CYQCI
safe communications

Intro to Quantum Communication

How quantum physics is changing the way we securely send information

Learning Outcomes

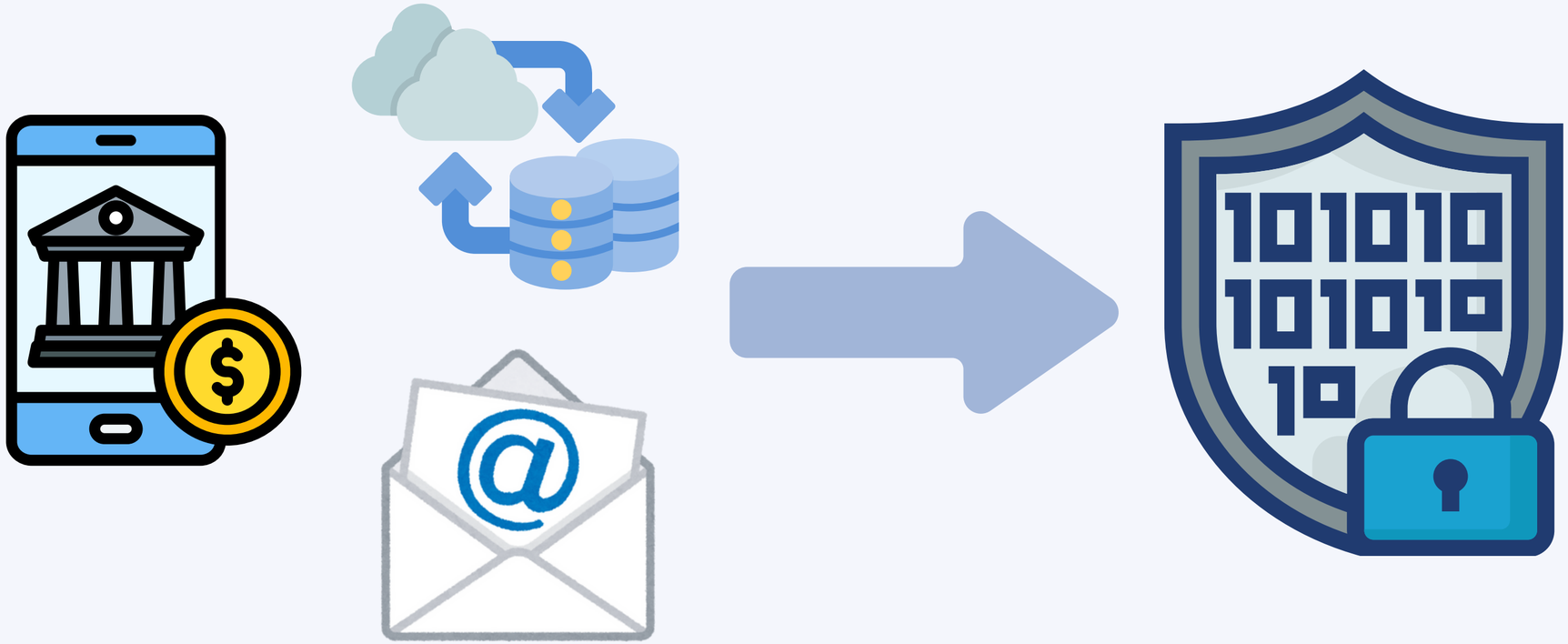
By the end of this unit, you will be able to:

Explain how classical encryption protects data.

Describe why current systems are vulnerable.

Understand how quantum communication improves security.

Every day, we send sensitive data - bank details, passwords, and health records. Keeping this data private relies on **encryption** and **secure communication networks**.



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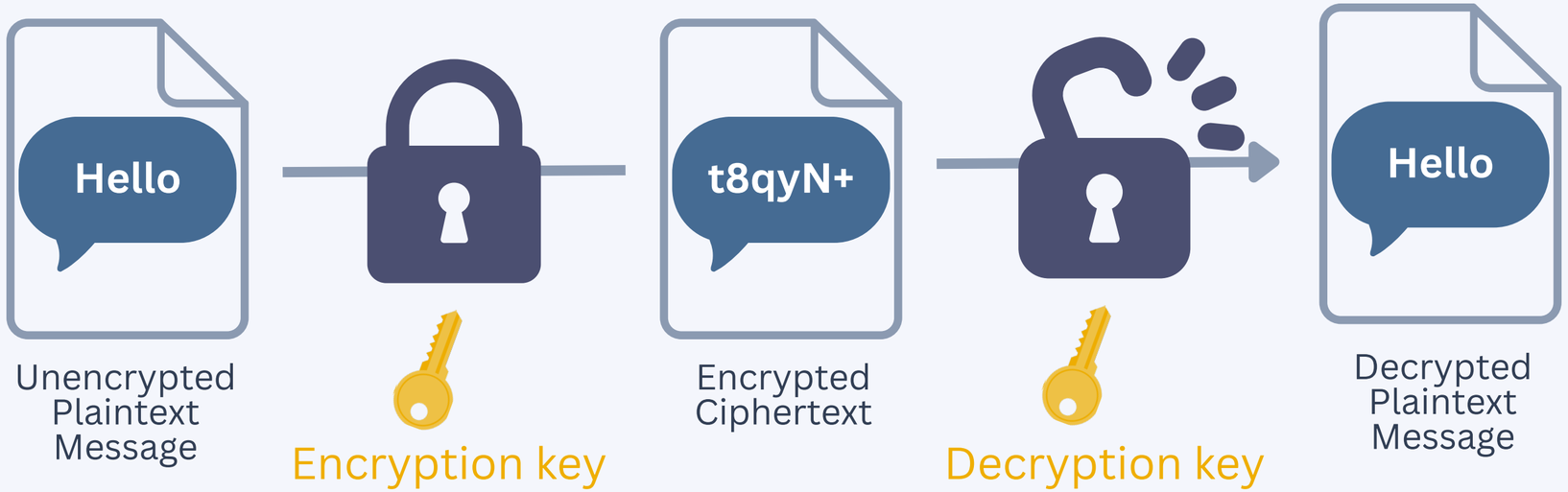
What is Encryption? How we Keep Information Safe

Every time we send a message, it is turned into a secret code (encryption), and only people with the right key can unlock, decrypt, and read the message.



