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Toshiba Quantum Key Distribution Systems

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Quantum Key Distribution at Toshiba

Toshiba's Cambridge Research Laboratory founded in 1991 and has pioneered quantum technology research, particularly quantum communications, for decades.

Recent performance records include: >10 Mbit/s secure bit rate, >600 km distance, high-bandwidth encrypted (100G) multiplexed classical & quantum comms.

In 2020, a new Quantum Technology division was formed, launching QKD as a commercial product for quantum-safe communications: https://www.toshiba.co.jp/qkd/en

The Toshiba QKD system distributes keys between 2 nodes,
for delivery to key-consuming applications (e.g. 100G AES encryptors)
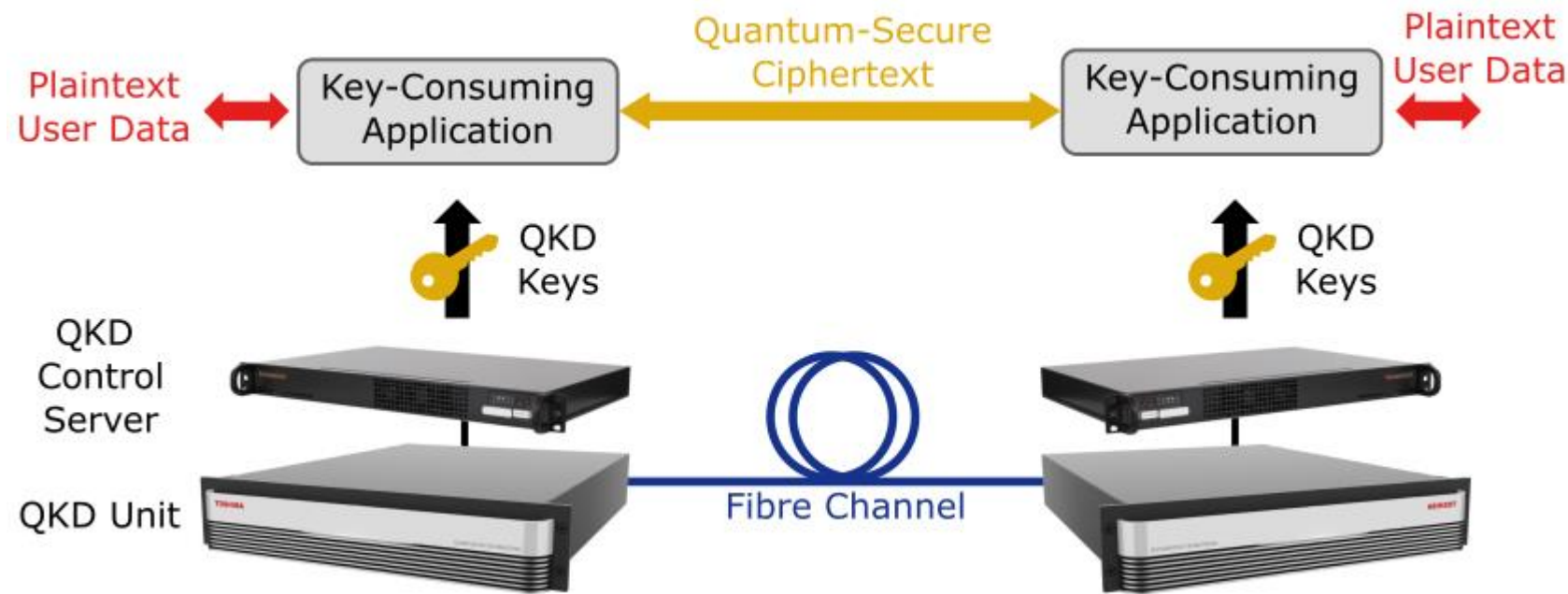
Uses T12 QKD Protocol
(Toshiba protocol based on efficiency improvements to BB84, with decoy states)

Each QKD System Comprises:

- 1 x QKD Transmitter Unit
- 1 x QKD Receiver Unit
- 2 x Control Servers

QKD Unit:
- 19" rack mount device (2U height)
- < 15 Kg

Control Server:
- 19" rack mount device (1U height)
- < 8 Kg

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QKD System Interface

- All required software is included on Control Server.

