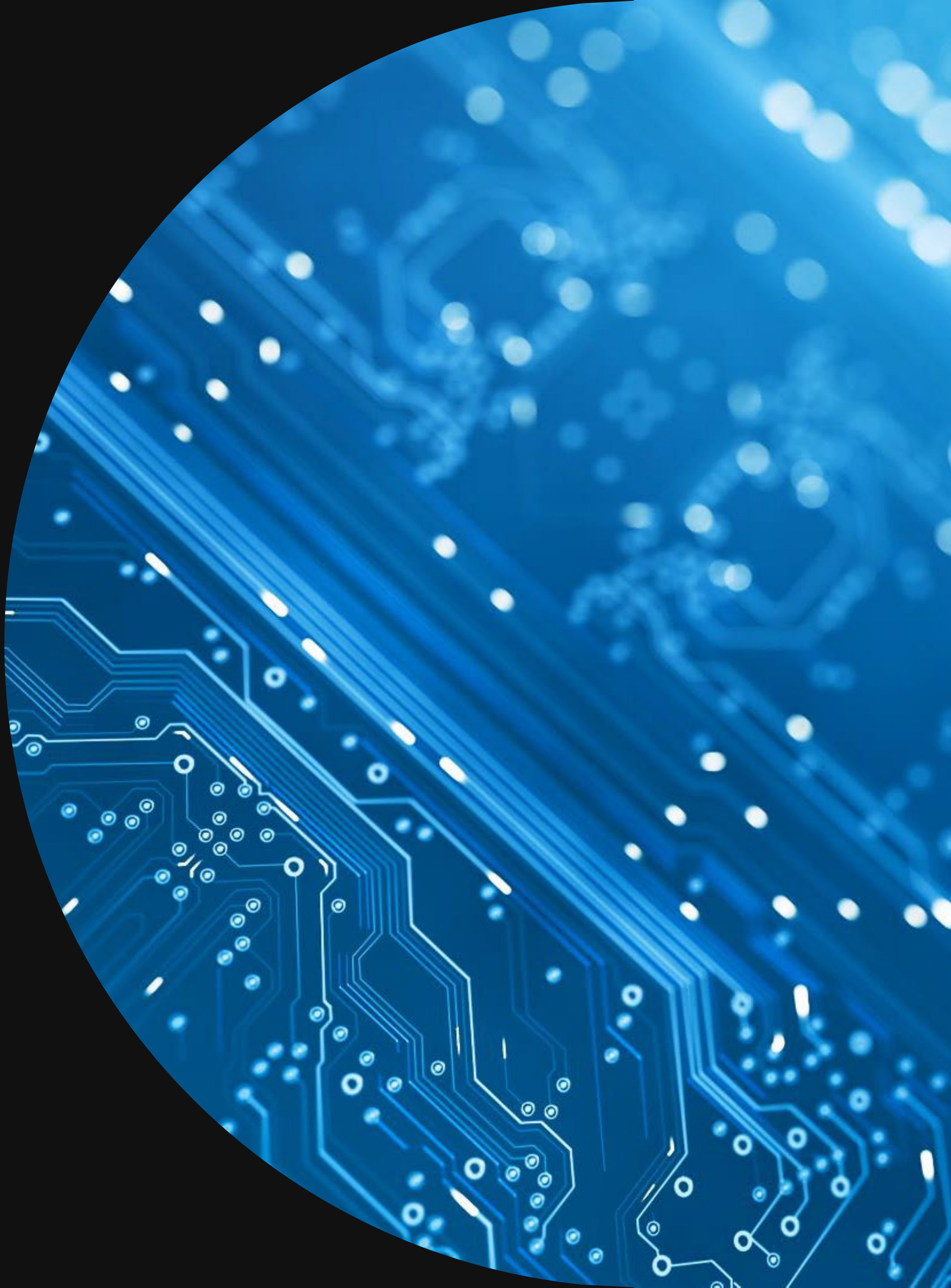
- Q&A

What is Post Quantum Cryptography?

