qLearn: Quantum Communications

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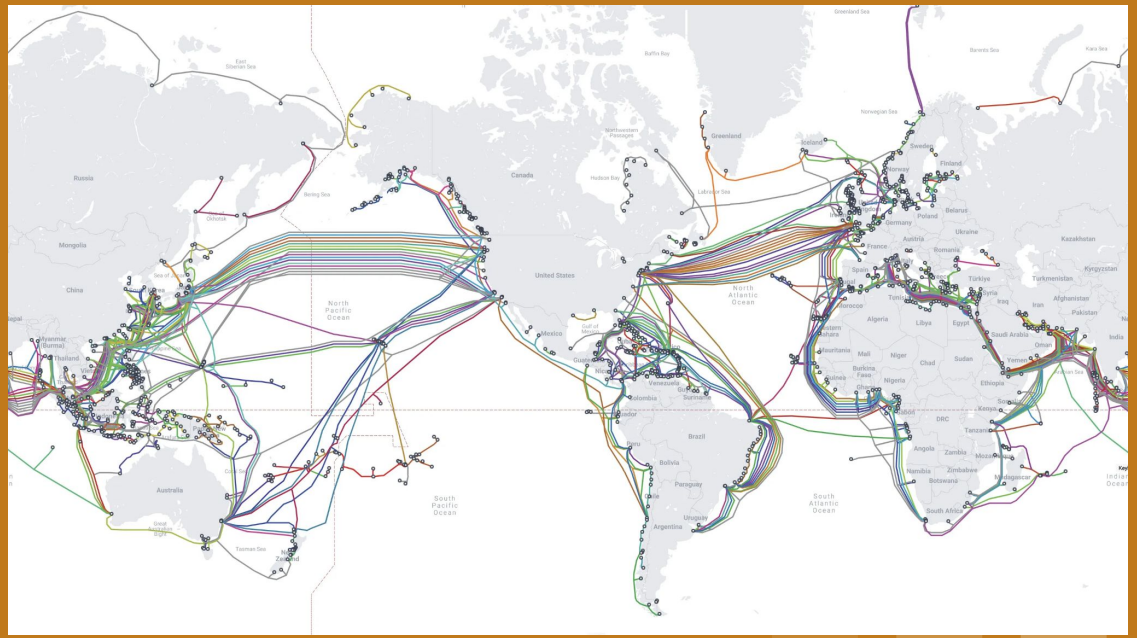
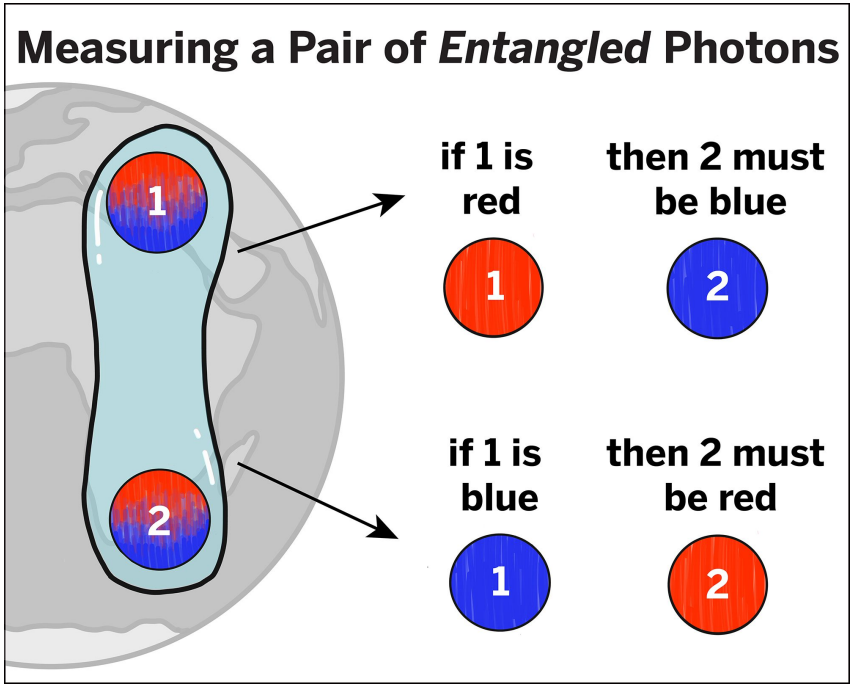
Classical Communications



Review: Entanglement



Limitation: No-Cloning Theorem

There is no unitary transform that allows us to copy a qubit

For arbitrary states

$$|\psi\rangle = \begin{pmatrix} a \\ b \end{pmatrix}, |\phi\rangle = \begin{pmatrix} c \\ d \end{pmatrix}$$

