WELCOME TO

Quantum Computing for Humans

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CoNetrix Security

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The slides, a recording, and certificate of attendance will be sent via email.

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- Audit Management
- Business Continuity Plan
- Compliance Management
- Cybersecurity
- Identity Theft Prevention
- Incident Management
- Internet Banking Security
- Phishing
- Policies
- Risk Assessment
- Vendor Management

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SUBMIT YOUR QUESTIONS!

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ABOUT THE PRESENTER

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Agenda

- The Basics
- Security Considerations
- Take Action

POLL QUESTION

How interested in Quantum Computing are you?

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POLL QUESTION

How **FEARFUL** of Quantum Computing are you?

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Quantum Computing

"The sky is falling!"

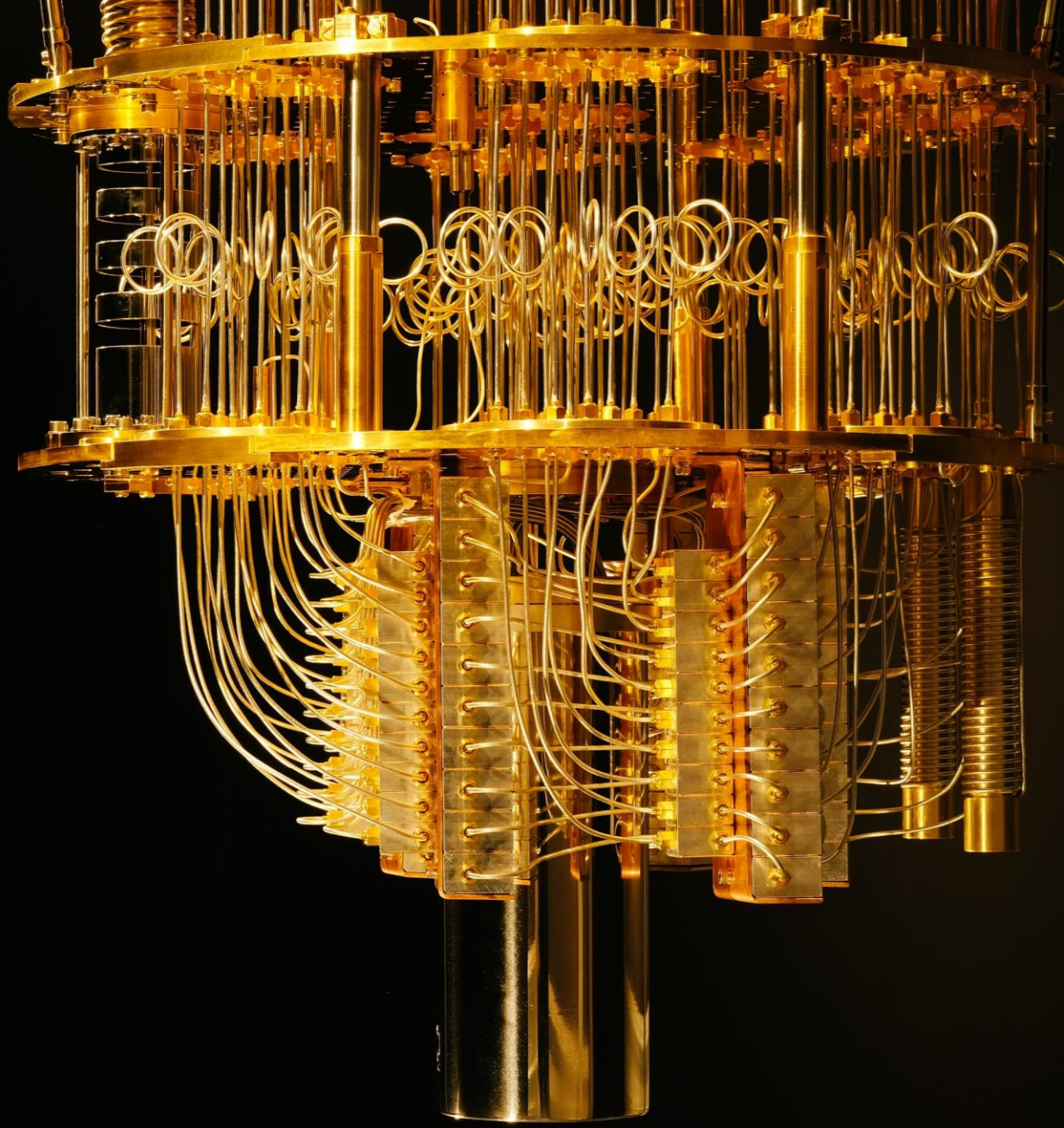
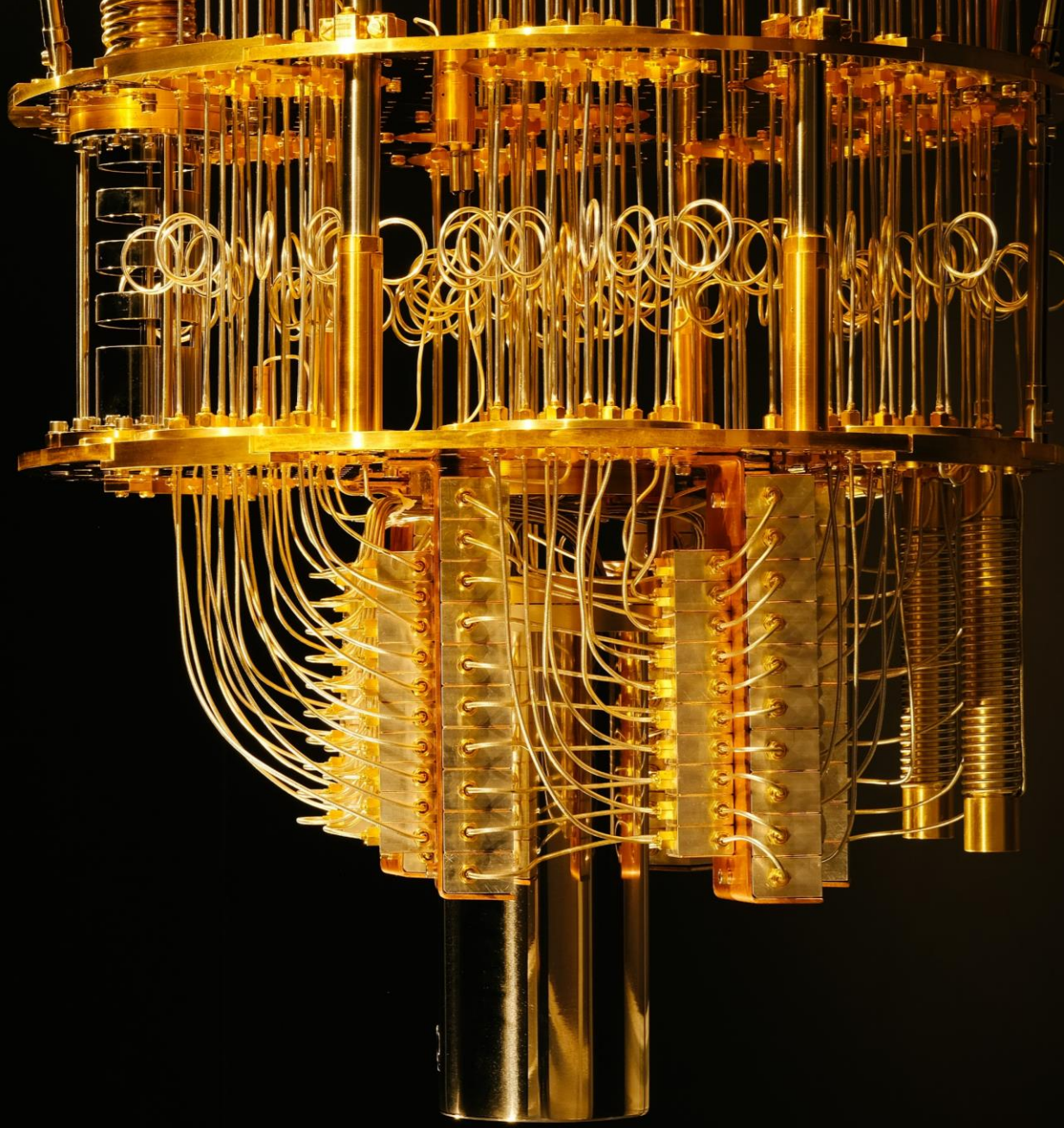


Image courtesy IBM Media Center

Quantum Computing

“There have already been examples of large batches of encrypted data being stolen by unknown actors, **possibly to be hoarded and decrypted later by using future technology**.

