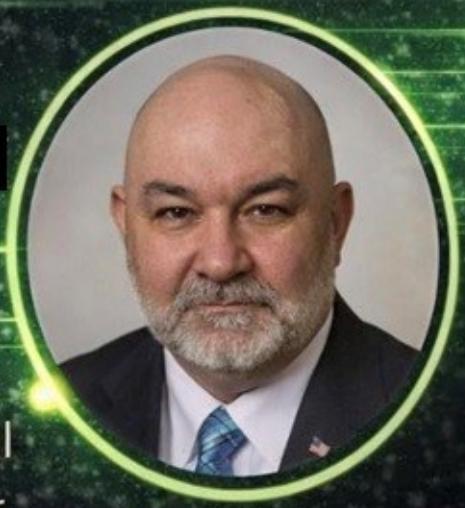
Harvest Now, Decrypt Later

Presentation

Chicago Quantum Group
July 2026



William Slater
Senior Cybersecurity Professional
& Quantum Technology Manager

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Disclaimer

This presentation will be delivered in July 2026 at the request of Chicago Quantum Grouo organizers.

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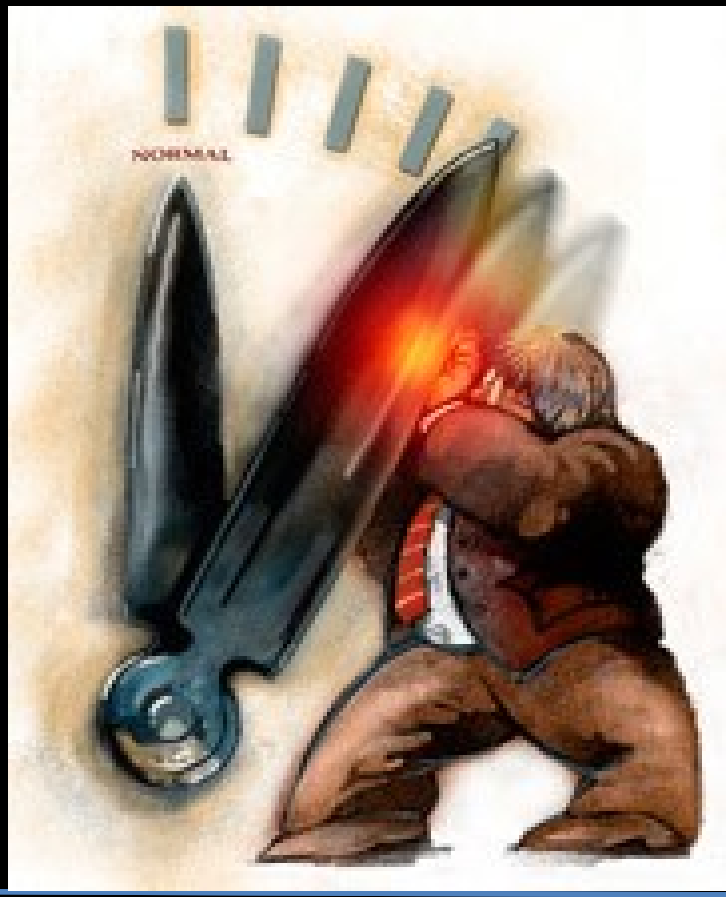
This Presentation Is Readily Available

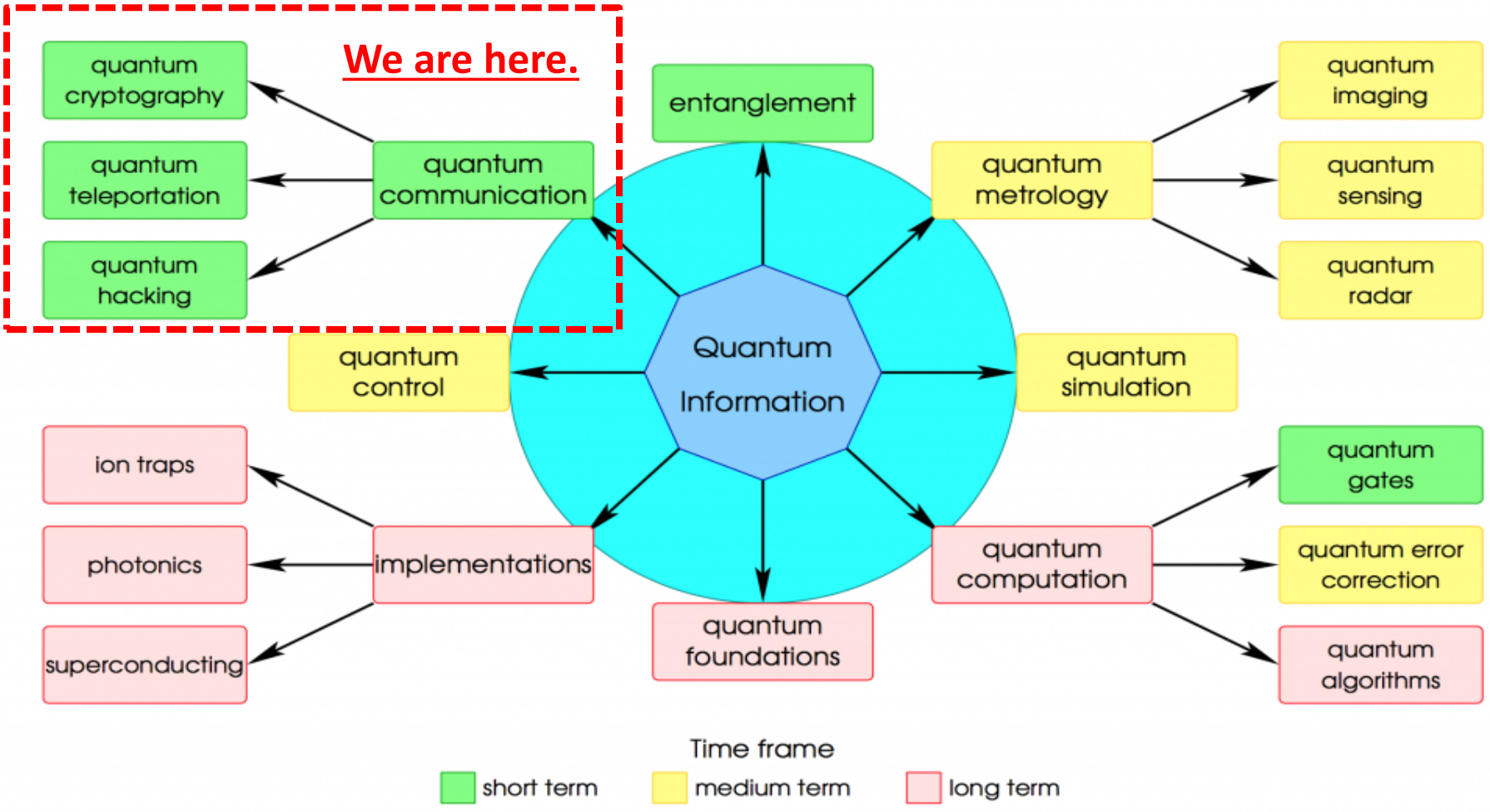
- Harvest Now, Decrypt Later– 2026 (July 2026)
- Presentation
  - **https://billslater.com/hndl2026.pdf**

Agenda

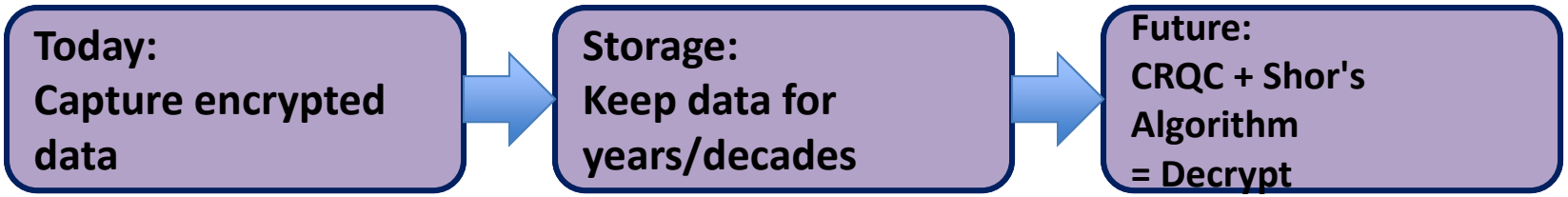
- What Is HNDL?
- Why HNDL Is Serious
- An Internet Minute
- Quantum Computers and Shor's Algorithm
- PQC as a Defense Against HNDL
- Illustrative PQC Readiness
- Who Has Started their PQC Migrations
- PQC Readiness with Timeline
- Key Mitigation Steps to Reduce HNDL Risk
- HNDL Mitigation Lifecycle
- Illustrative Quantum Risk Timeline
- Cryptographic Agility
- Key Takeaways and a Call to Action
- Questions and Answers
- References



Enter the Quantum Zone



HNDL in One Picture



HNDL = Adversaries harvest encrypted data now, store it and decrypt it later when quantum computers become powerful enough.

What is Harvest Now, Decrypt Later (HNDL)?

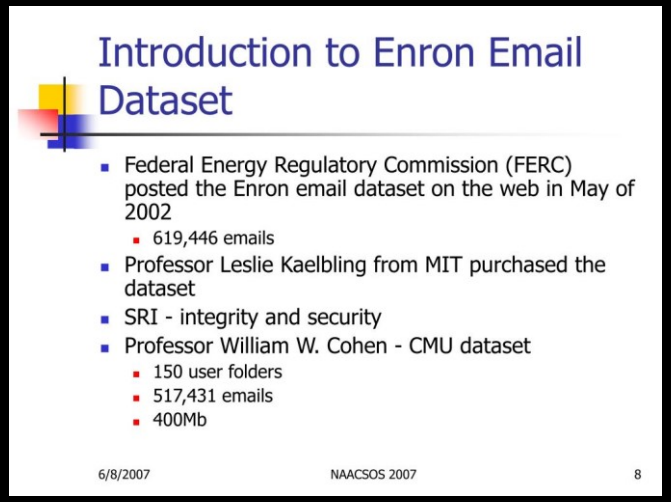
- Adversaries capture encrypted traffic and data today.
- They store it for years or decades, waiting for stronger compute.
- A future cryptanalytically relevant quantum computer (CRQC) can use Shor's Algorithm to break RSA/ECC keys.
- Result: Long-term confidentiality is lost even if systems appear secure today.

