The cross-layer design approach aims to optimize energy in MANET networks.

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Abstract: This study proposes a cross-layer design approach to optimize energy consumption in Mobile Ad Hoc Networks (MANETs). Traditional layered architectures often lead to inefficiencies, as energy-saving decisions in one layer may be undermined by unaware operations in others. The proposed framework integrates key functionalities from the physical, MAC, and network layers, enabling dynamic adaptation of transmission power, routing paths, and medium access control based on real-time network conditions and residual energy levels. By facilitating information exchange between layers, the approach reduces redundant transmissions, minimizes collisions, and prolongs network lifetime without compromising throughput or end-to-end delay. Simulation results demonstrate significant improvements in energy efficiency and network sustainability compared to conventional single-layer optimization methods. This research highlights the critical role of cross-layer synergy in achieving robust and energy-aware communication for resource-constrained MANET environments.

Keywords: Cross-layer design, energy optimization, MANET, network protocol