What is quantum computing?

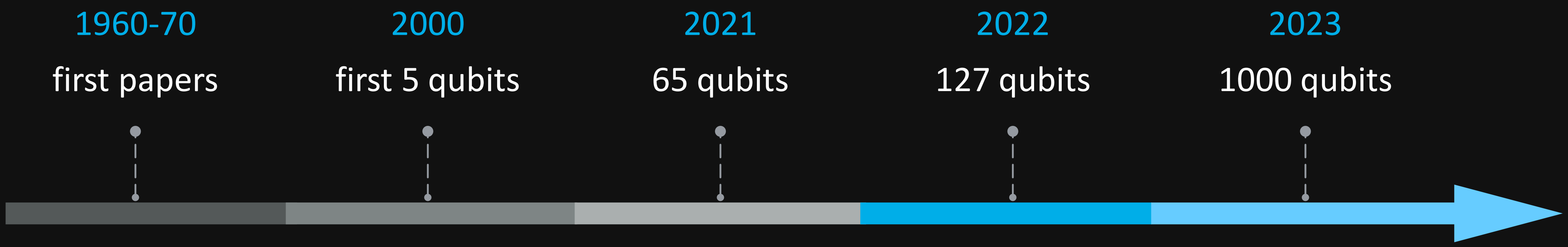
Computers that use quantum state of matter called superposition (and qubits) to conduct large scale calculations

- IBM
- Google
- Microsoft
- D-Wave
- Intel



What is quantum computing?

Idea of quantum computers is not new



1960-70 first papers

2000 first 5 qubits

2021 65 qubits

2022 127 qubits

2023 1000 qubits

Certain algorithms and mathematical equations are computed faster than on traditional computers

What is quantum computing?

What is the impact of QC?

Quantum computer will allow to perform almost instantly or greatly reduce computing time of certain algorithms necessary for cryptoanalysis of todays cryptography standards

Grover's algorithm
– symmetric ciphers
(like AES)

Shor's algorithm
– asymmetric ciphers
(like RSA, ECC)

What is quantum computing?

What is the impact of QC?

- There is another use for quantum computers

Physics

Chemistry

Medicine

AI

What challenges do we face?

What challenges do we face?

Security: confidentiality, integrity, proof of origin

- How long should data be confidential
  - → 3 years?
  - → 7 years?
  - → Maybe more?
- Proof of origin
- Proof of integrity

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Services and solutions will be affected?

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Services and solutions will be affected

Who should be afraid?

- Everyone – every service and device using PKI
- Potential attacks may influence nearly every cryptographic implementation that uses RSA or ECC algorithms
- For symmetric algorithms longer keys should be enough to provide security
- Hash functions will not be affected

Services and solutions will be affected

Who should be afraid?

- TLS – Transport Layer Security
  - → Confidentiality of data exchange
  - → Traffic scanning and collecting for future decryption

