

Research on optimizing the energy usage mechanism of mobile nodes to improve routing performance in ad hoc networks

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Abstract: This study investigates the optimization of energy utilization mechanisms in mobile nodes to enhance routing performance in ad hoc networks. Given the inherent constraints of battery power and the dynamic topology of mobile ad hoc networks (MANETs), energy efficiency is critical for prolonging network lifetime and maintaining reliable communication. The research proposes and evaluates a novel energy-aware routing protocol that integrates adaptive power management with dynamic route selection. By monitoring residual energy levels and transmission power consumption of individual nodes, the mechanism dynamically adjusts routing paths to balance energy load across the network, thereby preventing premature node failure. Simulation results demonstrate that the proposed approach significantly reduces average energy consumption per packet, extends overall network operational time, and improves key performance metrics such as packet delivery ratio and end-to-end delay compared to conventional routing protocols. The findings underscore the importance of energy-conscious design in ad hoc networks and provide a viable solution for enhancing both energy efficiency and routing robustness in resource-constrained mobile environments.

Keywords: Energy optimization, mobile nodes, routing, ad hoc network