ADVA™ Optical Networking

Quantum-safe data center interconnects

A practitioner’s guide

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OIDA Executive Forum 2019 – Panel 4: Commercial QKD & Encryption

Why do we care?

Data center A

Data center
interconnect (DCI)

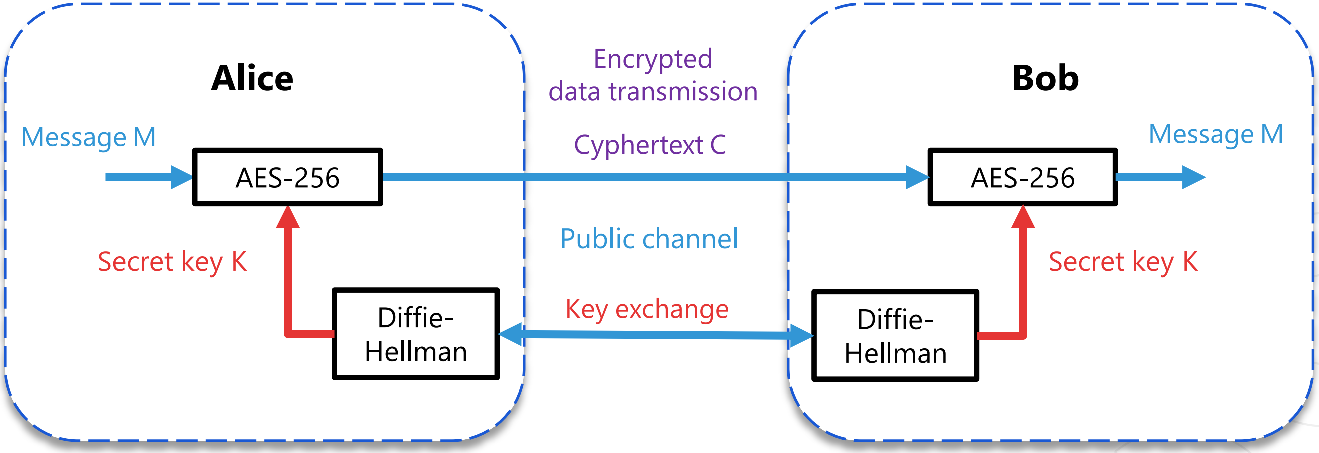
Fiber tapping devices

DWDM interception devices
10..100 Gb/s, direct detect & coherent

Data center B

Intercepting data center traffic is easy and can reveal a vast amount of critical data.

What can we do?



Alice

Message M

AES-256

Secret key K

Diffie-Hellman

Encrypted data transmission

Cyphertext C

Public channel

Key exchange

Bob

Message M

AES-256

Secret key K

Diffie-Hellman

On-the-fly encryption *secures* data communication over *insecure* channels.

What changes with quantum computers?

Data center A

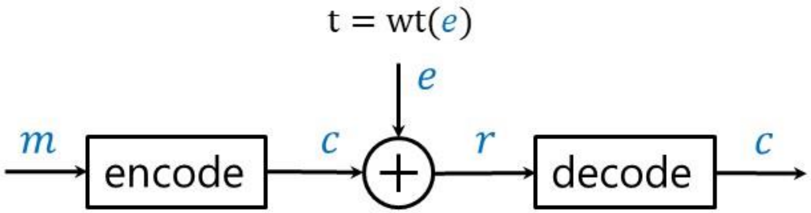
Adversary's recipe

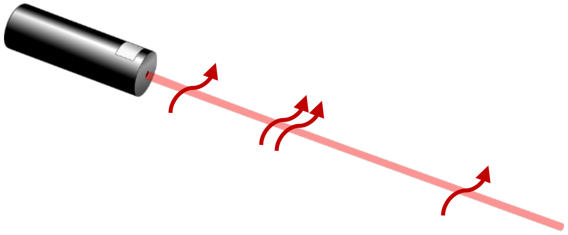
1. Intercept data communication
2. Store intercepted data
3. Use quantum computer to break key exchange protocol
4. Retrieve encryption keys
5. Decrypt data

Data center B

Quantum computers put secrecy of encrypted data communication at risk.