What Is Harvest Now, Decrypt Later? (HNDL)

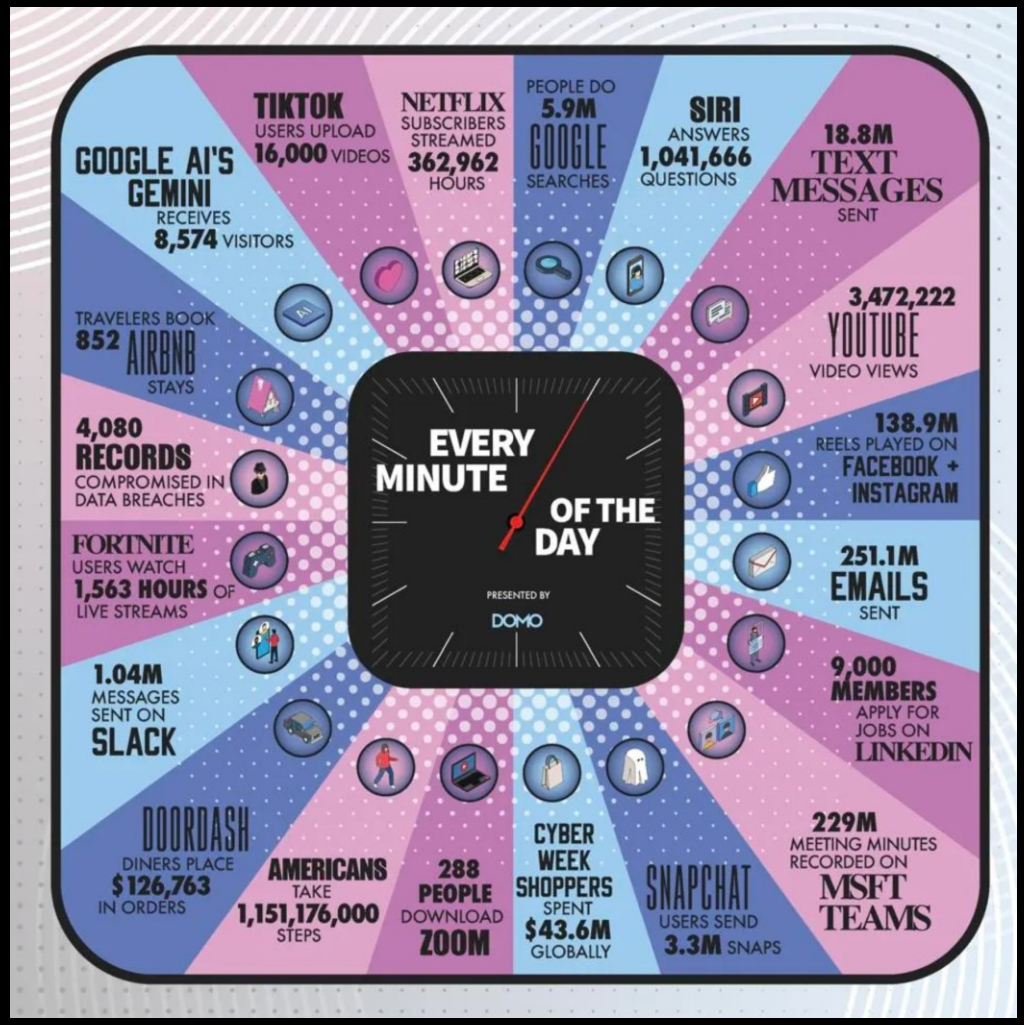
- Data that traverses the Internet is usually encrypted.
- The Bad Guys and Nation States are capturing and storing this data that is encrypted using older encryption algorithms.
- Between 2028 and 2030, when CRQC computers become commonplace, the harvested data can be decrypted at the time and place of the Bad Guys' choosing and they use this decrypted data to their advantage.
- Note that the decrypted data can also be data that belongs to organizations that have completed their PQC Migrations, because the harvest data was encrypted using olded algorithms that are vulnerable to cryptoanalytic attacks of Quantum Computers.

What Does a Harvest Now, Decrypt (HNDL) Attack Look Like?

- When Q-Day occurs, data that has been encrypted and captured will be at risk. This risk is known as " Harvest Now Decrypt Later ".
- Do an Internet Search on " ***Enron Email Dataset*** " and also " *Peter Attia Epstein* " and you will understand the awkward situations involving unintend releases of data that was previously thought to be CONFIDENTIAL and PROTECTED.



Internet Minute - 2025



Source: https://bondhighplus.com/blog/what-happens-in-an-internet-minute/

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Internet Minute – 2015 to 2025

Year	Emails Sent	Google Searches	YouTube Views	TikTok Views	Online Spend	App Downloads	Instagram Activity
2025	231M+	6.3M+	3.47M	625M videos watched	$43.6M+	174K	66K photos shared
2024	231M	6.3M	3.47M	625M videos watched	$43.6M (peak minute)	174K	66K photos shared
2023	231M	5.9M	3.67M	167M videos watched	$1.5M+ (est.)	174K	694M songs streamed
2022	231M	5.9M	508 hrs uploaded	1B+ interactions	$443K (Amazon only)	437K transfers	527K photos shared
2021	225M (est.)	5.7M (est.)	5.0M (est.)	167M (est.)	$1.3M (est.)	450K (est.)	800K (est.) scrolling
2020	190M	4.1M	4.7M	N/A	$1.1M	400K	694K scrolling
2019	188M	3.8M	4.5M	N/A	$996K	390K	347K scrolling
2018	187M	3.7M	4.3M	N/A	$862K	375K	174K scrolling
2017	156M	3.5M	4.1M	N/A	$751K	342K	46K posts uploaded
2016	150M	2.4M	2.78M	N/A	$203K	51K	527K photos shared
2015	204M	2M+	1.3M	N/A	$83K	47K	3,000 uploads

Source: https://bondhighplus.com/blog/what-happens-in-an-internet-minute/

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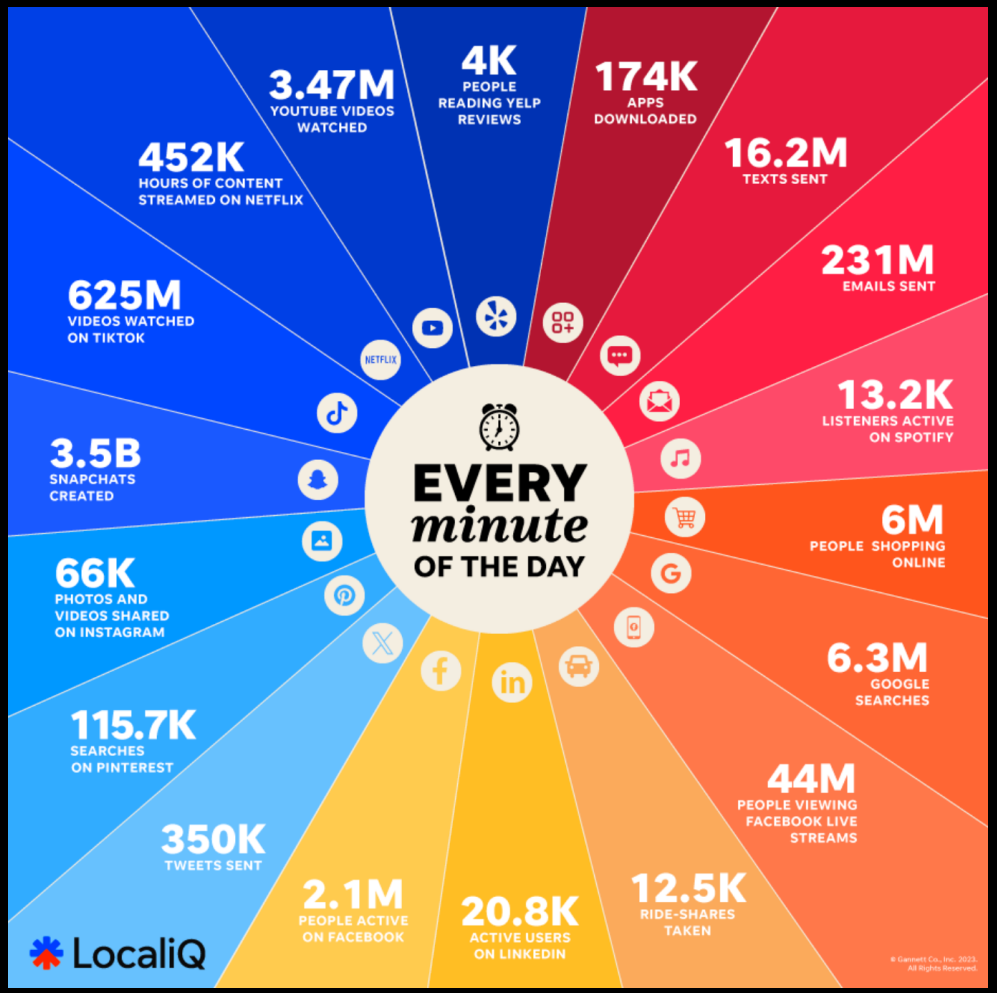
Internet Minute - 2025



Source:
https://localiq.com/blog/what-happens-in-an-internet-minute/

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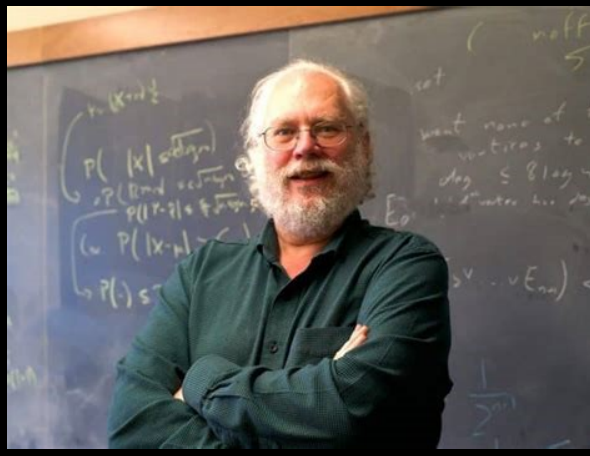
Why HNDL is a Serious Privacy Threat

- Targets data with long sensitivity lifetimes: PII, medical records, biometrics, financial histories, IP, classified data.
- Once decrypted, historical communications can be searched, correlated, and profiled without the victim ever knowing.
- Bulk HNDL harvesting enables mass surveillance and retroactive exposure of past behavior.
- Trust in digital records, contracts, and identities can be undermined when historic data is silently decrypted.

Quantum Computers & Shor's Algorithm

- Shor's Algorithm can efficiently factor large integers and solve discrete log problems.
- This breaks widely deployed public-key schemes such as RSA, Diffie–Hellman, and ECC.
- A CRQC could decrypt stored sessions protected only by these algorithms.
- Symmetric algorithms (e.g., AES) are less impacted, but key sizes may need to increase.