Classical Communication

Information is encrypted and transmitted through fiber optic cables or other communication channels, along with the digital “keys” used to decrypt the information.

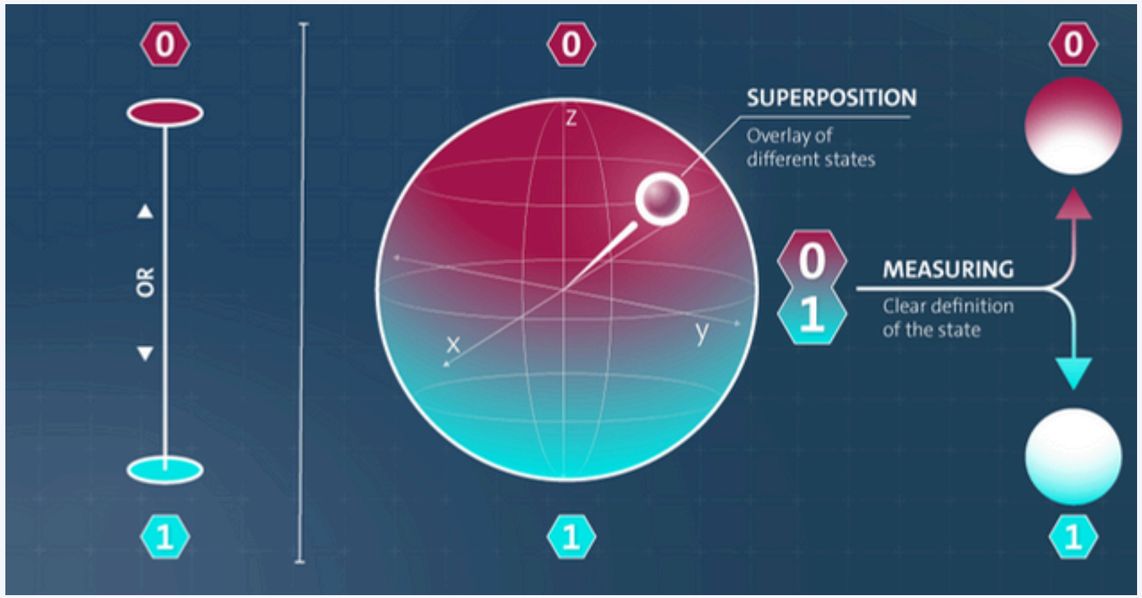
The data and the keys are sent as classical bits, 0s and 1s.

The Challenge with Classical Communication

- Classical encryption is based on complex mathematics.
- Emerging quantum computers could break today’s codes in the future.
- At the same time, cybersecurity risks - such as large-scale data breaches - are increasing.
- We need more secure communication networks to protect data in the future!

Quantum Communication - What makes it different

Classical Bit Quantum Bit / “qubit”



Source

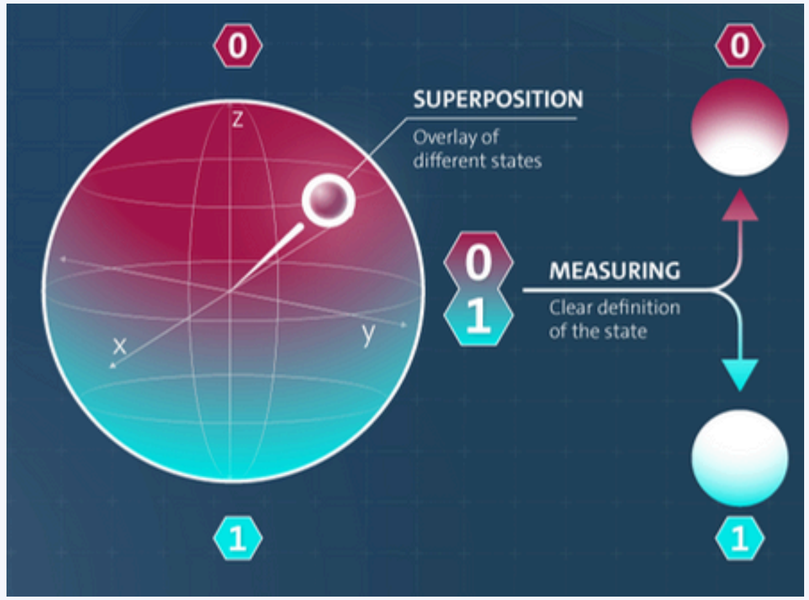
Quantum communication uses the laws of physics (and in particular quantum physics) to enable new ways to transmit information more securely.

It uses particles of light - photons - to send information securely by putting them in a state of superposition.

Superposition: the particle can exist in multiple states at once (it can be both 0 and 1 simultaneously).

Quantum Communication - What makes it different

Quantum Bit / “qubit”



Source

If a hacker tries to intercept a qubit (the quantum by measuring or copying it, its delicate quantum state “collapses” to either 0 or 1.

This automatically reveals that the data has been observed.

This makes it impossible for hackers to access the information without leaving clear evidence of tampering.

Quantum communication uses qubits, particles of light that carry quantum information, to exchange encryption keys securely, enabling next-generation data protection.