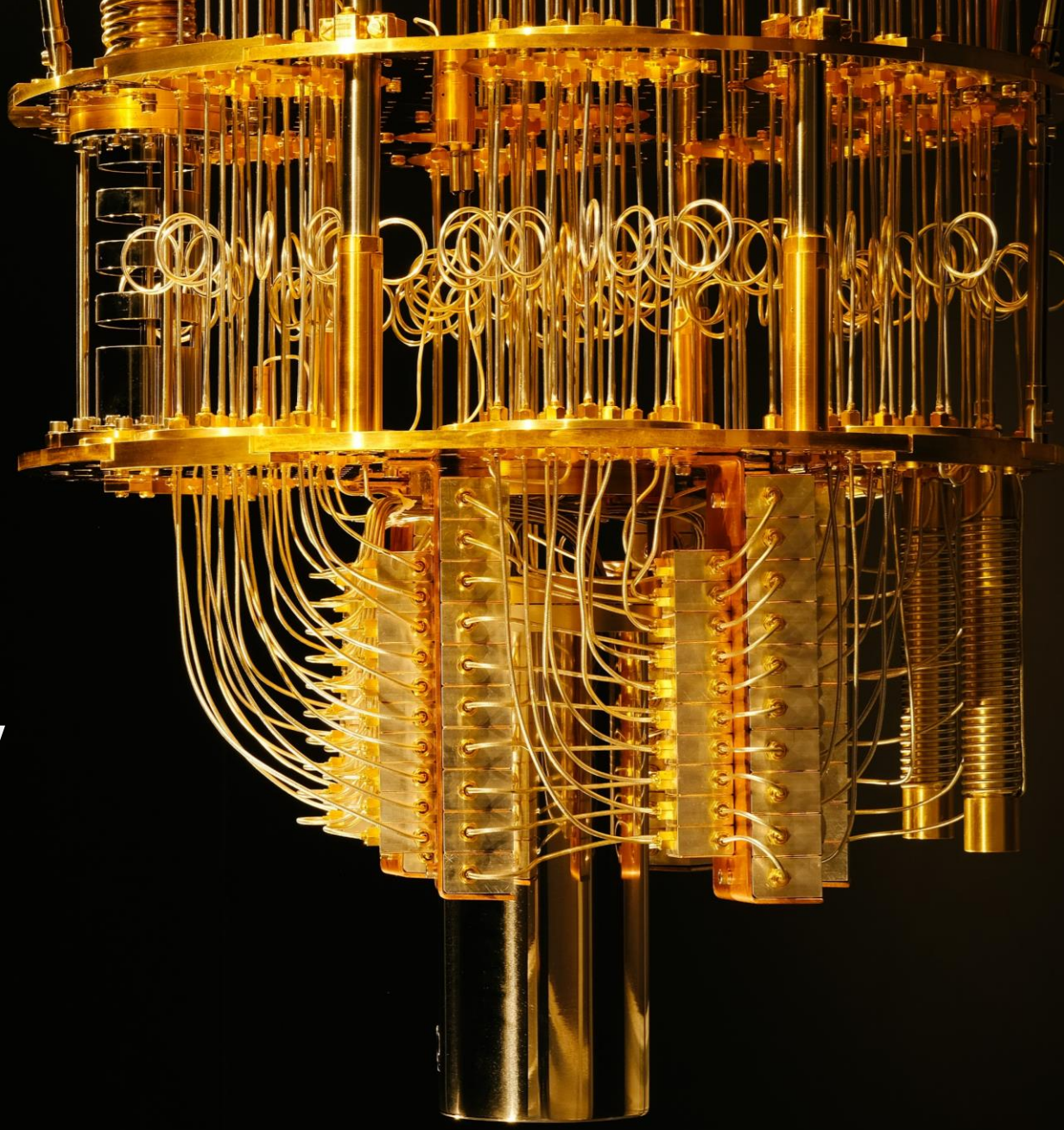


IBM, “What is quantum-safe cryptography?”
https://www.ibm.com/topics/quantum-safe-cryptography

Image courtesy IBM Media Center

Quantum Computing

“Not every data breach is discovered. **Any data not encrypted using quantum-safe standards today should be considered already lost.**