Peter Shor
MIT Professor
Inventor of Shor's Algorithm

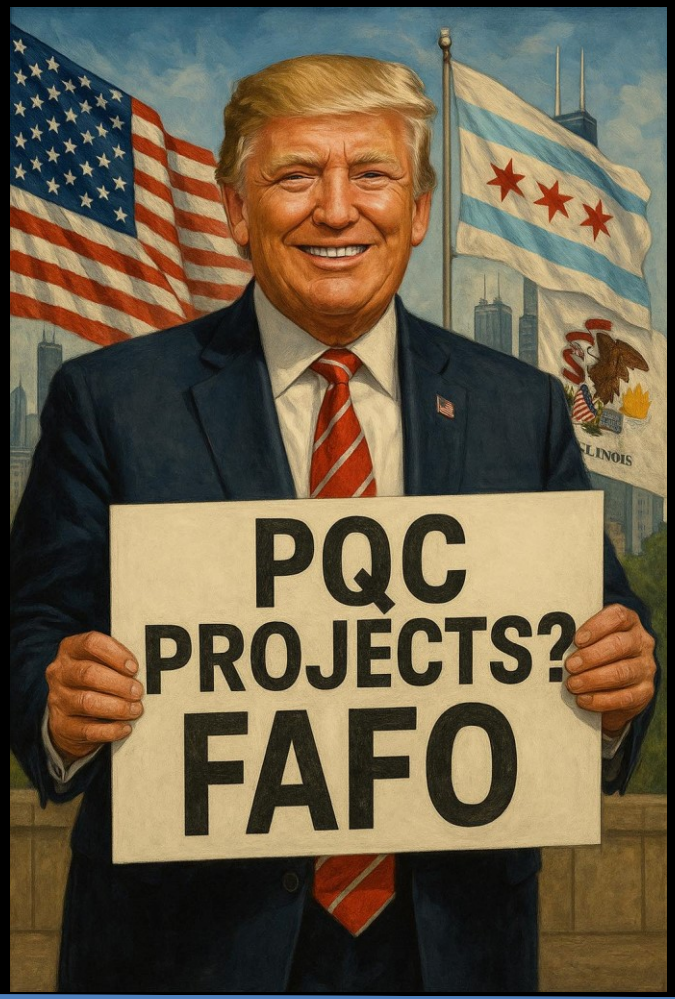
PQC as a Defense Against HNDL

Post-Quantum Cryptography (PQC) algorithms are designed to resist both classical and quantum attacks.

NIST has standardized PQC algorithms (e.g., Kyber for key establishment, Dilithium and SPHINCS+ for signatures).

NSA CNSA 2.0 and other national standards require quantum-resistant algorithms by the early 2030s.

Encrypting with PQC today ensures that harvested ciphertext remains secure even after Q-Day.



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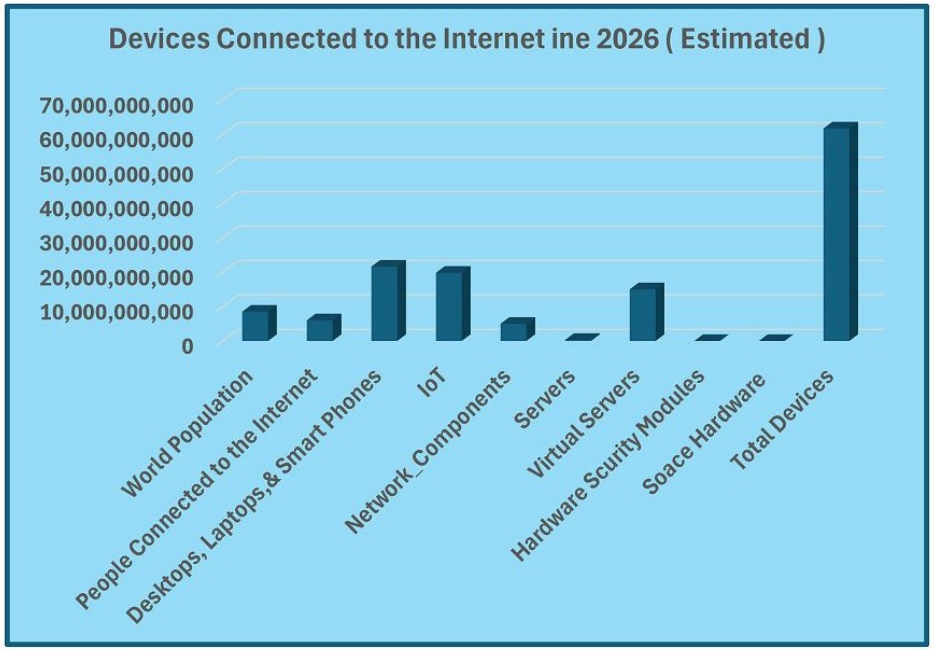
This Should Get Your Attention If You Care About PQC and the Internet

PQC System Engineer Readiness

How Large Is This Opportunity?

World Population	8,500,000,000
People Connected to the Internet	6,000,000,000
Desktops, Laptops,& Smart Phones	21,600,000,000
IoT	19,800,000,000
Network_Components	5,000,000,000
Servers	300,000,000
Virtual Servers	15,000,000,000
Hardware Scurity Modules	1,000,000
Soace Hardware	14,000
Total Devices	61,701,014,000

(All figures are estimated)



Sunday, April 12, 2026
Chicago, Illinois, USA

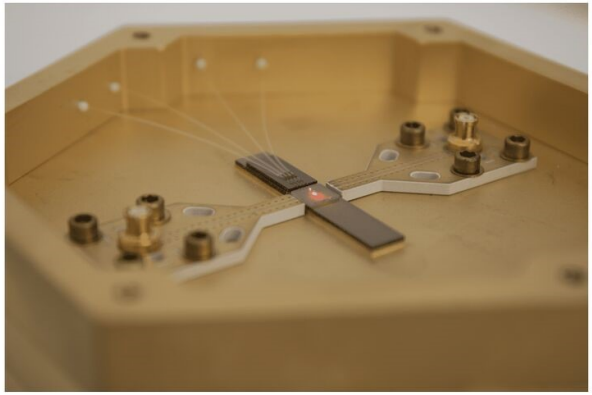
This Should Get Your Attention If You Care About PQC and the Internet

BARRON'S

TECHNOLOGY

Experts Are Worried 'Q-Day' Could Bring a $3 Trillion Banking Nightmare

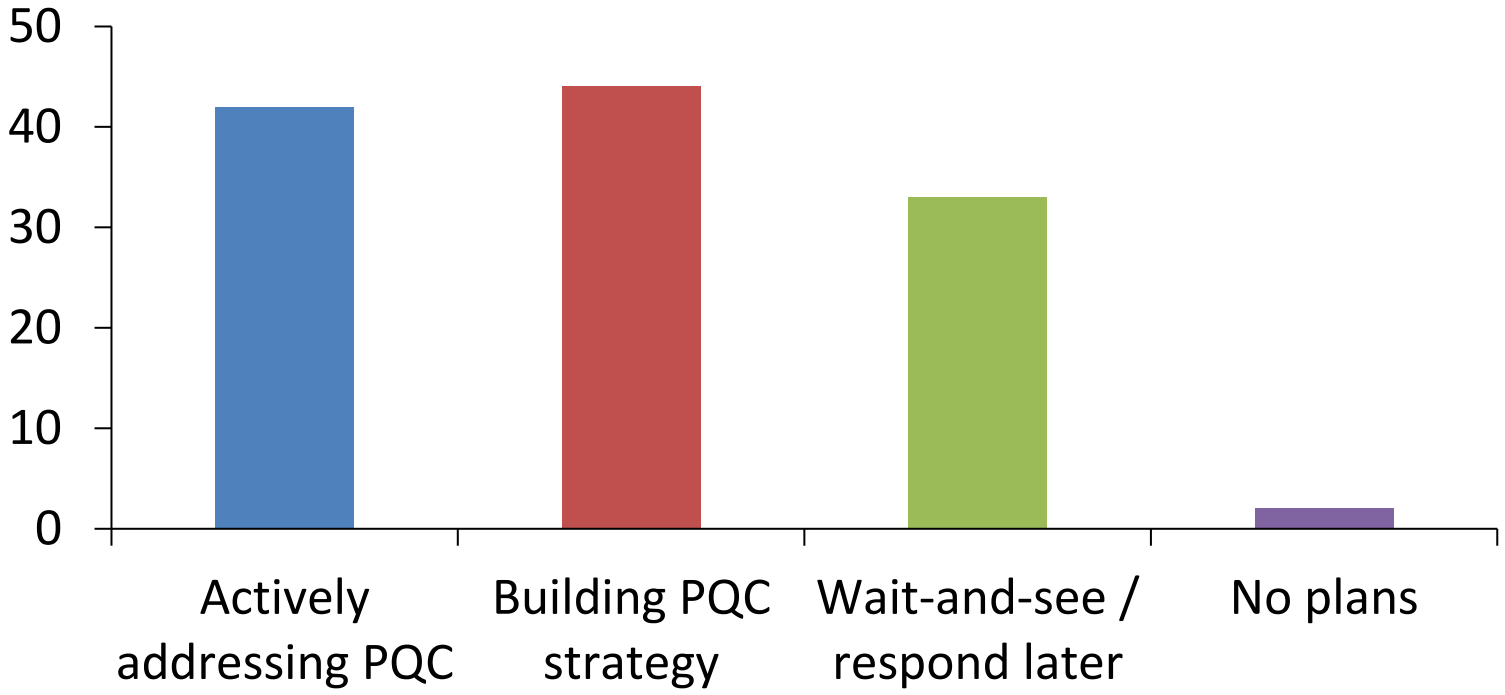
As enthusiasm abounds for quantum computing, Moody's cautions that the rise of ultra-powerful systems could upend the financial sector.



The Commerce Department has pledged to invest $2 billion in quantum computing as part of a deal that includes equity stakes in several companies. PHOTO: COURTESY IONQ

Illustrative PQC Readiness

(Selected Survey Metrics)



Note: Values are illustrative and based on multiple industry surveys.
Many large organizations are still in early planning stages.