Services and solutions will be affected

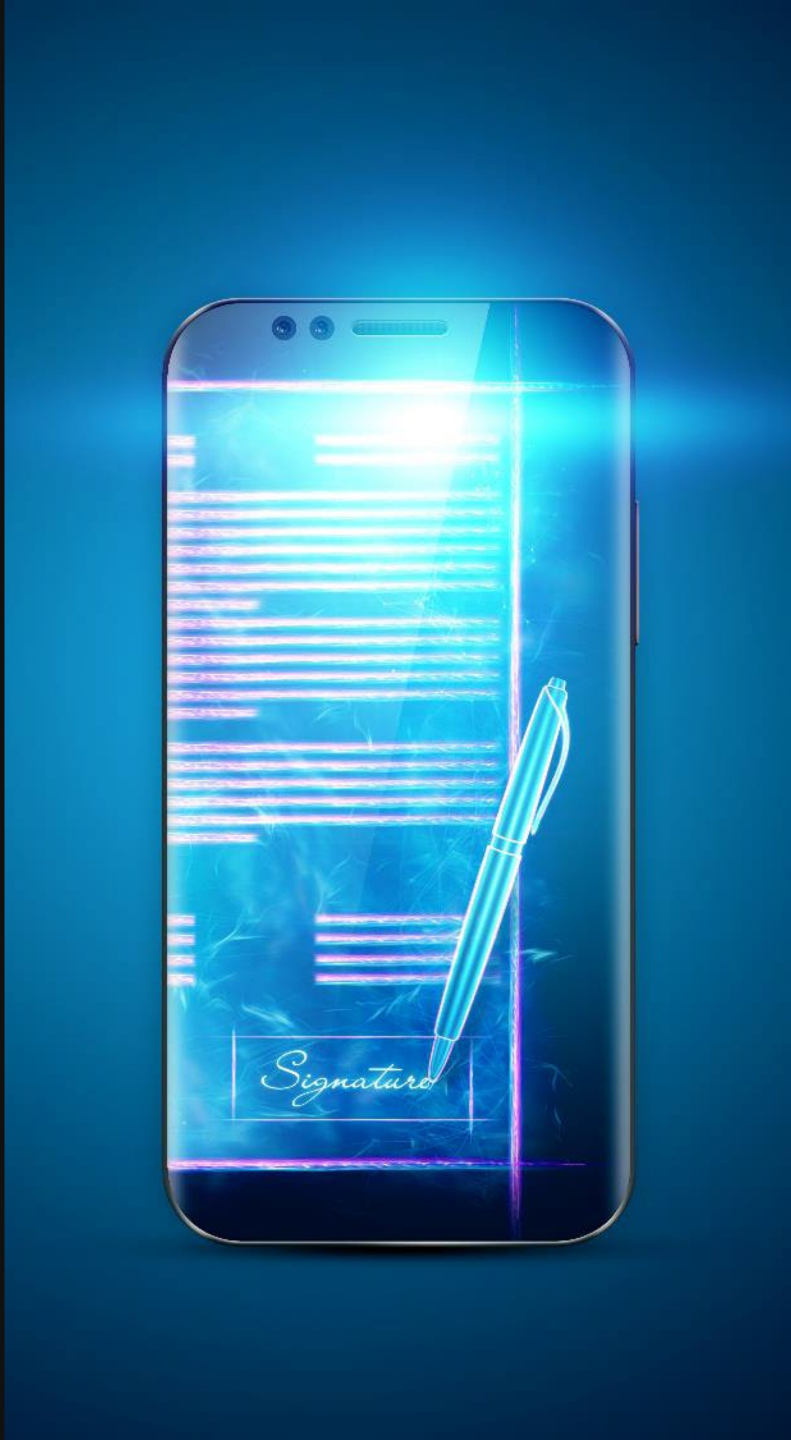
Who should be afraid?

Trust services providers:

- Long term certificates
- Documents archiving
- Signatures
- Other services

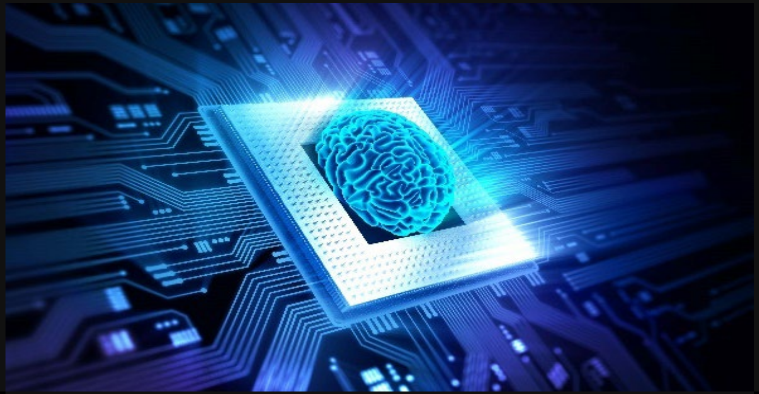
Consequences:

- Compromisation of signatures
- Loss of integrity
- Loss of proof of origin



Services and solutions will be affected

Who should be afraid?



