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Decentralized Routing and Diameter Bounds in Entangled Quantum Networks[1] LASZLO GYONGYOSI, University of Southampton, Hungarian Academy of Sciences, SANDOR IMRE, Budapest University of Technology and Economics — Entangled quantum networks are a necessity for any future quantum internet, long-distance quantum key distribution, and quantum repeater networks. The entangled quantum nodes can communicate through several different levels of entanglement, leading to a heterogeneous, multi-level entangled network structure. The level of entanglement between the quantum nodes determines the hop distance, the number of spanned nodes, and the probability of the existence of an entangled link in the network. In this work we define a decentralized routing for entangled quantum networks. We show that the probability distribution of the entangled links can be modeled by a specific distribution in a base-graph. The results allow us to perform efficient routing to find the shortest paths in entangled quantum networks by using only local knowledge of the quantum nodes. We give bounds on the maximum value of the total number of entangled links of a path. The proposed scheme can be directly applied in practical quantum communications and quantum networking scenarios.

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