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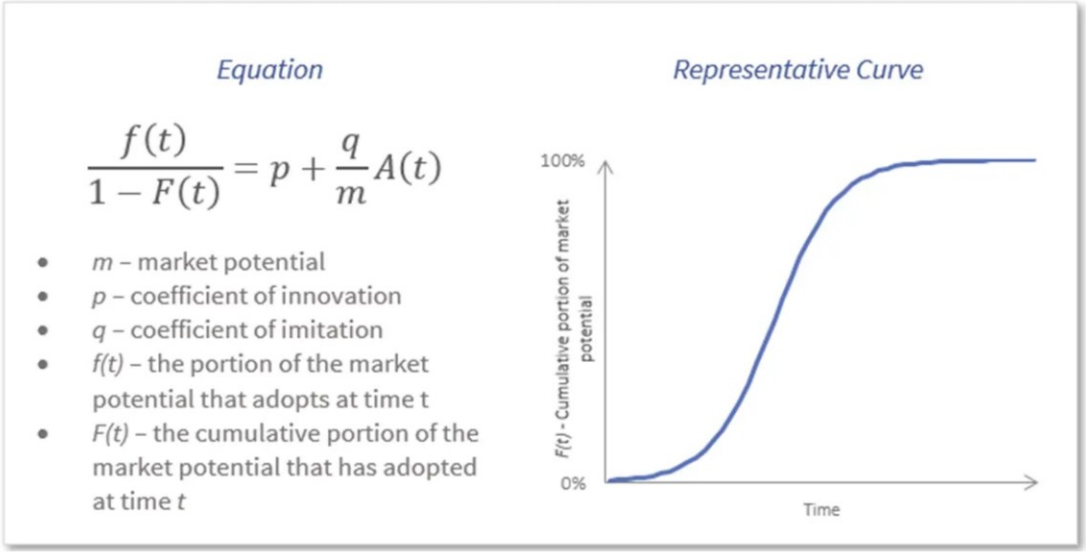

Bass Diffusion Model

Who Has Started Their PQC Migrations?

🤳 The Quantum Deadline: Good, Bad & Ugly of PQC Adoption

By 2033, a cryptographically relevant quantum computer (CRQC) could emerge - yet most systems won't be ready.
Using the Bass model (p ≈ 0.03, q ≈ 0.32), we forecast:
~50% PQC adoption by 2033
Group 1 (defense, core infra): ~70% ready
Group 2 (critical sectors): ~55%
Group 3 (commercial tech): ~35%
Group 4 (legacy systems): ~<20%
The risk? A fragmented, vulnerable internet—unless we act now.

Tehrani, M. (2025). "The Quantum Deadline: The Good, The Bad, and The Ugly of PQC Adoption", published d at Medium and retrieved from: https://medium.com/@madjid.tehrani_17692/the-quantum-deadline-the-good-the-bad-and-the-ugly-of-pqc-adoption-baf0348812e4 .

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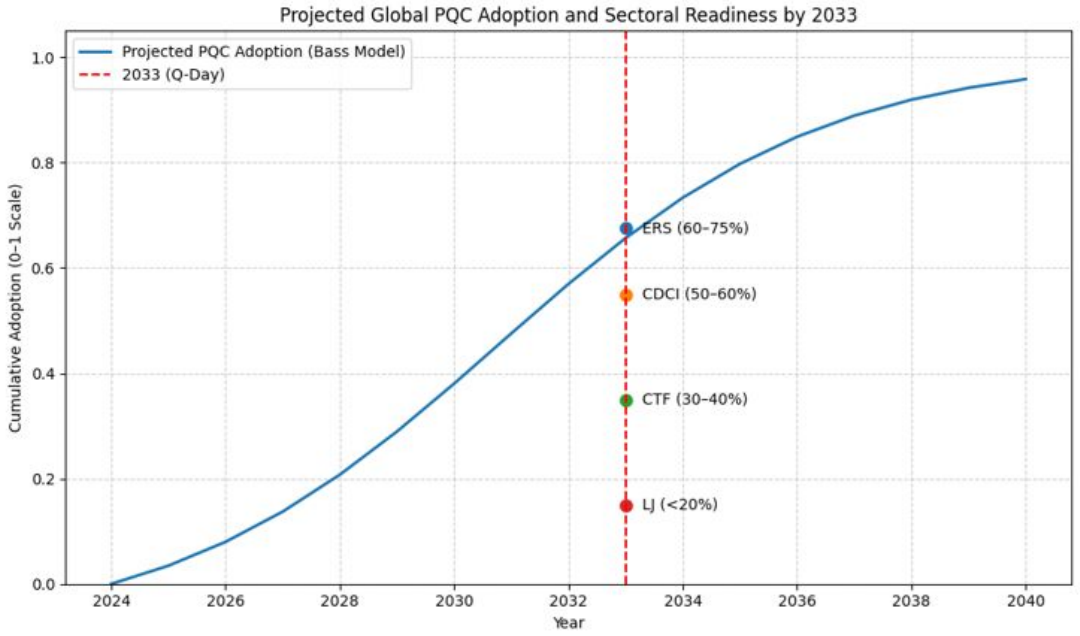

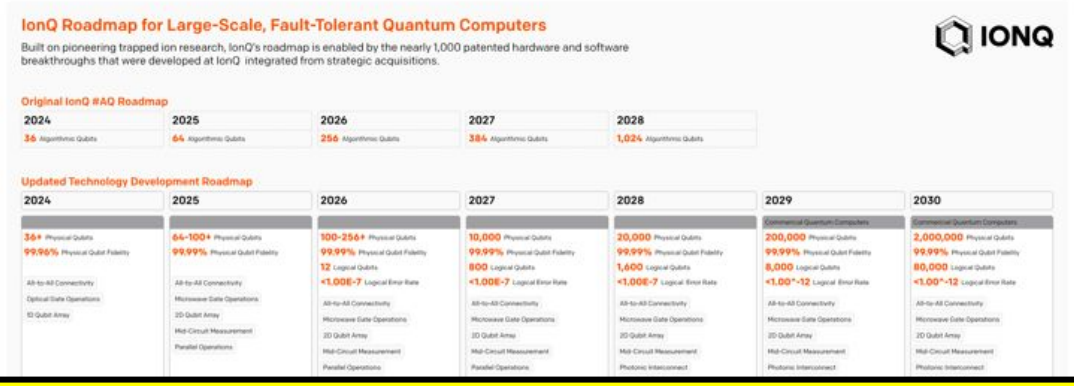

PQC Readiness

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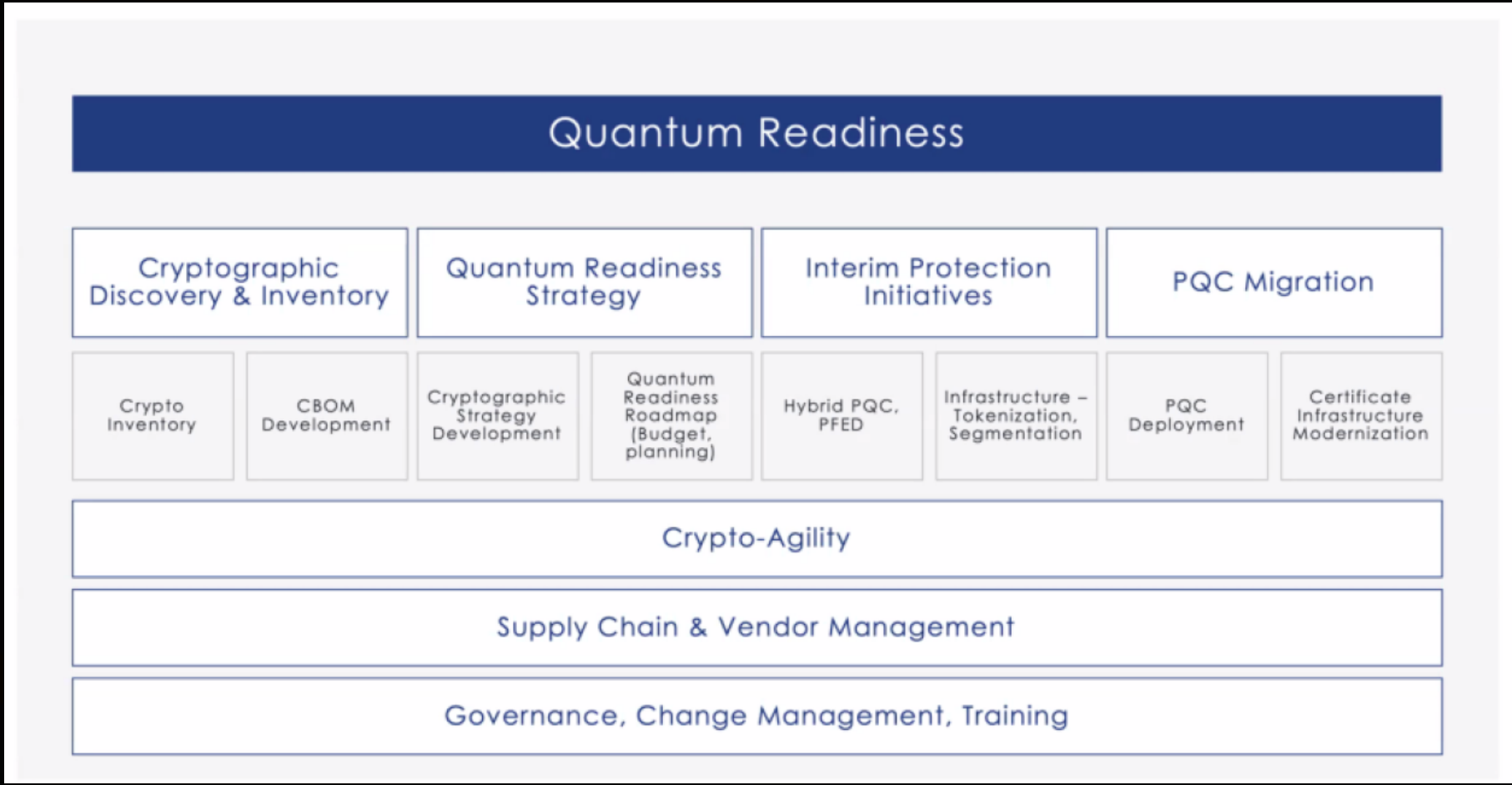
Key Mitigation Steps to Reduce HNDL Risk

- Create a ***cryptographic inventory*** (***CBOM***) (where public-key crypto is used, which algorithms, key sizes, and data lifetime).
- Identify "long-lived" data and high-value targets (citizen data, health, finance, critical infrastructure, defense).
- Upgrade protocols (***TLS/VPN/email/IoT/PKI***) to ***PQC*** and, in the near term, hybrid (classical + PQC) modes.
- Implement ***crypto-agility*** so algorithms, key lengths, and certificates can be swapped quickly without redesign.
- Encrypt sensitive ***data at rest*** with quantum-safe keys and strong access controls.
- Continuously monitor standards, vendor roadmaps, and quantum threat intelligence.