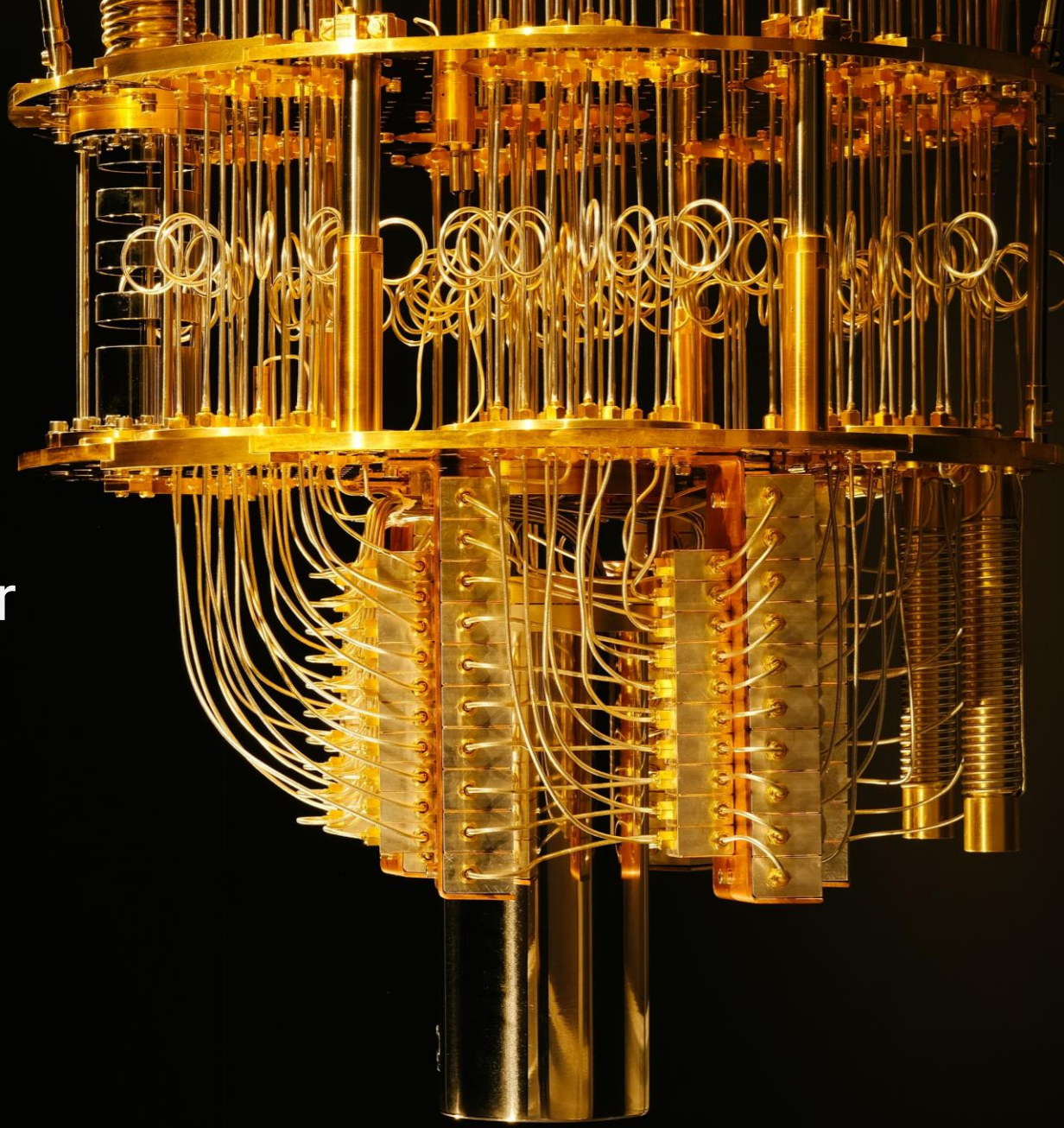


IBM, “What is quantum-safe cryptography?”
https://www.ibm.com/topics/quantum-safe-cryptography

Image courtesy IBM Media Center

Quantum Computing

“If you’re ready to act to protect your organization, the first step is to contact an IBM representative.”



IBM, “What is quantum-safe cryptography?”
https://www.ibm.com/topics/quantum-safe-cryptography

Image courtesy IBM Media Center

The Basics

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What is Quantum Computing, anyway?

