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Exploring the potential of hybrid two-qubit solid-state nodes for quantum networks PETER HUMPHREYS, NORBERT KALB, ANDREAS REISERER, JACOB BAKERMANS, STEN KAMERLING, QuTech and Kavli Institute of Nanoscience, NAOMI NICKERSON, Department of Materials, University of Oxford, EARL CAMPBELL, Department of Physics and Astronomy, University of Sheffield, MATTHEW MARKHAM, DANIEL TWITCHEN, Element Six Innovation, SIMON BENJAMIN, Department of Materials, University of Oxford, TIM TAMINIAU, RONALD HANSON, QuTech and Kavli Institute of Nanoscience — We demonstrate an elementary quantum network consisting of a pair of hybrid two-qubit quantum nodes. These nodes combine nitrogen-vacancy defects in diamond as spin-photon interfaces for entanglement generation, state manipulation and measurement along with coupled carbon nuclear-spin quantum memories. We utilise this network to investigate different quantum information protocols for establishing links over few-qubit quantum networks in the near term. We find that the ability to coherently store quantum information during attempts to generate network links may increase the rate at which entanglement can be generated.

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