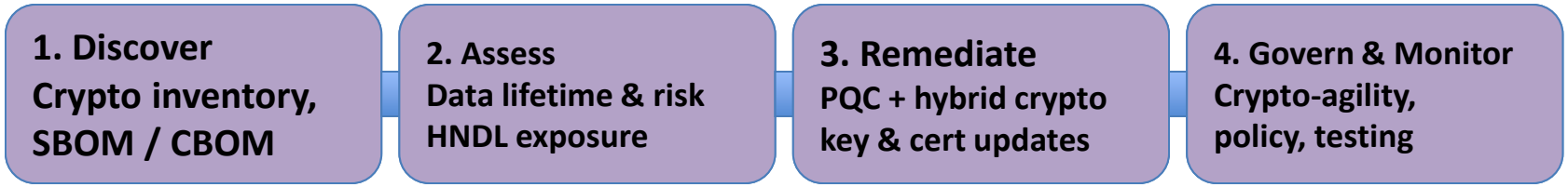
HNDL

Quantum Readiness



Slide Source: Mr. Marin Ivezic, 2025.

HNDL Mitigation Lifecycle



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Cryptographic Agility *is a measure of an organization's ability to adapt cryptographic solutions or algorithms (including their parameters and keys) quickly and efficiently in response to developments in cryptanalysis, emerging threats, technological advances, and/or vulnerabilities.*

It is also a design principle for implementing, updating, replacing, running, and adapting cryptography and related business processes and policies with no significant architectural changes, minimal disruption to business operations, and short transition time.

- Design principle
- Adapt to ANY future threats to cryptography
- Minimal disruption to business

Good old exit plans, no more set and forget in cryptography

PKI Consortium (2025). PQC Conference, January 2025.

HNDL
Cryptographic Agility

- All organizations need to be thinking about ***Cryptographic Agility*** RIGHT NOW. In fact, the experts as saying that all initial PQC Migration Projects MUST be coupled with Cryptographic Agility Projects that are conducted simultaneously.
- References:
  - ***RFC 7696*** https://www.rfc-editor.org/rfc/pdfrfc/rfc7696.txt.pdf
  - ***Becoming Quantum Safe***, by Jai Singh Arun, Ray Harishankar, and Walid Rjaiibi, 2025

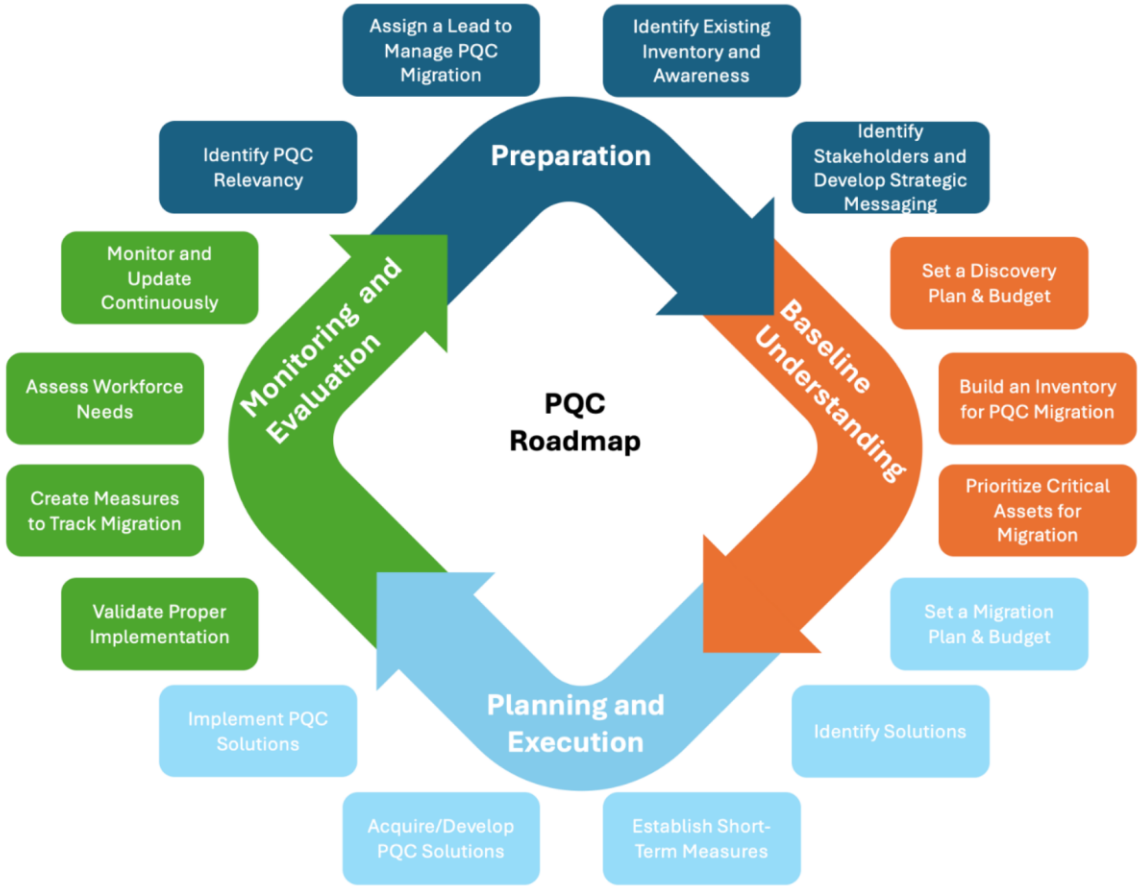
5-Year Crypto Agility Roadmap

Year	Objective
Year 1	Enterprise crypto inventory & CBOM
Year 2	Hybrid cryptography deployment
Year 3	Enterprise PQC migration scaling
Year 4	Legacy crypto retirement
Year 5	Automated crypto agility operations

Long-Term End State

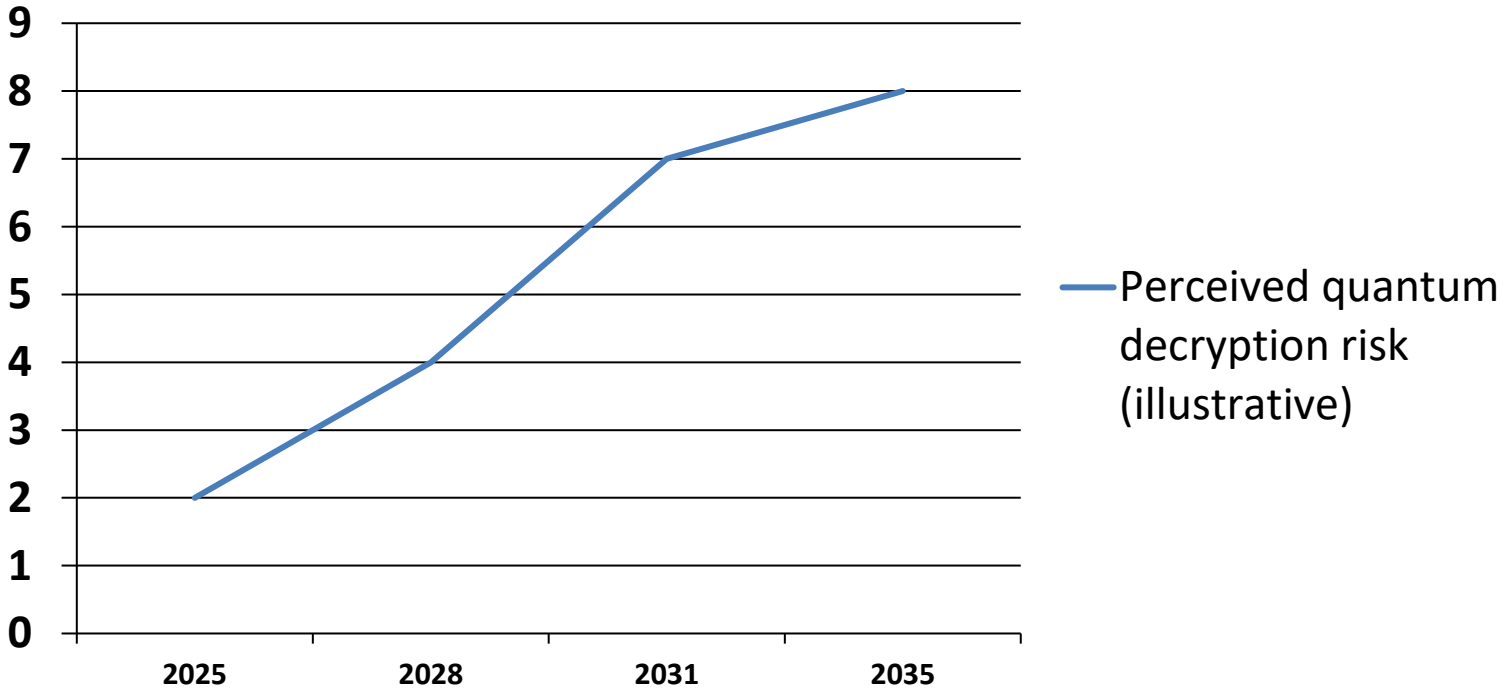
- Quantum-safe enterprise
- Fully automated certificate lifecycle
- Dynamic algorithm replacement
- Continuous crypto compliance
- Enterprise crypto telemetry & monitoring

Figure 1. PQC Roadmap Categories.



PKI Consortium (2025). PQC Conference, January 2025.

Illustrative Quantum Risk Timeline (2025–2035)



Analysts expect CRQCs capable of breaking today's public-key cryptography sometime in the 2030s, with some forecasts as early as ~2030–2035.
Because of HNDL, sensitive data must be protected well before " Q-Day ".