Other services:

- IoT
- Cars
- Smartcard solutions
- Other devices
- eID systems

Consequences:

- Loss of device authentication mechanisms
- eID compromisation

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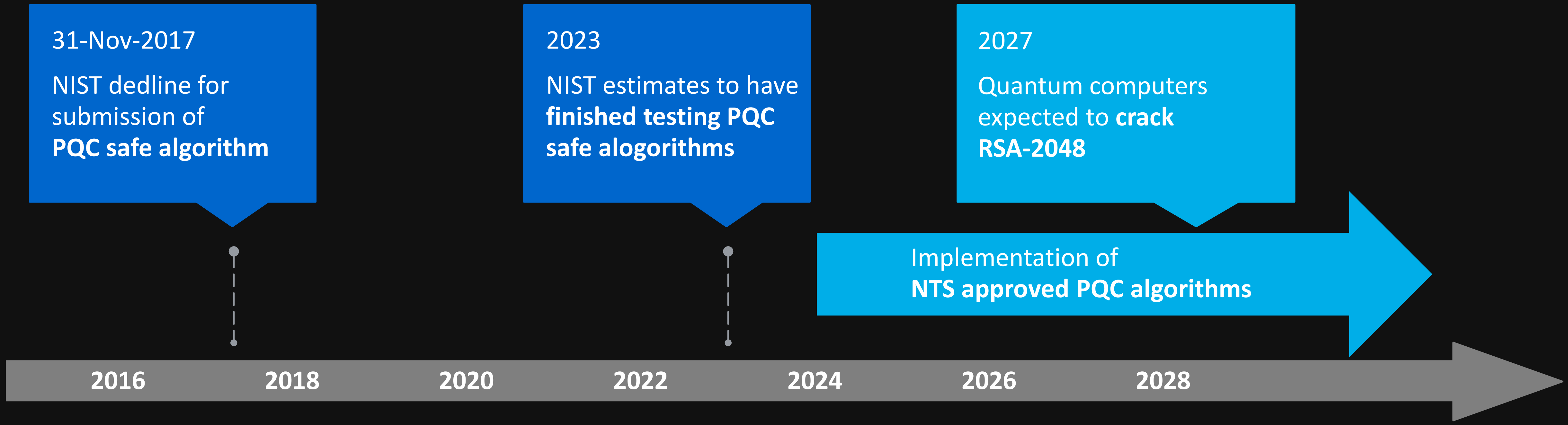
What are the consequences?

What are the consequences?

NIST

- Since 2016 NIST is working on standardization of new algorithms



31-Nov-2017

NIST dedline for submission of **PQC safe algorithm**

2023

NIST estimates to have **finished testing PQC safe alogorithms**

2027

Quantum computers expected to **crack RSA-2048**

Implementation of
NTS approved PQC algorithms

What are the consequences?

NIST

- New algorithms for data encryption:
  - → Classic McEliece
  - → CRYSTALS-KYBER
  - → NTRU
  - → SABER
- New algorithms for digital signatures:
  - → CRYSTALS-DILITHIUM
  - → FALCON
  - → Rainbow

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What are the consequences?