How can we make the key exchange quantum-safe?





Post-quantum cryptography (PQC)

- Provides computational security
- Is based on hardness of math problems
- Works on any communication channel
- Requires endpoint protocol access only
- Is independent of optical layer

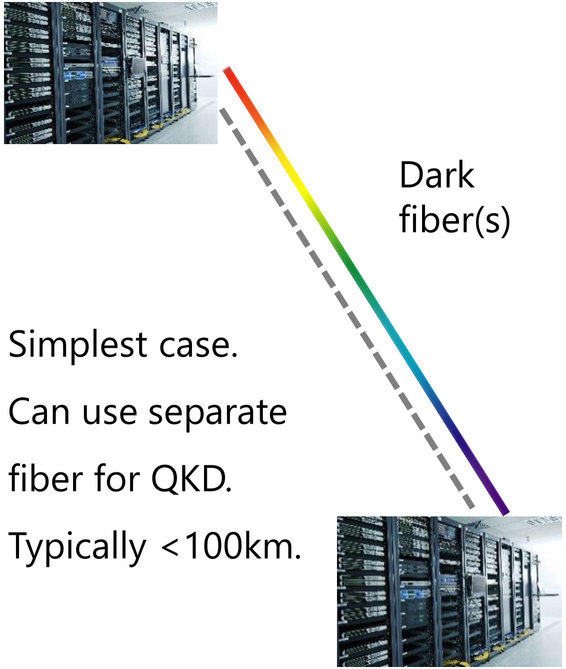
Quantum-key distribution (QKD)

- Provides information-theoretic security
- Is based on laws of quantum physics
- Needs optical fiber or free-space channel
- Requires access to physical infrastructure
- Depends on optical link performance

Note: Security is only as strong as the weakest link in the chain.

What are practical DCI deployment scenarios?

Metro DCI link

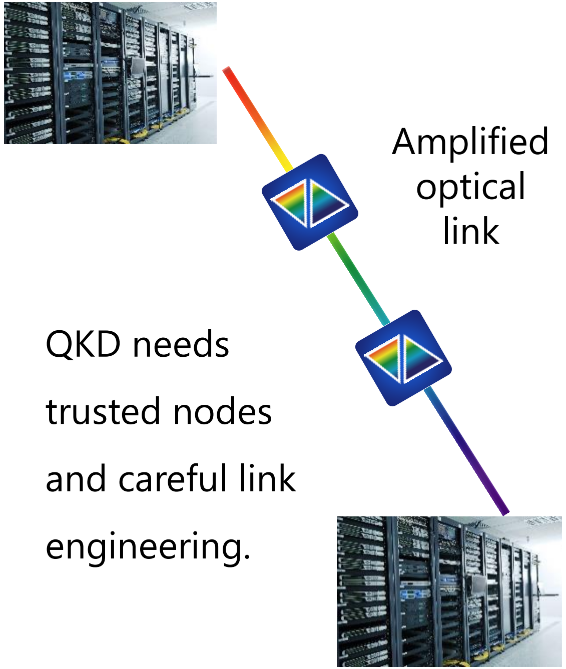


Simplest case.

Can use separate fiber for QKD.