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Coin Computing

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Coin Computing

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Coin Computing

1 2 3 4

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Traditional Computing

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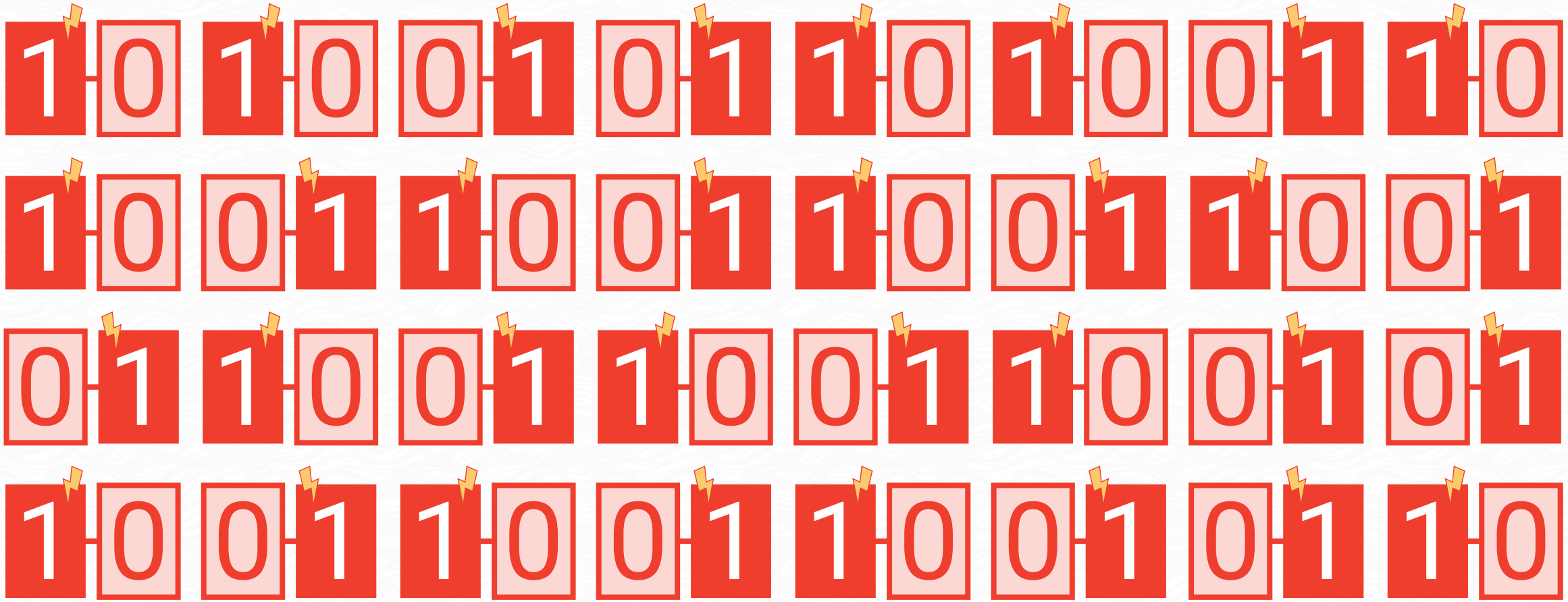
Traditional Computing



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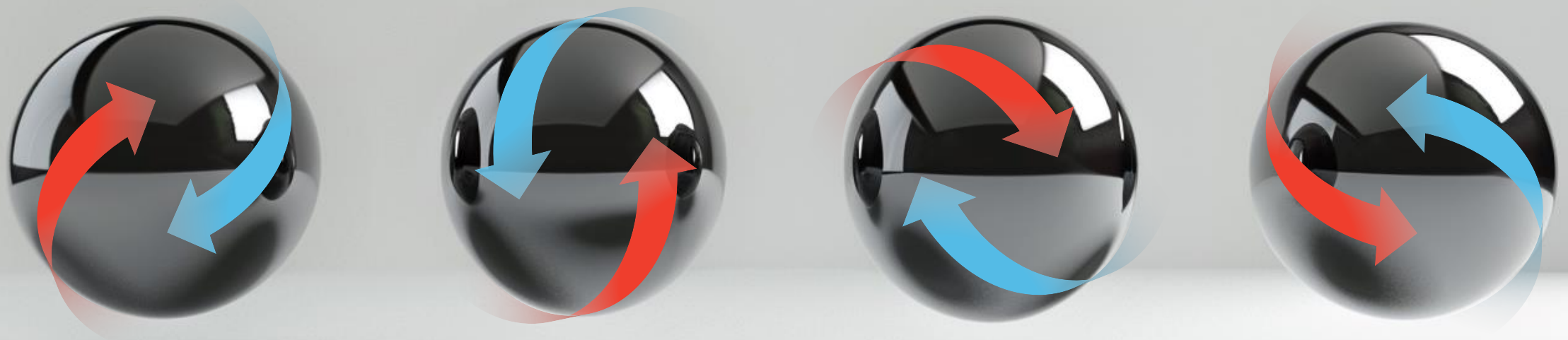
QUANTUM COMPUTING

Quantum Computing



Qubits
Superposition

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Security Considerations

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POLL QUESTION

How much would you say you **LOVE** math?

