



THE UK QUANTUM COMMUNICATIONS HUB Quantum Networks



The quantum networks may be used for a variety of purposes:

- Research and Development - for new technologies, systems, theoretical approaches and protocols
- Applications - from system-level management of keys, and their distribution for transparent use, to higher-level applications for securing services
- Technology Testing - by experimentalist researchers, developers of systems and system integrators
- Demonstration and User Engagement - a showcase for technologies and services, a means to engage with potential users and suppliers of services
- Trials - of technologies, systems and applications with early adopters

For further information about the Hub's networks, and discussion of options for access and use, contact enquiries@quantumcommshub.net

www.quantumcommshub.net



Funded by:



Funded by the UK National Quantum Technologies Programme / EPSRC and industry partners in support of:

Research & Development
Technology Testing
Performance Optimisation
Application Development
Demonstration and User Engagement
Trials with Early Adopters

The Quantum Communications Hub and its partners, academic and industrial, have established the UK's first Quantum Networks

- **UKQN.** A research-focused network, connecting the multi-node quantum 'metro' networks in the cities of Bristol and Cambridge over the National Dark Fibre Facility. (www.ndff.ac.uk)

- **UKQNTel.** A quantum-secure connection between the Cambridge node of the UKQN and Adastral Park, home to BT's Research & Innovation Labs and Innovation Martlesham, the ICT cluster that has grown around it.

Extending over 410km, the networks include a range of connecting technologies, from city-scale 'metro' (*multiple inter-connected nodes in urban environments*), to inter-city 'backbone' (*connecting 'metro' networks along a common spine*). Many-to-one 'Access' connections (providing multiple individual access points to individual network nodes) are also being deployed to increase the density of users in specific locations.

Central to both networks is Quantum Key Distribution (QKD), an established quantum technology for the provably secure distribution of secret keys for the encryption of data. The encrypted data may then be transmitted over conventional communications media - typically standard optical fibre - and securely stored.

UKQN

- Length of 410km over four links with three intermediate nodes
- Utilising single mode fibre from the NDFF - National Dark Fibre Facility
- Locations have low loss optical switches allowing reconfiguration between classical and quantum research network
- Network comprises four spans of 129, 112, 51 and 118 km
- Furthest distance between trusted nodes – 129 km / 28dB loss

BRISTOL

- Launched in September 2019
- QKD provided over 5GUK test network using specially developed Open Source software over four optical network nodes across the city
- World first experimental demonstration of quantum (QKD) secured Network Function Virtualisation (NFV) orchestration with Software Defined Networking (SDN) control. This replaces the need for purpose-built hardware appliances with standard off-the-shelf IT network infrastructure
- Manageable, cost-effective network architecture with proven resistance to security breaches, adaptable to integration with classical communications and leading to improved UK infrastructure and device interoperability on a national scale



CAMBRIDGE

- Launched in June 2018
- Four nodes: Electronic Engineering Division at West Cambridge, the Department of Engineering and the University's central network facility in the city centre, and Toshiba Research Europe Ltd (TREL) on the Cambridge Science Park
- Secure key rates on all links consistently above 1Mb/s
- Concurrent 100Gb/s traffic over all links
- Well over 100Tb of secure key transferred
- Long term, stable performance



UKQNTel - ADASTRAL PARK



- Launched in March 2019
- Over 125km of standard BT optical fibre between Cambridge and Adastral Park, with BT Exchanges acting as 'trusted nodes' along the route
- Use of standard commercial grade fibre providing real-world environment for trials
- Quantum and non-quantum traffic carried over the same link
- Over 500Gb/s key rate of encrypted data secured by quantum keys transmitted across 120 km multiple hop deployed fibre network
- Robust, stable performance- allowing -4dBm concurrent classical power before QBER and secure key rate degradation