- Graphical user interface (GUI) can be used for real-time monitoring and log viewing.

- The QKD Control Servers include a Key Management System (KMS) for key storage & key delivery

- KMS follows the ETSI GS QKD 014 Standard v1.1.1 (already widely supported by encryptors)

GROUP SPECIFICATION
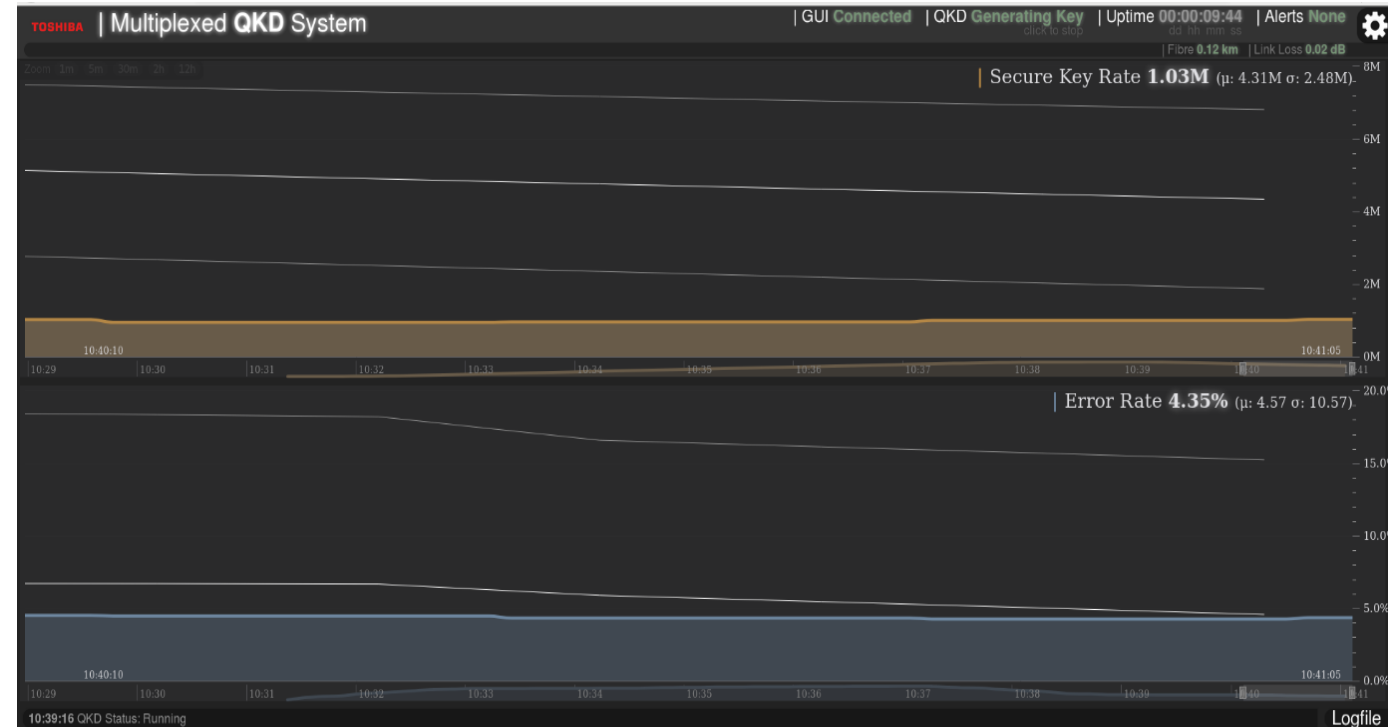
QKD System Operation