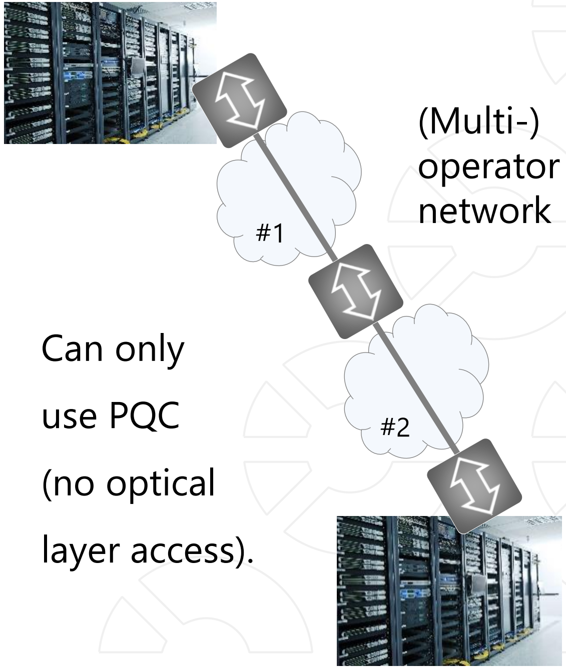
Typically <100km.

Long-haul DCI link



QKD needs trusted nodes and careful link engineering.

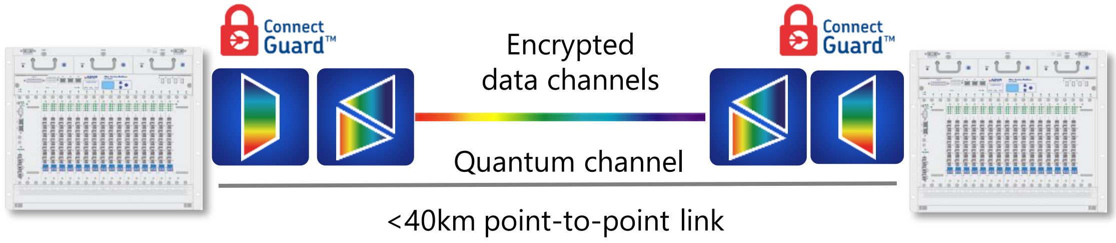
DCI via layer 1 VPN



Can only use PQC (no optical layer access).