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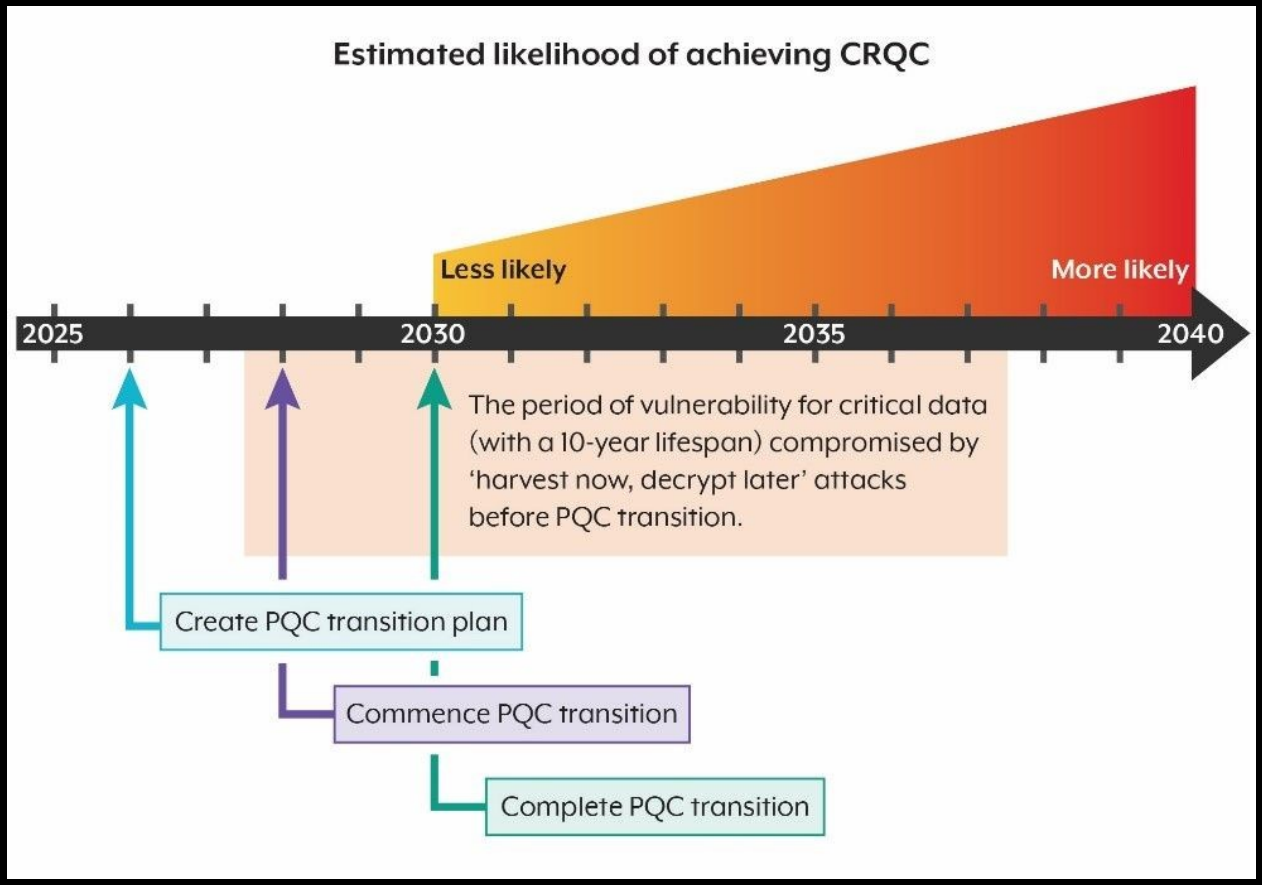
Illustrative Quantum Risk Timeline (2025–2035



Analysts expect CRQCs capable of breaking today's public-key cryptography sometime between 2029 and 2035, with some forecasts as early as ~2030–2035. Because of HNDL, sensitive data must be protected well before " Q-Day ".

Key Takeaways & Call to Action

- ***HNDL*** is happening now: adversaries may already be collecting your encrypted data.
- The arrival of ***CRQCs*** is uncertain, but many experts place ***Q-Day*** between 2029 and 2033.
- Because of long data lifetimes, waiting until Q-Day is too late—historic data will already be exposed.
- Begin **PQC Planning** and ***Migration*** immediately, starting with discovery, prioritization, and crypto-agility.
- Treat ***PQC Migration*** as a strategic, multi-year program, not a one-time IT upgrade.
- Strive for ***Cryptographic Agility*** to become more effective at maintaining Cryptographic Requirements an Compliance in the Future.

HNDL

Questions and Answers

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HNDL

About Me

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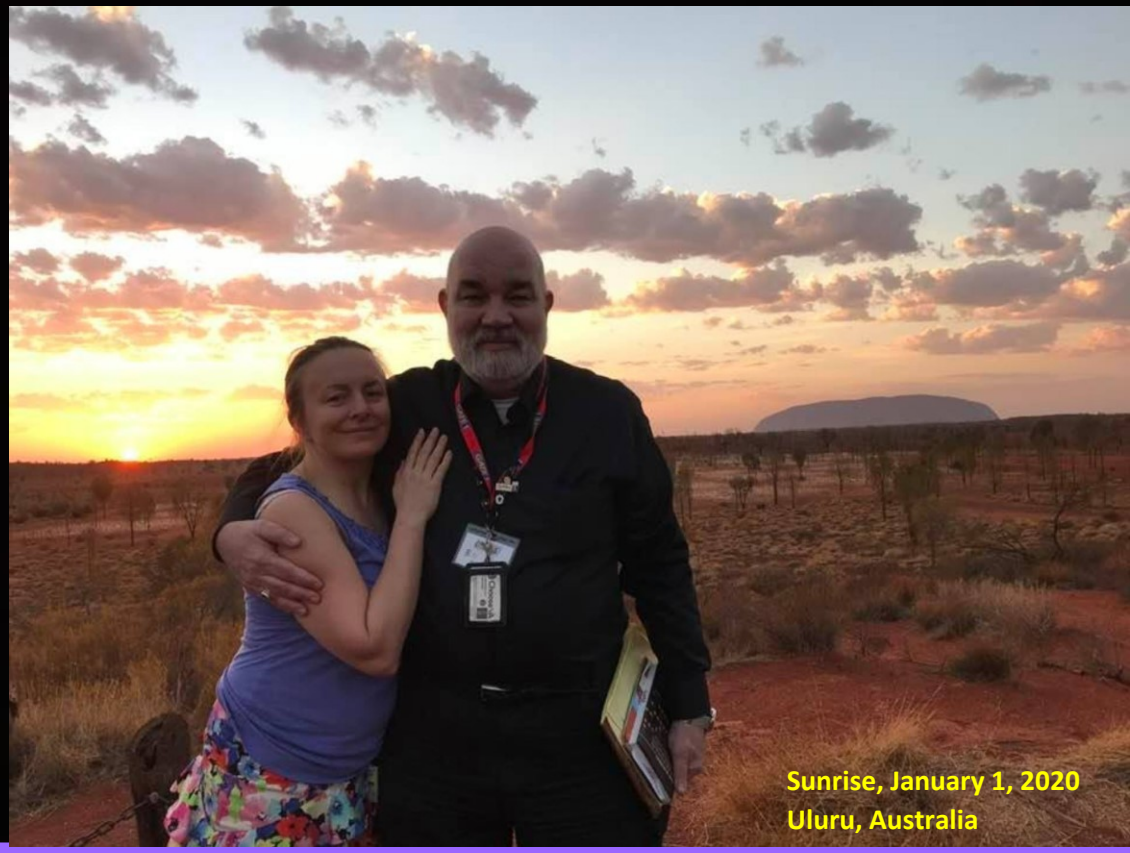
3. CEO and owner of Slater Technologies, Inc. (since 1989)
4. In Quantum since 2011
5. Started in Cybersecurity in the U.S. Air Force: 1977.
6. Former U.S. Air Force Computer System Staff Officer who served at Strategic Air Command HQ.
7. Programming Languages: 43
8. 3 Graduate Degrees
   - MS Computer Informatiom Systems
   - MBA
   - MS Cybersecurity
9. 88 Certifications including CISSP, SSCP, CISA, PMP.
10. Certified Project Manager with over 25 years experience.
11. Born and Raised in Memphis, Tennessee
12. Lives and works in Chicago, Illinois, USA
13. Published Author: https://billslater.com/writing
14. Working with QSECDEF since September 2024.
15. Happily married to Joanna Roguska since December 2000.
16. Avid fan of Andreas Vollenweider Music (since 1985), Chess (since 1964), and Judo (since 1968).
17. Voracious Reader with 18,000 physical books and 8000 digital books.
18. Meyers-Briggs: INFP.
19. Non-Denominational Christian (since 1973).

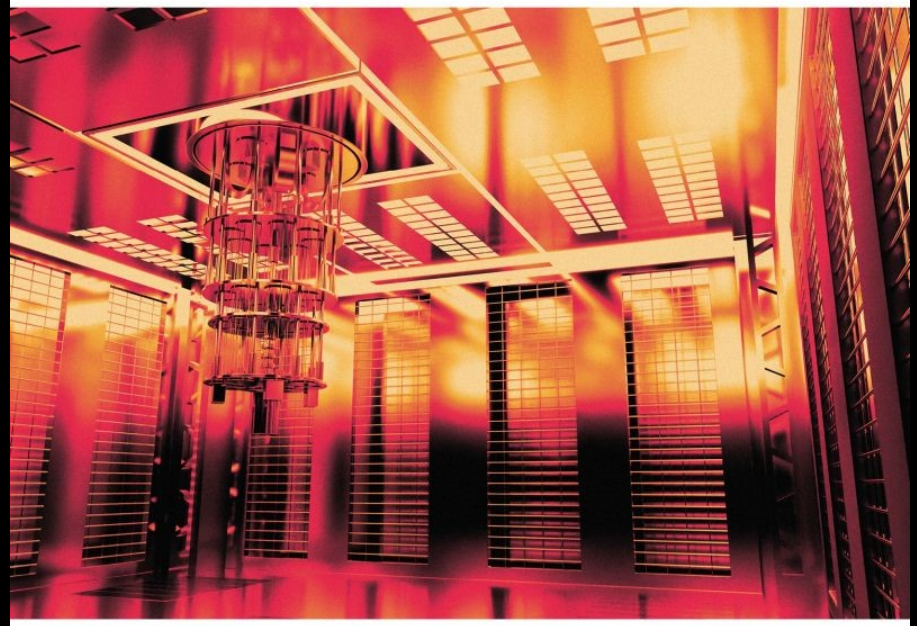


Sunrise, January 1, 2020
Uluru, Australia

WIRED

HAPPY Q-DAY

Warning: It'll be the worst holiday in the history of the world.