- Plug & play installation

- Hands-free auto-alignment routine when starting up

- Numerous proprietary technologies for self-stabilizing high-rate QKD (ensures continuous optimal performance, even if fibre link is perturbed)
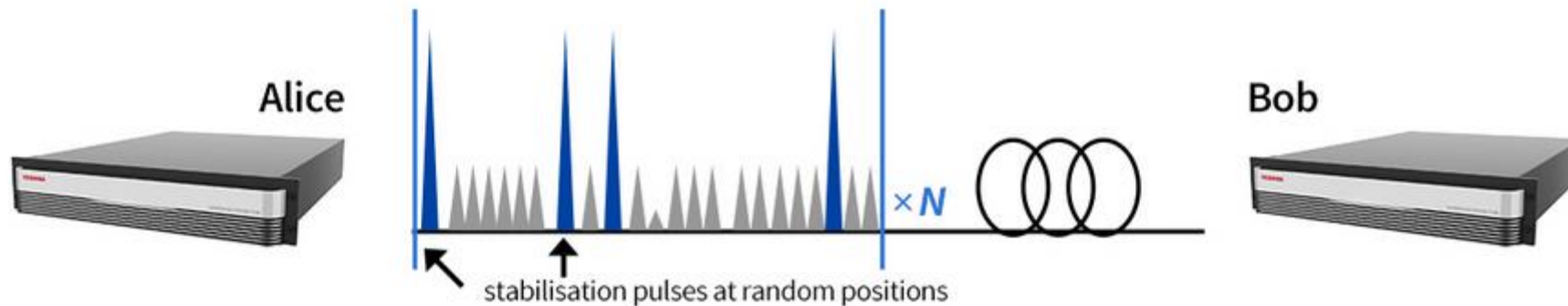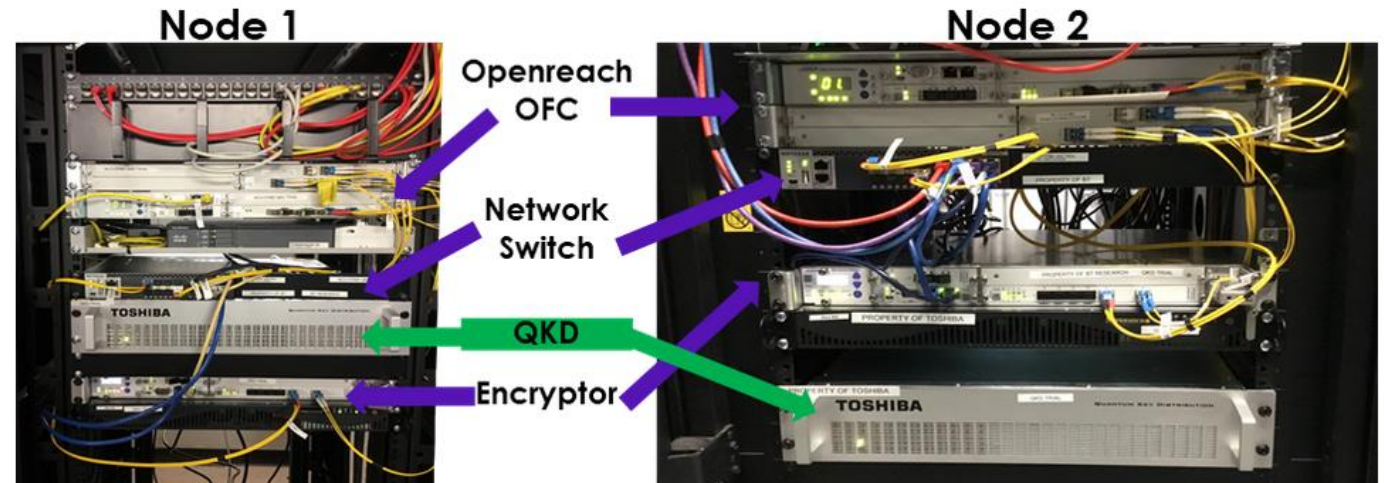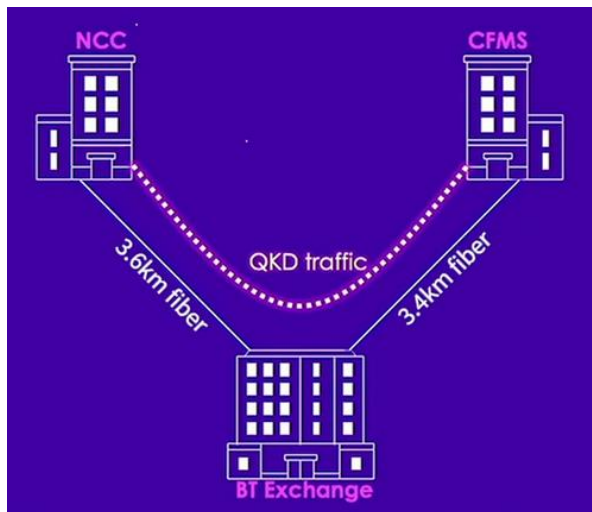

