Low-loss distribution network automation for quantum communication

Overview

Here, we propose a quantum network architecture that leverages reconfigurable quantum interfaces and wavelength-selective switches to overcome bandwidth and latency constraints. Practical distributed quantum computing and error correction require quantum networks with high-qubit-rate, high-fidelity, and low-reconfiguration-latency. Unfortunately, current approaches are limited by fundamental con-straints: single-channel entanglement rates remain at the MHz level with. Modern optical networking techniques have the potential to greatly extend the applicability of quantum communications by moving beyond simple point-to-point optical links, and by leveraging existing fibre infrastructures. We experimentally demonstrate many of the fundamental capabilities that are. work and well-established technologies in modern optical communications. NASA SCaN is a program for all of NASA's space communications activities, which enables both NASA and non-NASA missions. Realizing such networks requires addressing multiple practical challenges in long-distance quantum key distribution : time synchronisation, inter-ferometer.

Article Content

Mar 14, 2026

Telecom band quantum dot technologies for long-distance quantum

rable for a future solid-state quantum internet based on fiber networks. In this review, we present the physics and technological developments towards epitaxial QD devices emitting in the telecom O- and

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Twin-field quantum key distribution without optical frequency ...

Twin-field (TF) quantum key distribution (QKD) has rapidly risen as the most viable solution to long-distance secure fibre communication thanks to its fundamentally repeater-like rate

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Long-distance coherent quantum communications in deployed telecom networks

Our results demonstrate repeater-like quantum communication in an operational network setting, doubling the distance for practical real-world QKD implementations without cryogenic cooling.

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Optical Networking for Quantum Key Distribution and Quantum Communications

Efficient networking solutions are clearly needed to move QKD and other types of quantum communications beyond the realm of niche deployments. Many of the technologies, components and

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Decoy-state quantum key distribution from a satellite to a ground station is achieved with much greater efficiency than is possible over the same

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The Computational and Latency Advantage of Quantum Communication Networks

Abstract—This article summarises the current status of classical communication networks and identifies some critical open research challenges that can only be solved by leveraging quantum technologies.

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Deployed quantum key distribution network: further, longer and more

Realizing such networks requires addressing multiple practical challenges in long-distance quantum key distribution : time synchronisation, inter-ferometer stabilisation and automation.

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Quantum key distribution in a packet-switched network

In a previous work, we introduced packet switching in quantum networks as a path to the Quantum Internet and presented a proof-of-concept for its application to quantum key distribution (QKD).

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A NEW CONTROL AND MANAGEMENT ARCHITECTURE FOR SDN-ENABLED QUANTUM

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Towards Quantum-Native Communication Systems: State-of-the-Art,

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Quantum information transmission is subject to imperfections in communication processes and systems. These

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We describe a quantum networking architecture which can provide the flexibility and scalability likely to be critical for supporting widespread deployment of quantum applications.

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Large-scale quantum communication networks with integrated

A lab-scale proof-of-principle demonstration of a quantum network comprising one server chip and 20 client photonic chips implementing twin-field quantum key distribution shows excellent ...

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Progress on Quantum Key Distribution Using Ultralow Loss Fiber

Here, we present a compact and autonomous QKD system that is capable of distributing provably-secure cryptographic key over 307 km of ultra-low-loss optical fibre (51.9 dB loss).

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Quantum Communication 101

A major step forward in the development of quantum networks will therefore be the reliable and long-distance distribution of quantum entanglement, which will enable quantum repeater technology to

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A review of quantum communication and information networks with ...

Quantum communication and information networks offer unprecedented processing efficiency and security for data transfers. Technologies like quantum key distribution (QKD), quantum

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Experimental results show that, compared to the state-of-the-art baseline, QuComm reduces the amount of inter-node communication by 54.9% on average, over various distributed

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A secure communication in distributed system using

Tuo et al. suggest a quantum-secure communication for the industrial automation networks. Their solution is a hybrid cryptographic system to

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Long-distance coherent quantum communications in

Here we implement the coherence-based twin-field QKD protocol over a 254-kilometre commercial telecom network spanning between Frankfurt and

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Entanglement distribution in lossy quantum networks

Entanglement distribution is essential for unlocking the potential of distributed quantum information processing. We consider an N-partite network where entanglement is distributed via a

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Integrating quantum key distribution with classical communications in ...

Abstract: Quantum key distribution (QKD) provides information-theoretic security based on the laws of quantum mechanics. The desire to reduce costs and increase robustness in real-world applications

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Long distance quantum communication

Quantum communication supports and extends conventional communication methods. It provides means to securely establish secret keys for secure communication and ultimately allows to connect

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Scalable low-latency entanglement distribution for distributed quantum ...

Here, we propose a quantum network architecture that leverages reconfigurable quantum interfaces and wavelength-selective switches to overcome bandwidth and latency constraints.

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This work provides a communication-e cient quantum algorithm that tackles two traditional machine learning prob-lems, the least-square tting and softmax regression problems, in

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