Contents

BY AMIT KATWALA

ILLUSTRATIONS BY NICHOLAS LAW

Q Day is the finish line for PQC readiness

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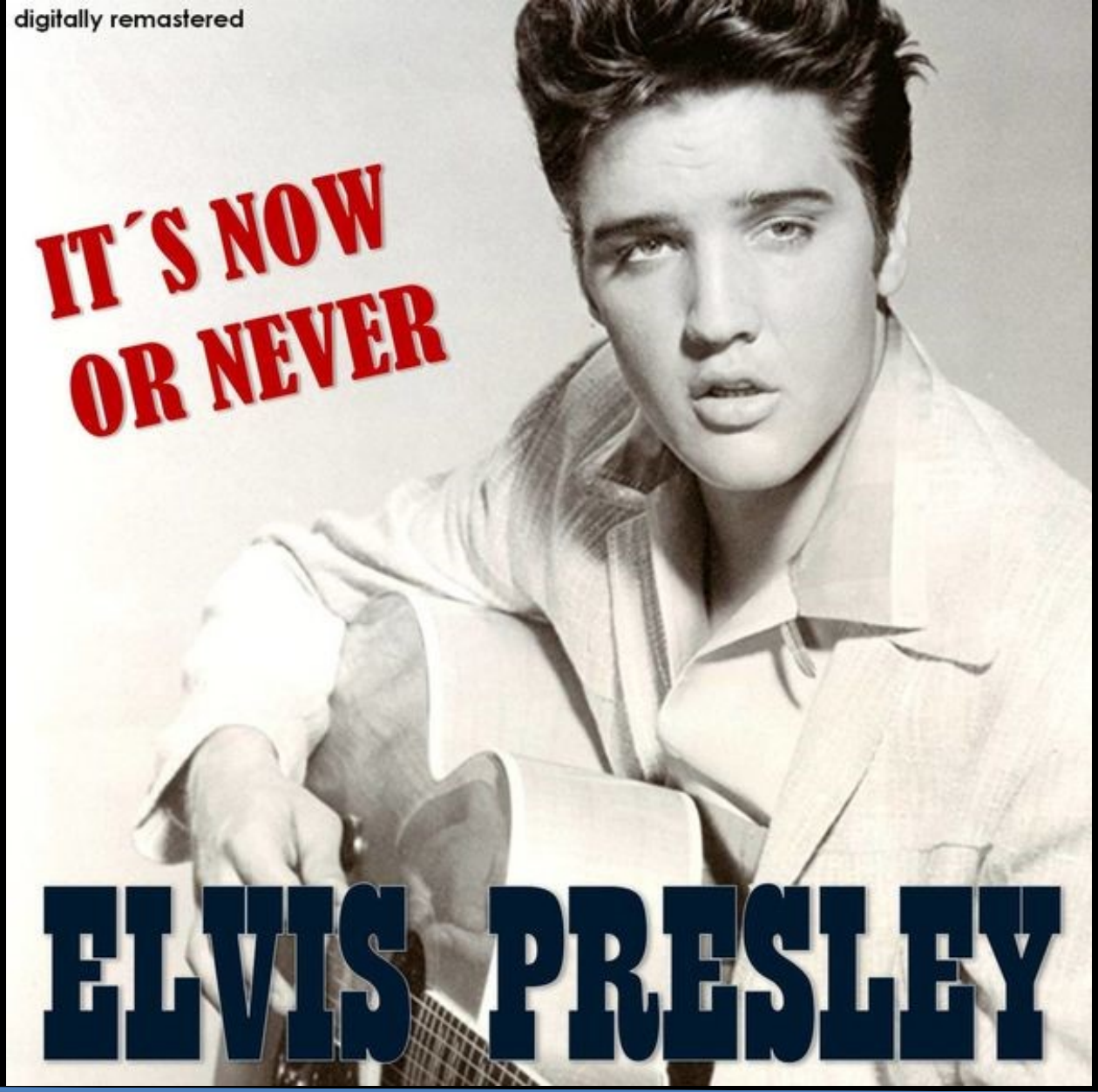

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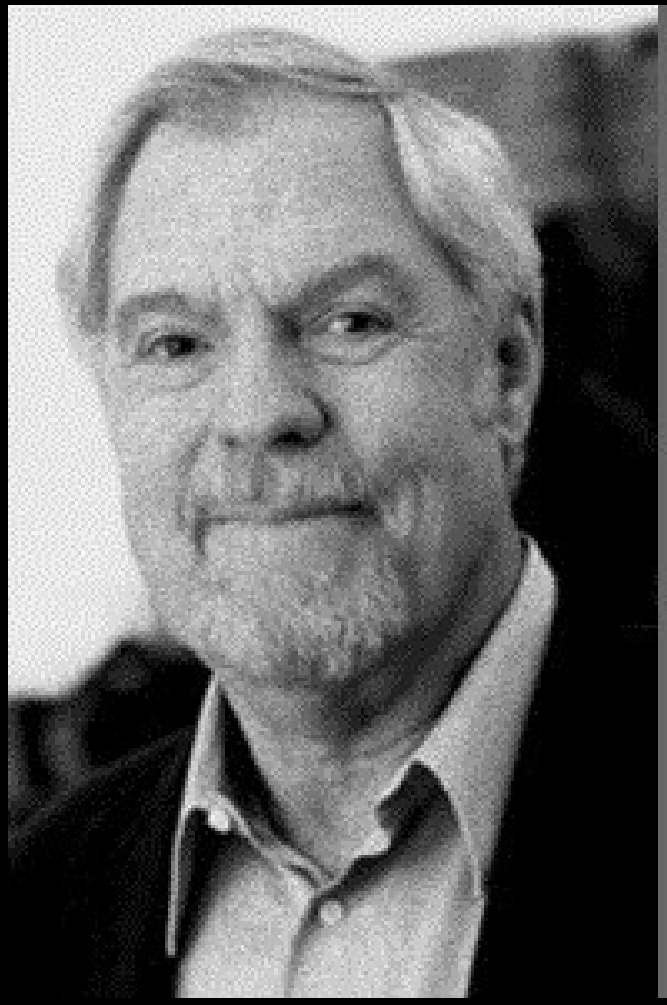
Supplemental Slides

Stockdale Paradox

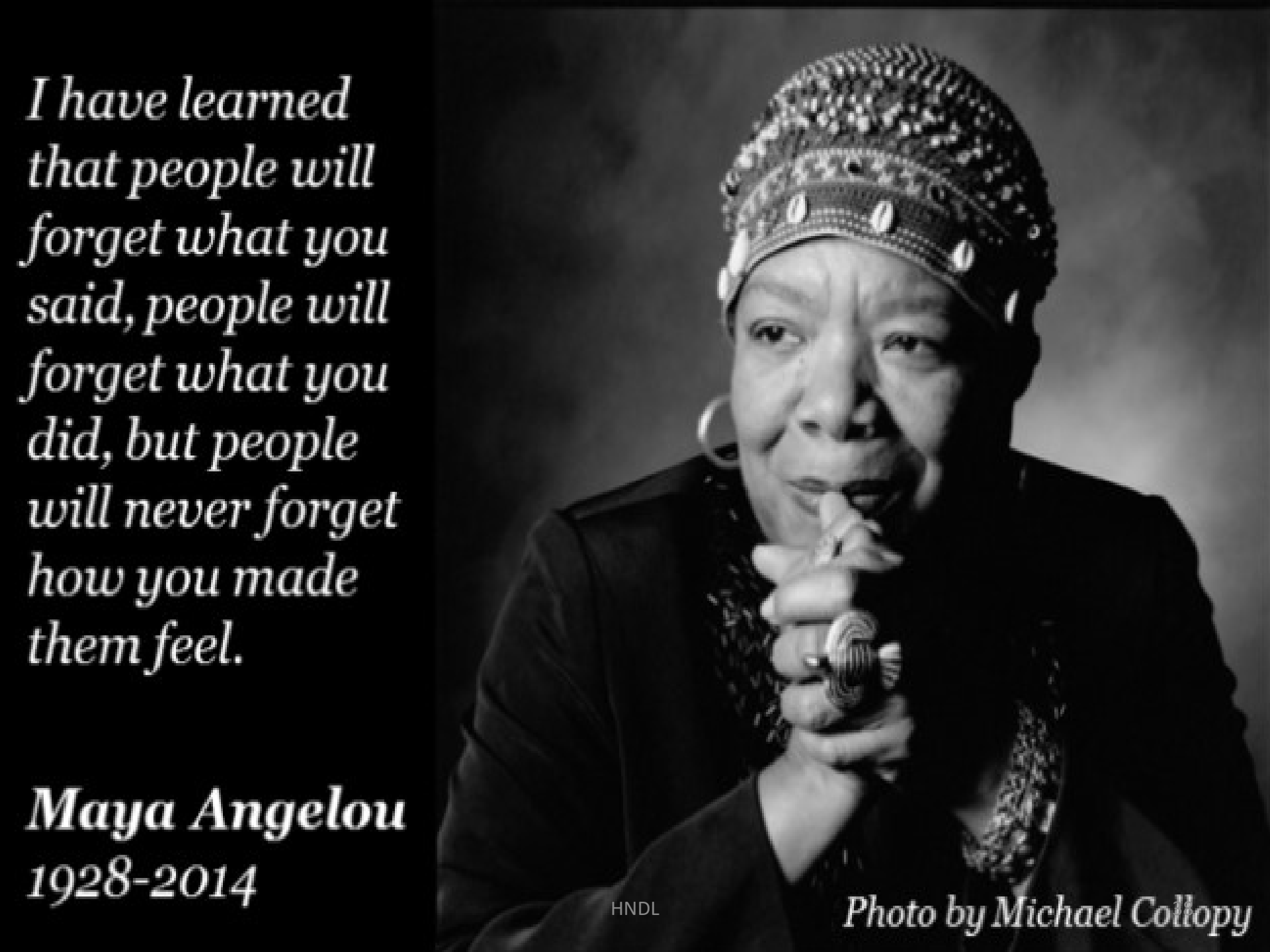
You must never confuse faith that you will prevail in the end -- which you can never afford to lose -- with the discipline to confront the most brutal facts of your current reality, whatever they might be.

Admiral James B. Stockdale



"One of life's most painful moments comes when we must admit that we didn't do our homework, that we are not prepared."

Merlin Olsen


I have learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel.
Maya Angelou
1928-2014
HNDL
Photo by Michael Collopy

Quantum References

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12:00 Noon, NSW Australia (contact Muria.Roberts@protonmail.com for more information)

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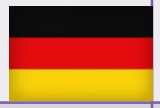
FREE Quantum Group Meetings

QSECDEF - Germany & France - Meets Weekly, every Tuesday
Event Link: https://zoom.us/j/91478584384
Event Date and Time - Tuesday, April 7, 2026
15:00 CEST / 14:00 UK / 09:00 EST / 08:00 CST / 02:00 Wednesday - Australia
Steve Vaile is the Director. steve@qsecdef.com



Australia
QSECDEF Australian Quantum Group - 9:00 Central Time, every Sunday . It's 12:00 Noon Monday in Australia
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Wonderful People, and Great Presentations!
Muria Roberts is the Director - Muria.Roberts@protonmail.com

Chicago Quantum Meetup - Monthly Meetings
https://www.meetup.com/chicago-quantum-computing-meetup-group-revival/
Registration required - Meetup
Do an Internet Search - Chicago Quantum Meetup. Sometimes they have 1 to 0 meetings per month.
Barry Burd and Ron Schreiner are the Directors.