- Precision temporal & spectral filtering to minimize noise, enabling high-bandwidth multiplexed classical signals

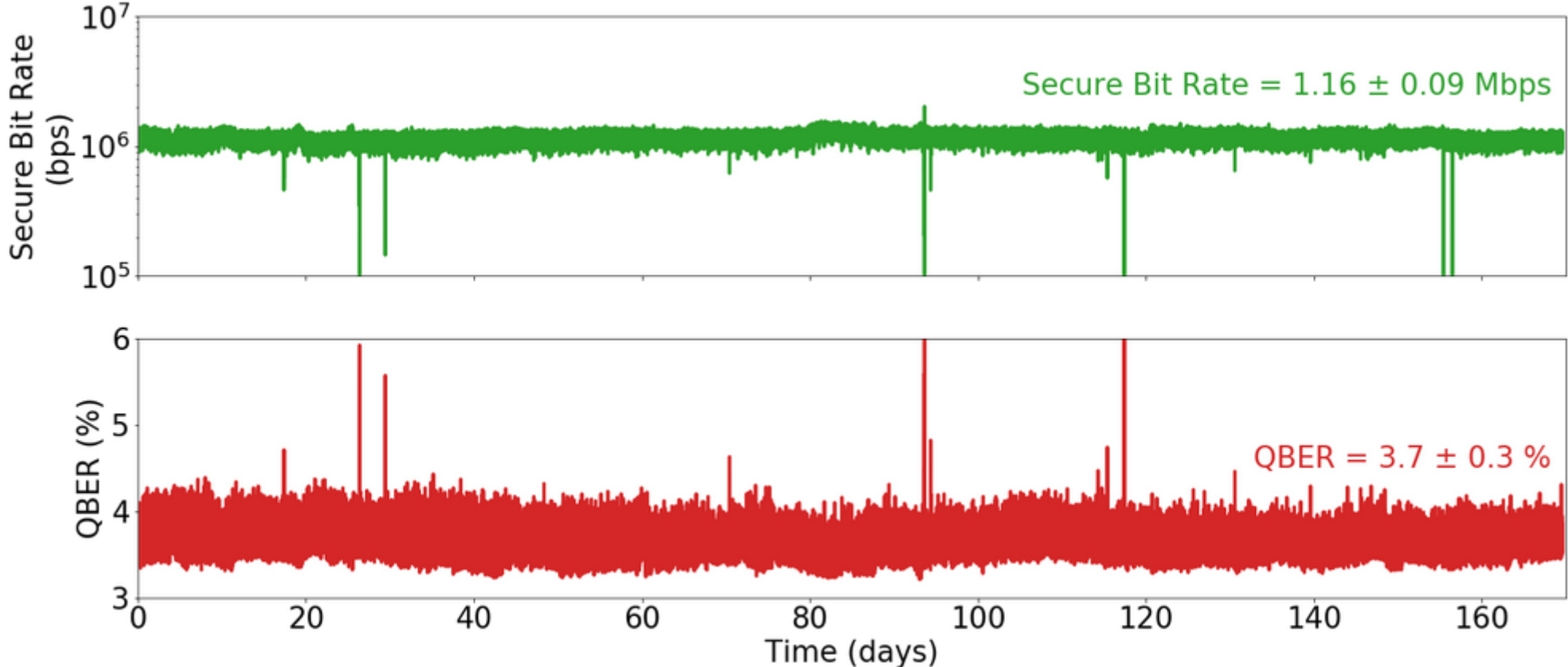# Use Case: Industrial Quantum-Secure Fibre Network

Toshiba & BT recently demonstrated the **UK's first industrial quantum-secure network** (connecting 2 smart manufacturing sites across 7 km in Bristol, UK).

