Goal 6 Realization of a fault-tolerant universal quantum computer that will revolutionize economy, industry, and security by 2050.

Scalable and Robust Integrated Quantum Communication System

Project manager

(selected in 2022)

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R&D institutions

Keio University, Kanazawa University, Okinawa Institute of Science and Technology (OIST), Kyushu University, The University of Osaka, Yokohama National University, The University of Electro-Communications, International Christian University, National Institute of Information and Communications Technology (NICT), Institute of Physical and Chemical Research (RIKEN), National Institute of Informatics (NII), Chuo University, Mercari, Inc., LQUOM, Inc.

Summary of the project

Our goal is to construct a universal quantum communication network testbed. These networks are one of the key technologies necessary for the realization of large-scale, distributed quantum computers (QCs). We will integrate hardware and software to demonstrate the principles and techniques of communication architecture and protocols, with the ultimate goal of practical implementation. This project's results will contribute not only to the development of large-scale, distributed quantum computers, but also the implementation of a quantum internet, helping make real the dream of a world where quantum information flows freely. We will proceed with a two-pronged strategy, which involves implementing and demonstrating the principles and technologies of the entire system on a small scale using the testbed, and validating scalability using simulations.

Milestone by 2030

We will develop large-scale quantum network technology to realize a distributed QC by connecting QCs through quantum communication.

Milestone by 2025

We will develop key technologies for a quantum network that connects QCs through quantum communication. By integrating these achievements, we will implement a prototype of a quantum network in the testbed and verify the principles and technology of the system.

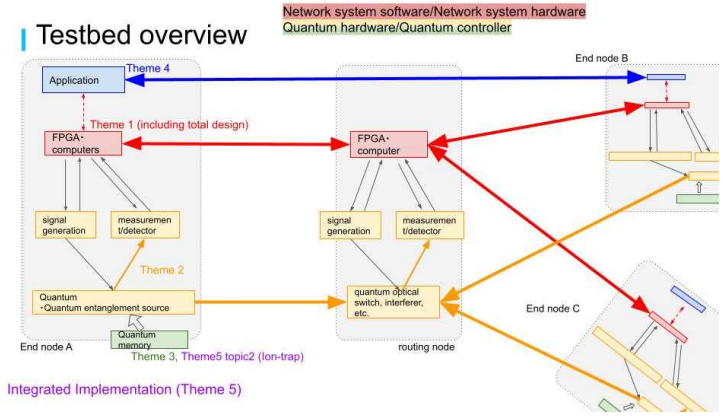

Fig. 1. Conceptual view of fully implemented System

Project structure

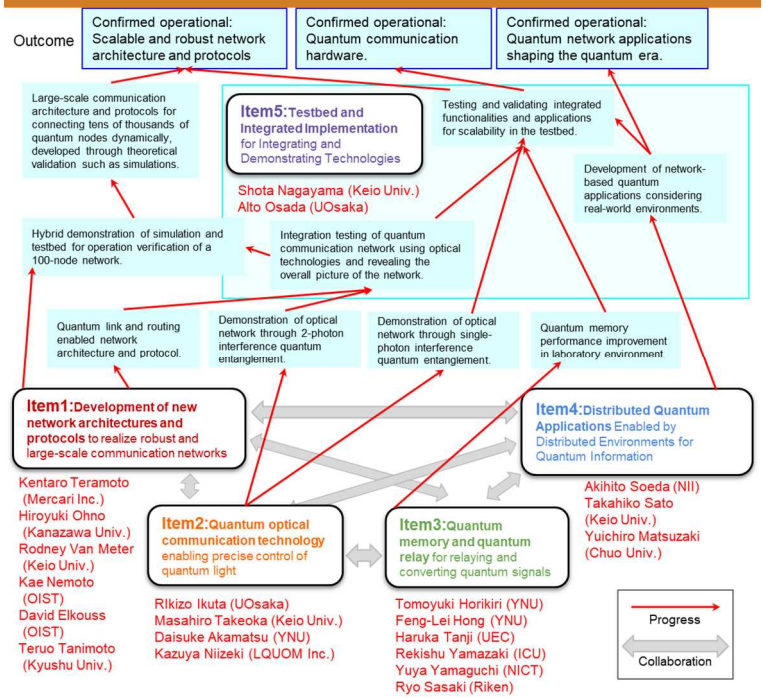

Fig. 2. Structure of the R&D Items

Building a quantum network requires cross-disciplinary collaboration, involving specialists in fields as disparate as information systems and physics. For instance, even simple end-to-end quantum bit transmission involves complex distributed processing that utilizes both quantum and classical computations, as well as their communication. Although the project is divided into different items and themes based on expertise, we engage in collaborative research that is not necessarily bound by role assignments in order to facilitate such interdisciplinary collaboration. We also collaborate with other projects to pursue the realization of an integrated quantum network that can connect any type of quantum computer.

JST Japan Science and Technology Agency