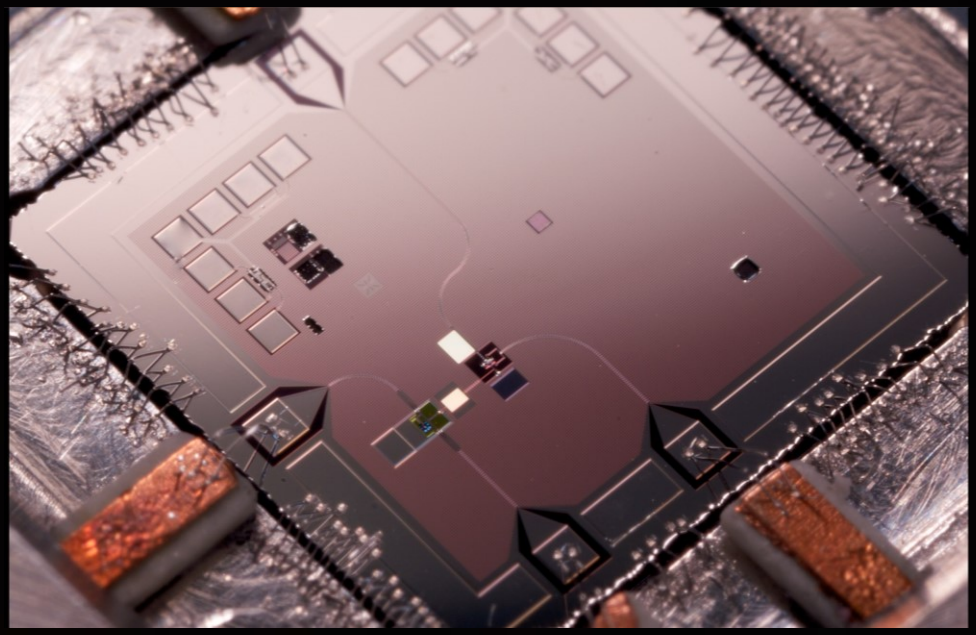
Washington DC Quantum Meetup - Monthly Meetings
https://www.eventbrite.com/o/washington-dc-quantum-computing-meetup-33793545445
Registration required x 2 - Meetup AND EvenBrite.
Do an Internet Search - Washington DC Quantum Meetup. Sometimes they have 3 to 4 meetings per month.
Helen Ma is the Director.

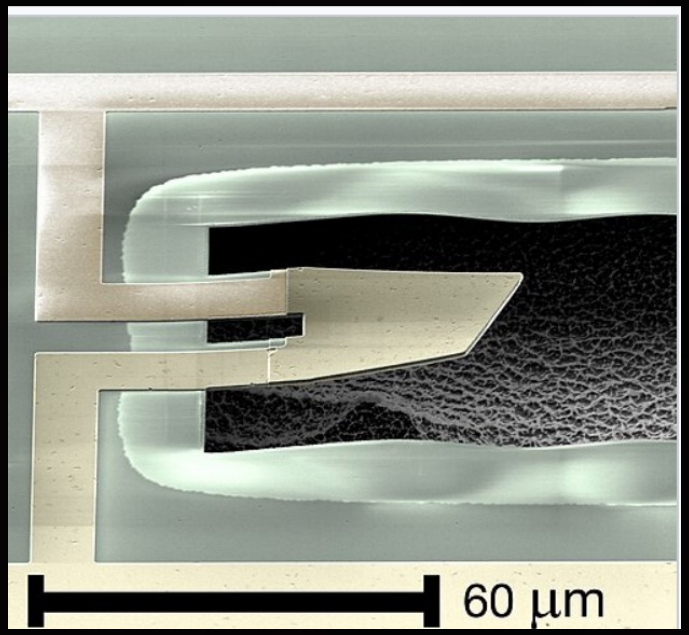
Alexandria, Egypt - Amsterdam, Netherlands Quantum Group - Monthly Meetings
https://duckduckgo.com/?q=Alexandria%2C+Egypt+-+Amsterdam++Quantum+Group&atb=v314-1&ia=web
Registration required on LinkedIn
Do an Internet Search - Alexandria Quantum Meetup. Sometimes they have 1 meetings per month, or every other Month.
Dr. Taha Selim is the Director.

Philippine Quantum Society
On Facebook, with announced Meetings on Zoom.
https://www.facebook.com/qcsp.ph
See the Quantum-Readiness Workshop, Apr 23-24:
https://quantumreadyph.qcsp.institute

World's First Quantum Machine, 2010

Wikipedia, 2011 - https://en.wikipedia.org/wiki/Quantum_machine





End of Presentation

THE MAP OF QUANTUM PHYSICS

DOMAIN OF SCIENCE

BY DOMINIC WALLIMAN © 2020

PRE-QUANTUM MYSTERIES

ATOMIC SPECTRA

BLACKBODY RADIATION

INTENSITY

WAVELENGTH

THE STABLE ATOM

PHOTOELECTRIC EFFECT

RADIOACTIVITY

QUANTUM FOUNDATIONS

THE WAVE FUNCTION

PARTICLE-WAVE DUALITY

THE BORN RULE

INTERFERENCE PATTERN

DOUBLE SLIT EXPERIMENT

THE SCHRÖDINGER EQUATION

$$i\hbar\frac{\partial}{\partial t}\Psi(\vec{r},t) = -\frac{\hbar^2}{2m}\nabla^2\Psi(\vec{r},t) + V(\vec{r})\Psi(\vec{r},t)$$

THE DIRAC EQUATION

$$i\hbar\gamma^\mu\partial_\mu\psi - mc\psi = 0$$

THE HEISENBERG UNCERTAINTY PRINCIPLE

DEFINITE POSITION

DEFINITE MOMENTUM

BELL'S THEOREM

CORRELATION

ENERGY QUANTIZATION

HIGHER ENERGY

INTERPRETATIONS OF QUANTUM MECHANICS

COPENHAGEN

WAVE

PARTICLE

THE MEASUREMENT PROBLEM

PILOT WAVE

MANY WORLDS THEORY

QBISM

CONSISTENT HISTORIES

AND MANY OTHERS...

TRANSACTIONAL INTERPRETATION

STOCHASTIC INTERPRETATION

QUANTUM DARWINISM

COSMOLOGICAL INTERPRETATION

ALTERNATIVE COLLAPSE

QUANTUM GRAVITY

M-THEORY

STRING THEORY

LOOP QUANTUM GRAVITY

QUANTUM PHENOMENA

QUANTUM SPIN

PARTICLE PROPERTIES

POSITION

SPIN (INHERENT ANGULAR MOMENTUM)

MOMENTUM

MASS

COLOUR CHARGE

FLAVOUR

ELECTRIC CHARGE

BARYON NUMBER

WEAK HYPERCHARGE

LEPTON NUMBER

LEPTON FAMILY NUMBER

SUPERPOSITION

QUANTUM NUMBERS

SCHRÖDINGER'S CAT

ENTANGLEMENT

DECOHERENCE

QUANTUM TUNNELING

QUANTUM HALL EFFECT

SUPERCONDUCTIVITY

SUPERFLUIDITY

COOPER PAIRS

CASIMIR EFFECT

TOPOLOGICAL PHASE TRANSITIONS

LOWER TEMPERATURE

HIGHER TEMPERATURE

PHASE TRANSITIONS

TEMPERATURE

QUANTUM CRITICAL REGIME

SUPERCONDUCTOR

NORMAL METAL

MAGNETIC FIELD

ZERO-POINT ENERGY

QUANTUM THEORY

POSTULATES (PARAPHRASED)

1. WAVE FUNCTION DETERMINES EVERYTHING
2. ALL OBSERVABLES HAVE OPERATORS
3. OBSERVABLES ARE HERMITIAN
4. EIGENFUNCTIONS OF OPERATORS ARE INDEPENDENT
5. EXPECTATION VALUE INTEGRAL
6. TIME DEPENDENT SCHRÖDINGER EQUATION

PATH INTEGRALS

A

B

QUANTUM FIELD THEORY

SYMMETRIES

HILBERT SPACE

PARTICLE PHYSICS

QUANTUM CHROMODYNAMICS

STRONG FORCE

ELECTROWEAK INTERACTIONS

ELECTROMAGNETISM + WEAK FORCE

γ W^- W^+ Z^0

QUANTUM ELECTRODYNAMICS

QUANTUM INFORMATION

QUANTUM CRYPTOGRAPHY

QUBITS

0

1

QUANTUM COMPUTING

QUANTUM SIMULATION

QUANTUM TELEPORTATION

BELL-STATE ANALYSER

CLASSICAL SIGNAL

ENTANGLED PHOTONS

QUANTUM COMMUNICATION

QUANTUM INTERNET

QUANTUM COMPLEXITY COMPUTATIONAL COMPLEXITY

P SPACE

NP PROBLEMS

NP COMPLETE

P PROBLEMS

BQP

THE STANDARD MODEL OF PARTICLE PHYSICS

FEYNMAN DIAGRAMS

ANTI-MATTER

PROTON

ANTI-PROTON

P

$\bar{P}$

QUARKS

THE HIGGS BOSON

GAUGE BOSONS

LEPTONS

PARTICLE ACCELERATORS

SOLID STATE DEVICES

BAND THEORY OF SOLIDS

N-TYPE

P-TYPE

HOLES

ELECTRONS

TRANSISTORS

SOURCE

GATE

DRAIN

N-TYPE

P-TYPE

SOLAR PANELS

QUANTUM TECHNOLOGY

LIGHT EMITTING DIODES

POSITIVE TERMINAL

NEGATIVE TERMINAL

SUPERCONDUCTING MAGNETS

S.Q.U.I.D.S

JOSEPHSON JUNCTION

LASERS

CHARGE-COUPLED DEVICES

CCD SENSOR

ATOMIC CLOCKS

ELECTRON MICROSCOPES

SCANNING TUNNELING MICROSCOPES

ATOMIC FORCE MICROSCOPES

NUCLEAR MAGNETIC RESONANCE IMAGING

MAGNETIC RESONANCE IMAGING

CONDENSED MATTER PHYSICS

QUANTUM BIOLOGY

PHOTOSYNTHESIS

BIRD NAVIGATION

SENSE OF SMELL

ENZYMES

COLD ATOM PHYSICS

DEGENERATE ULTRACOLD GASES

DEGENERATE FERMI GAS

BOSE-EINSTEIN CONDENSATE

RYDBERG MATTER

QUANTUM CHEMISTRY

ELECTRONIC STRUCTURE

MOLECULAR DYNAMICS

QUANTUM MONTE CARLO METHODS

NUCLEAR PHYSICS

NUCLEAR FISSION

NUCLEAR FUSION

RADIOACTIVE DECAY

ALPHA DECAY

BETA DECAY

e^-

GAMMA DECAY

γ

HNDL

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