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Encryption

“Encryption uses math to protect sensitive electronic information, including the secure websites we surf and the emails we send.

Widely used public-key encryption systems, **which rely on math problems that even the fastest conventional computers find intractable**, ensure these websites and messages are inaccessible to unwelcome third parties.”

“NIST Announces First Four Quantum-Resistant Cryptographic Algorithms”, July 2022

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Factoring

$21 = 7 \times 3$

$589 = 19 \times 31$

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Factoring

2271109657295089438126732046783160281980413790315184793946932235968178538976936789851159929183020345892030402942331837763843035866183250236826189427319820836291980285801873167460241766280380139266209769305593666500942338271388291899180812405278977640789143108340988718475071361723519196778237630975954714150 59

Factoring

3316168417829610832584679326283002267239813128404018693570786836250576270476624411258192895124897883591920703350613067254603426306342664766246120461395855650858224411887099209614313363676290624792607790927860566828981298749299969508553040397689724995835530632997521325585606060382581812010248092028823836832 13

Factoring

753695942276973745626235236679260610184276071133581436616824488723013945900685633138409796140400160907036377827331886910861072076652298594602328880052486042103060318338825644379032726927746980324377647865663078823314979657805621883127860713895116093641216891390381340751077225187673662339822716350372970182734447458232082365502827126339793721640164910036377352414057814749016711915694285292364 93

Factoring

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30788233149796578056218
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72970182734447458232082
36550282712633979372164
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14749016711915694285292
36493

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Factoring

"To give you an idea of the scale: **factoring a 500 digit number into its primes could take as long as the planet's formation**, and for huge numbers, the factoring process could take longer than the age of the universe itself."

Andreas Maier, "Prime numbers and their importance to modern life", CodeCoda, August 16, 2021, emphasis in the original

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Solutions and Strategies

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Quantum-Safe Cryptography

Quantum-resistant encryption algorithms:

CRYSTALS-Kyber
CRYSTALS-Dilithium
FALCON
SPHINCS+

“NIST Announces First Four Quantum-Resistant Cryptographic Algorithms”, July 2022

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Quantum-Safe Cryptography

First three finalized Post-Quantum Encryption Standards:
Federal Information Processing Standard (FIPS)

FIPS 203 (CRYSTALS-Kyber, renamed ML-KEM)
FIPS 204 (CRYSTALS-Dilithium, renamed ML-DSA)
FIPS 205 (Sphincs+, renamed SLH-DSA)

"NIST Releases First 3 Finalized Post-Quantum Encryption Standards", August 2024

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Quantum-Safe Cryptography

"We encourage system administrators to start integrating them into their systems immediately, because **full integration will take time**."

"There is no need to wait for future standards. Go ahead and start using these three."

"NIST Releases First 3 Finalized Post-Quantum Encryption Standards", August 2024

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Guidance!

1. **Establish a quantum-readiness roadmap.**

   [Establish] a project management team to plan and scope the organization's migration to PQC. Quantum-readiness project teams should initiate proactive cryptographic discovery activities that **identify the organization's current reliance on quantum-vulnerable cryptography**.

Quantum-Readiness: Migration to Post-Quantum Cryptography, August 2023

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Guidance!

2. Prepare a cryptographic inventory.

Organizations should create a cryptographic inventory that offers **visibility into how the organization leverages cryptography** in its IT and OT systems.

Quantum-Readiness: Migration to Post-Quantum Cryptography, August 2023

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Guidance!

3. **Discuss post-quantum roadmaps with technology vendors.**

   [Engage with] technology vendors to learn about vendors' quantum-readiness roadmaps, including migration.

   Solidly built roadmaps should describe how vendors plan to migrate to PQC, charting timelines for testing PQC algorithms and integration into products.

Quantum-Readiness: Migration to Post-Quantum Cryptography, August 2023

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Guidance!

4. Supply chain quantum-readiness:

Organizations should develop an understanding of their reliance/dependencies on quantum-vulnerable cryptography in systems and assets, as well as **how the vendors in their supply chain will be migrating to PQC.**

Quantum-Readiness: Migration to Post-Quantum Cryptography, August 2023

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Questions?
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Questions?
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THANKS FOR JOINING

Quantum Computing for Humans

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Remember to complete the survey!

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