ETSI, ENISA, BSI

- Help in transition to new algorithms and implementations:
  - → ENISA: POST-QUANTUM CRYPTOGRAPHY Current state and quantum mitigation
  - → ETSI: CYBER Migration strategies and recommendations to Quantum Safe schemes
  - → BSI: Migration to Post Quantum Cryptography

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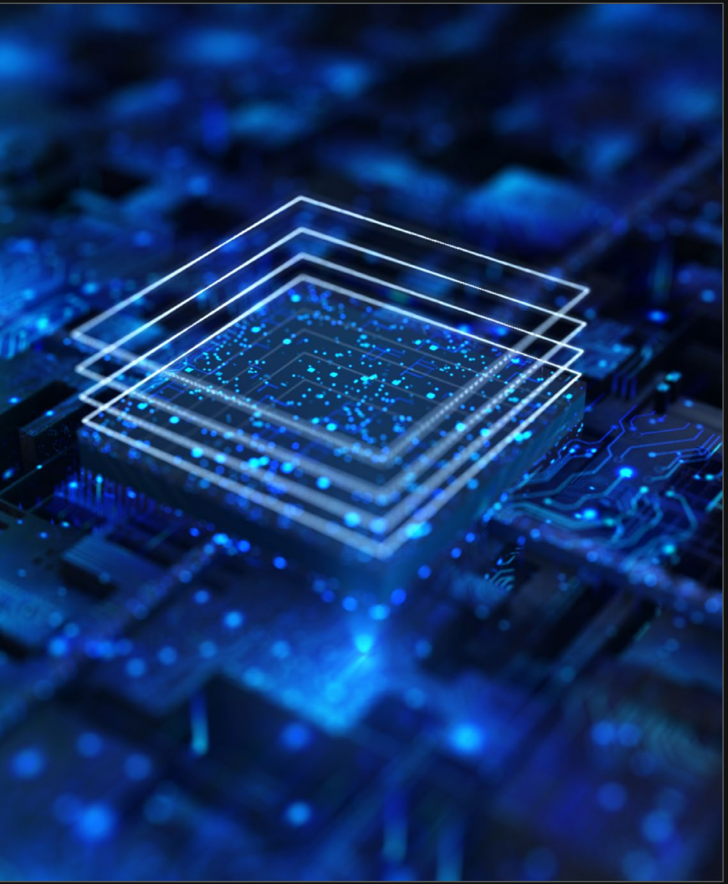
How can we prepare?

How can we prepare?

Are there any solutions for us?



✓

Get ready for new standards in cryptography

- Build knowledge
- Involve in standardization

✓

HSMs providers

- Pressure in implementing new algorithms
- Certification of devices will take time after new algorithms are recommended

How can we prepare?

What can we do?

- Implement Crypto agility
  - → Investigate new approaches
  - → Prepare infrastructure and applications
  - → Talk with vendors and pressure on new solutions
  - → Will allow easier change of todays and future algorithms
- Implement hybrid solutions
  - → We can use „classic" and post quantum algorithms for signatures
  - → Lack of standards to implement and recognize PQ algorithms today
  - → No PQ algorithm validation services

How can we prepare?

What can we do?

- ENISA guidelines
  - → TR 103 616 Quantum-Safe Signatures
  - → TR 103 619 Migration strategies and recommendations to Quantum Safe schemes
- Flexibility will allow to implement future changes easier and more reliable;
  - → Crypto agility
  - → Implement hybrid solutions
  - → Due to attack potential, focus on changing long term solutions and services like archive, conservation, and other using 3-5+ years valid certificates

Impact on the business?

