

A Cross-Layer Approach to Enhancing the Performance of the AODV Routing Protocol in Wireless Ad Hoc Networks (WANETs)

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Abstract: *Ad hoc networks that do not depend on fixed infrastructure but instead use multi-hop wireless links to communicate are called WANETs. These networks are decentralized and self-configuring. Because of their adaptability, they play a crucial role in emergency response, defense operations, and disaster management. Nevertheless, WANET routing is extremely difficult because of the unpredictable link quality, limited energy resources, dynamic topology, and mobile nodes. Although the Ad hoc On-Demand Distance Vector (AODV) protocol's on-demand route discovery is extensively used, it has a few drawbacks, such as a high energy consumption rate, a high rate of route failures, and limited support for Quality of Service (QoS). By facilitating data exchange between the network, media access control (MAC), and physical levels, this study improves AODV. The three enhanced versions of AODV that are suggested here are ER-AODV, E-AODV, and R-AODV. These versions aim to optimize routing decisions by considering energy metrics, signal strength, and transmission circumstances. The cross-layer variations outperform typical AODV in terms of throughput, latency reduction, packet delivery ratio, and energy consumption, according to NS-2 simulation results. In wireless contexts that are both dynamic and energy-constrained, the results show that cross-layer awareness greatly improves routing efficiency, reliability, and network longevity.*

Keywords: Cross-Layer Design, Energy Efficiency, AODV, Network Lifetime, Throughput, End-to-End Delay, Packet Delivery Ratio, Residual Energy, Routing Protocol, Wireless Ad Hoc Networks