All off-the-shelf equipment, compatible with national network infrastructure.
Keys supplied to 10G encryptor: **transparent 10G-encrypted link for end-users.**

Installation was plug & play (**all QKD and user data multiplexed on existing fibre**) and the system has run for 6 months uninterrupted.

https://www.ispreview.co.uk/index.php/2020/10/bt-and-toshiba-deploy-first-uk-industrial-quantum-secure-fibre-network.html

Within OpenQKD consortium, Toshiba supplied 2 QKD devices for **protecting medical data** transmitted between 2 hospitals and 2 data centres.

QKD protected data in transit. Sharmir secret sharing protected data at rest.

This demonstrates **integration of QKD to form quantum-secure communication systems**, compatible with existing networks and their data needs.

QKD Links
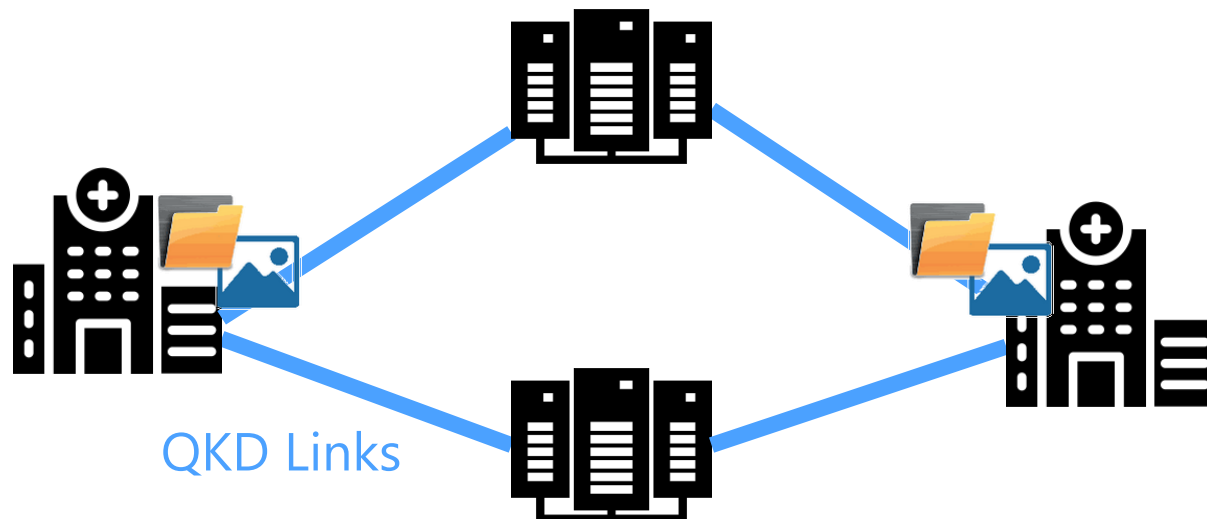
- System installed by end users with remote assistance from Toshiba

- QKD bit rate: 1.92 Mb/s over 10 km link (QBER: 3.9%)

- Real-world operation with medical data

https://www.prnewswire.com/news-releases/fragmentix-storage-solutions-gmbh-medical-data-successfully-protected-by-quantum-cryptography-in-graz-301190726.html

Toshiba is providing numerous system in OpenQKD to demonstrate seamless integration of QKD into existing communications networks across Europe, including:

Cambridge
Securing medical data in transit and at rest

Padau
Combining satellite communications with terrestrial QKD infrastructure

Madrid
Securing end-to-end communications for business-to-business & 5G networks

Berlin
Secure communication for 5G networks, with QKD and post-quantum crypto

Poznan
Securing data centre communications for banking, healthcare and government

Graz & Vienna
Secure secret sharing between hospitals & securing government ministry communications

Questions?

Quantum Key Distribution

The new age of secure communication, powered by quantum physics

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QUANTUM KEY DISTRIBUTION