Some quantum-safe deployment examples

Financial institution

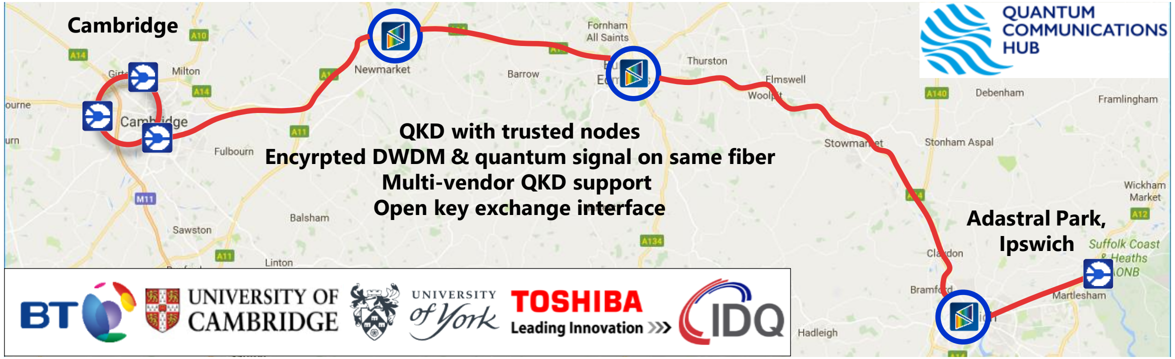


Encrypted data channels

Quantum channel

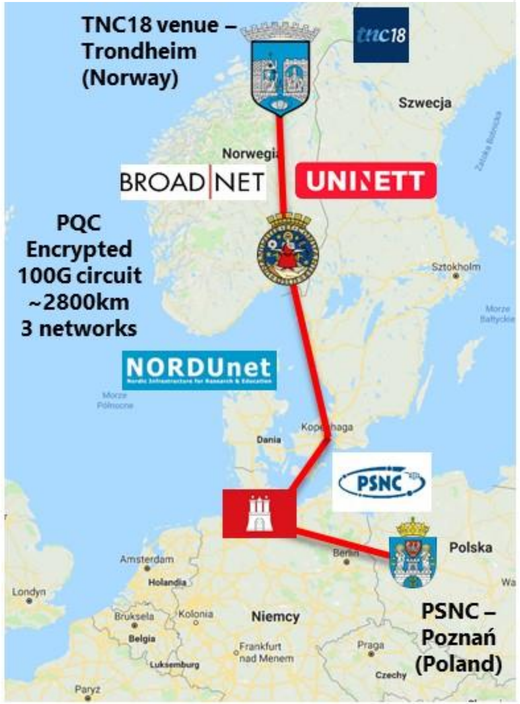
<40km point-to-point link

UK regional network



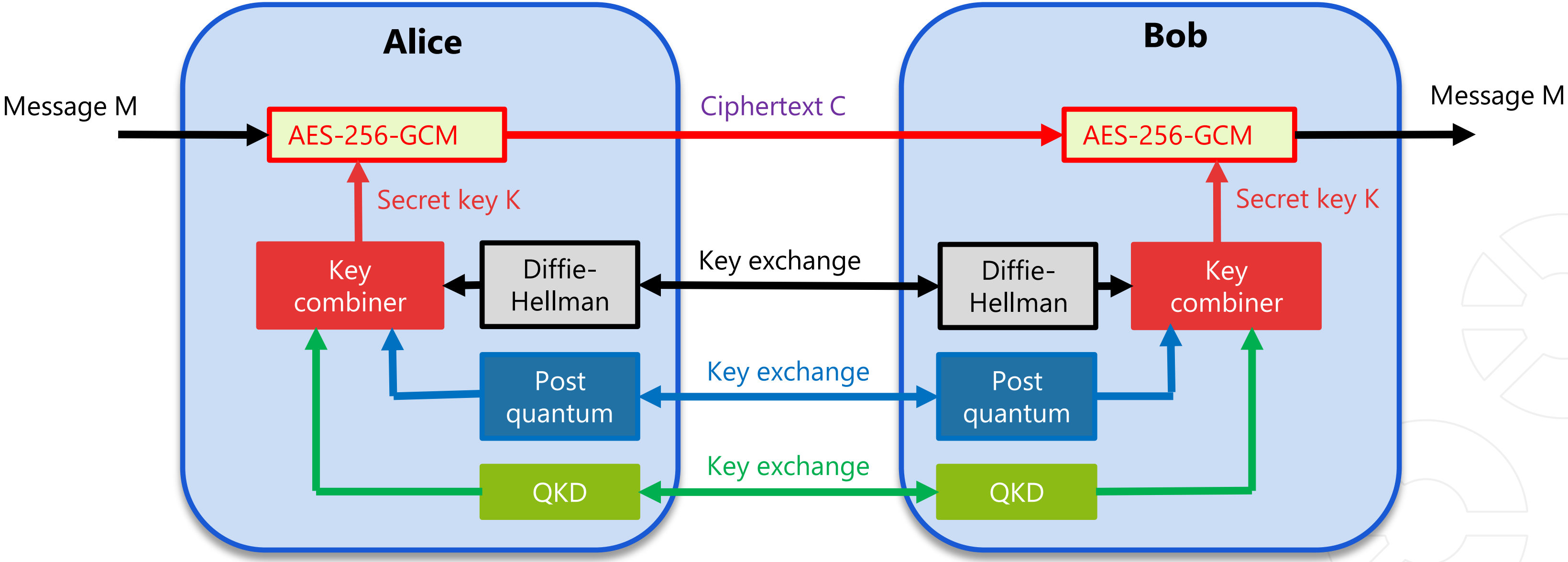
QKD with trusted nodes
Encyrpted DWDM & quantum signal on same fiber
Multi-vendor QKD support
Open key exchange interface

EU research network



PQC Encrypted 100G circuit ~2800km 3 networks

Do I need to decide for one key exchange scheme?



Key exchange schemes can be combined to provide robust quantum-safe solutions.

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Thank you

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