

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 constraints: 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

enable 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

Feb 15, 2026

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

Oct 22, 2025

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.

Aug 17, 2025

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

Oct 27, 2025

Satellite-to-ground quantum key distribution

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

Jan 20, 2026

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.

Jan 14, 2026

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.

Jan 27, 2026

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).

Jun 20, 2026

A NEW CONTROL AND MANAGEMENT ARCHITECTURE FOR SDN-ENABLED QUANTUM

Abstract This paper aims to address the challenge of designing secure and high performance Quantum Key Distribution Networks (QKDN), which are essential for encrypted

Jun 01, 2026

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

This survey also reviews quantum optimization algorithms and quantum neural networks to explore the potential integration of quantum communication and quantum computing in future systems.

Jan 04, 2026

A quantum router architecture for high-fidelity entanglement flows in ...

Here, we address this with a quantum router architecture comprising many quantum memories connected in a photonic switchboard to broker entanglement flows across quantum networks.

Nov 07, 2025

Enhancing Quantum Information Distribution Through Noisy ...

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

Nov 12, 2025

Optical Networking for Quantum Key Distribution and Quantum

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

Dec 24, 2025

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 ...

Sep 27, 2025

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).

Aug 14, 2025

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

Aug 29, 2025

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

May 22, 2026

Quantum Key Distribution Strategy for Power Quantum Communication ...

To address these challenges, this paper models a quantum communication network architecture for power systems based on trusted relay nodes and designs a reinforcement learning-based quantum

May 11, 2026

Progress on Quantum Key Distribution Using Ultralow Loss Fiber

Global quantum communications will enable long-distance secure data transfer, networked distributed quantum information processing, and other entanglement-enabled technologies.

Oct 08, 2025

Quantum Key Distribution Strategy for Power Quantum

To address these challenges, this paper models a quantum communication network architecture for power systems based on trusted relay nodes and designs a reinforcement learning-based quantum

Jan 05, 2026

QuComm: Optimizing Collective Communication for Distributed

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

Nov 13, 2025

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

Jul 13, 2025

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

Jul 05, 2025

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

May 15, 2026

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Sep 08, 2025

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

Apr 29, 2026

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

Aug 18, 2025

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.

May 24, 2026

TechTarget

TechTarget provides purchase intent insight-powered solutions to identify, influence, and engage active buyers in the tech market.

Jan 16, 2026

Communication-Efficient Quantum Algorithm for Distributed Machine

This work provides a communication-efficient quantum algorithm that tackles two traditional machine learning problems, the least-square fitting and softmax regression problems, in

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