Software and protocol stacks for quantum networks

Wojciech Kozlowski

QuTech, Delft University of Technology, the Netherlands

Abstract

The second quantum revolution brings with it the promise of a quantum internet. As research efforts move beyond basic demonstrations of fundamental physics new challenges emerge in the field of system design and implementation of quantum networks. For example, scaling current quantum communication experiments to a global quantum internet will also require platform-independent programmability and robust automation capabilities. A new – quantum – software and network protocol stack need to be developed for this purpose. In this talk I will present our efforts on the first ever implementation of a link and physical layer protocol on state-of-the-art solid-state quantum networking nodes. The physical layer protocol provides a best-effort service for entanglement generation attempts and the link layer protocol abstracts that into a robust and platform-independent entanglement generation service. We evaluate our implementation by running a full state tomography of the delivered entangled states, as well as preparation of a remote qubit state on a server by its client. Our results mark a clear transition from physics experiments to quantum communication systems, which will enable the development and scaling of future quantum networks.