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Highly Efficient Long-Distance Quantum Communication: a Blueprint for Implementation[1] LINSHU LI, SRERAMAN MURALIDHARAN, Yale University, JUNGSANG KIM, Duke University, NORBERT LUTKENHAUS, University of Waterloo, MIKHAIL LUKIN, Harvard University, LIANG JIANG, Yale University — Quantum repeaters provide a way for long distance quantum communication through optical fiber networks. Transmission losses and operation errors are two major challenges to the implementation of quantum repeaters. At each intermediate repeater station, transmission losses can be overcome using either heralded entanglement generation or quantum error correction, while operation errors can be corrected via entanglement purification or quantum error correction. Depending on the mechanisms used to correct loss and operation errors respectively, three generations of quantum repeaters have been proposed. We present a quantitative comparison of different quantum repeater schemes by evaluating the time- and qubit-resource consumed simultaneously. We can identify the most efficient scheme for given technological capabilities, which are characterized by fiber coupling efficiency, local gate fidelity, and local gate speed. Our work provides a roadmap for high-speed quantum networks across continental distances.

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