There is no unitary transform. U such that for all ψ

$$U(|\psi\rangle|\phi\rangle) = |\psi\rangle|\psi\rangle$$

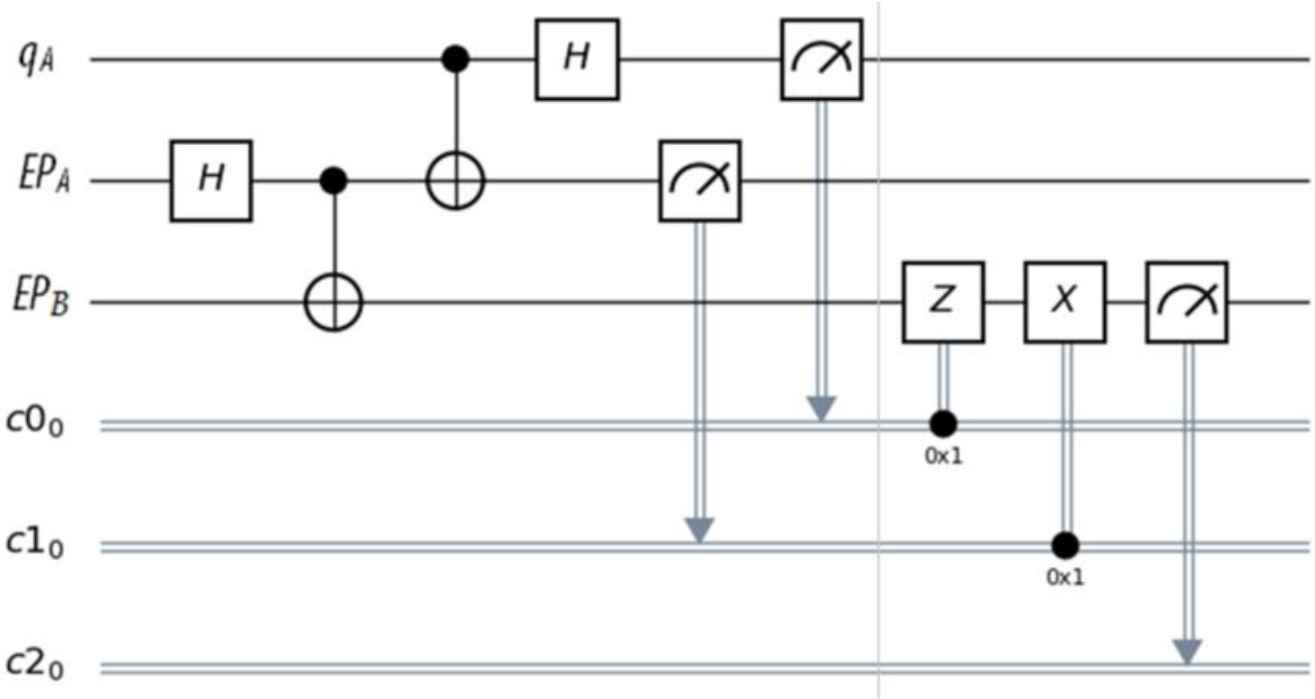
**Note: for unobserved states only

TLDR: We cannot copy qubits

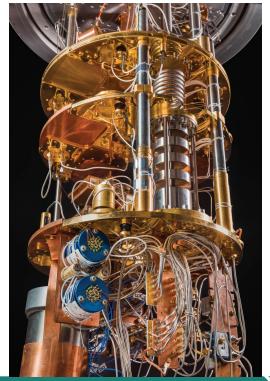
We mitigate this by
interchanging states

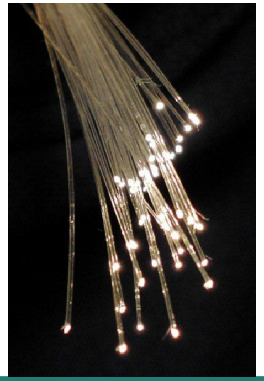
Quantum Teleportation

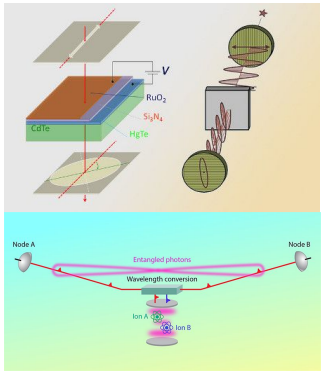
Transferring one qubit state to another qubit

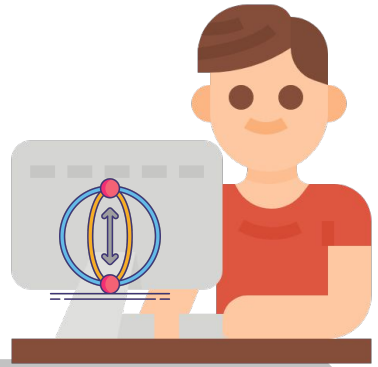


The Quantum Network









Quantum Device

Quantum Device/QPU generates quantum information to transmit

Communication Lines

Qubits are transported through photonic transportation lines, as of right now we can use standard telecom optic fibers

Signal Control

To maintain and control transmitted signals, we use a variety of devices; Optical switches are devices that control optical signals to deliver qubits to the intended device; Quantum repeaters maintain and transport qubits over long distances

End-User Device

The qubit signals then arrive at the end device, which are then decoded/measured to view information

Emergent Technology: Quantum Repeaters