

Research analyzing the operational efficiency of the RPL protocol for Internet of Things applications.

Vongvilay Sitthideth

Abstract: This study analyzes the operational efficiency of the RPL (Routing Protocol for Low-Power and Lossy Networks) in the context of Internet of Things (IoT) applications. Given the constrained nature of IoT devices, including limited energy, memory, and processing capabilities, the performance of the routing protocol is critical to network longevity and reliability. Through simulation-based analysis, this research evaluates key performance metrics such as packet delivery ratio, end-to-end delay, energy consumption, and network convergence time under varying network densities and traffic loads. The results indicate that while RPL demonstrates robust adaptability to network topology changes, its performance degrades significantly under high node density due to increased control overhead and route instability. Furthermore, the study identifies specific scenarios where the default Objective Function (OF0) leads to suboptimal parent selection, causing premature energy depletion in critical nodes. The findings provide actionable insights for optimizing RPL configurations, including the tuning of trickle timer parameters and the selection of alternative objective functions, thereby enhancing the protocol's suitability for diverse IoT deployments.

Keywords: RPL, IoT, operational efficiency, routing protocol