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Impact on the business

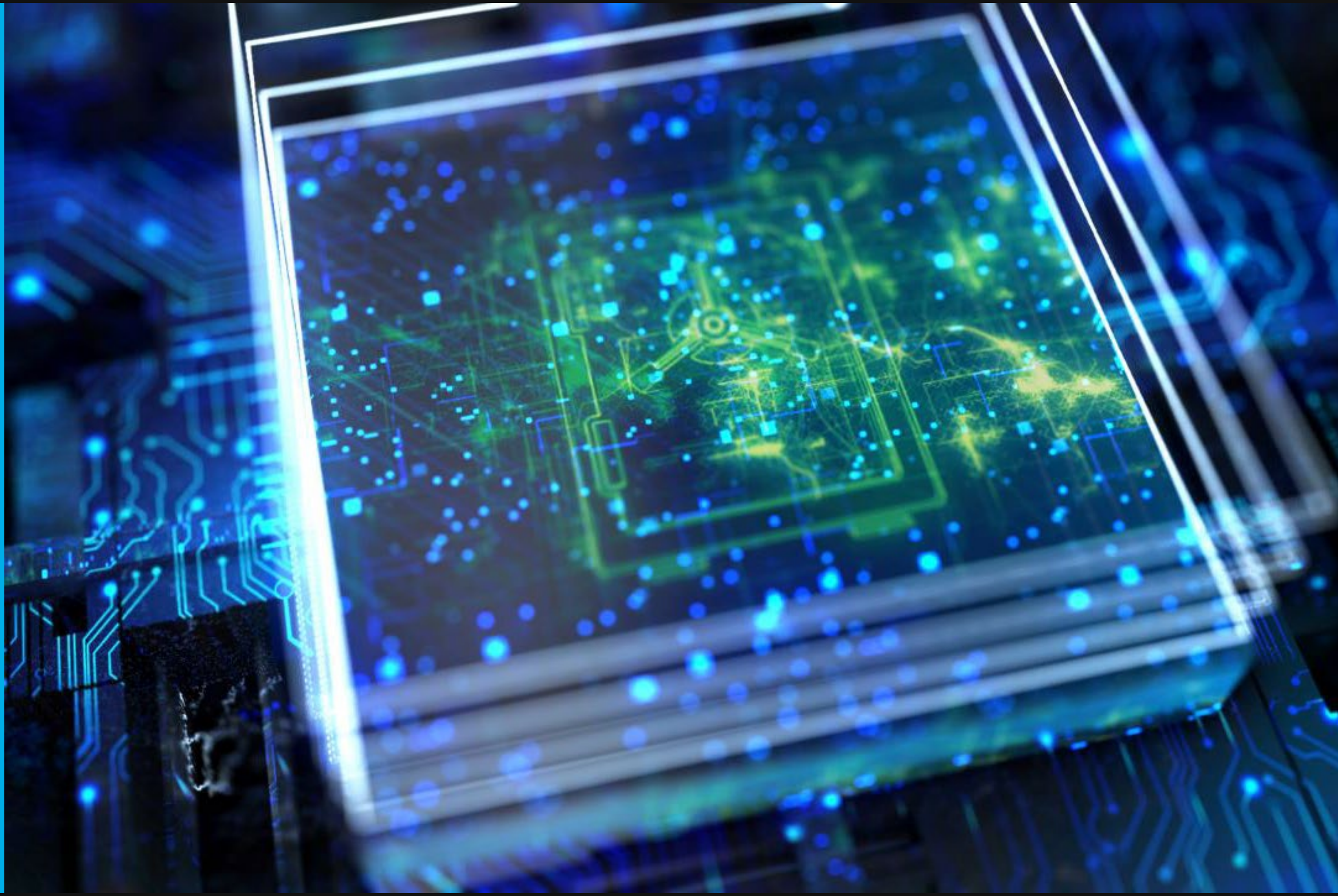
How Asseco is preparing?

- We are implementing Crypto agility
- Preparing issuing hybrid RSA/ECC + PQC certificates
- Testing PQ algorithms accepted to Round 3 NIST evaluation process

Impact on the business

How Asseco is preparing?

- We talk with
  - → IBM
  - → Entrust
  - → Microsoft
- We are preparing to test HSM devices
- We are testing our components with PQ
- We want to involve in standardization work of ETSI, ENISA
- Still looking for potential partners



Impact on the business

How can we all prepare?

- We need more involvement in standardization work from ETSI and ENISA
- We need more guidelines, standards, best practices
- We need updated ETSI ALGO paper
- We need data structures for hybrid solutions
- We need data structures for two signatures on one document (RSA and PQ)

Q&A

Thank you.

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