

ABSTRACT

Wireless ad-hoc networks face various challenges, such as dynamic topology changes, limited bandwidth, and high energy consumption. In such conditions, traditional IP-based protocols become less efficient as they rely on continuous route updates and do not support local data storage. This can lead to increased latency, packet loss, and inefficient use of communication resources, especially in networks without fixed infrastructure.

This study implements Named Data Networking (NDN) as an alternative content-centric approach that supports distributed caching mechanisms and adaptive forwarding. The system was tested directly on a wireless ad-hoc network using Banana Pi R2 Pro devices. Performance evaluation was carried out based on throughput, round trip time (RTT), and packet loss parameters, across four different node position scenarios. Three approaches were tested: IP protocol, NDN with active caching, and NDN without caching.

The results show that the NDN with cache approach delivered the highest performance, achieving stable throughput of 40.0 Kbps, low RTT ranging from 9.227–18.826 ms, and 0% packet loss in all scenarios. The NDN without cache approach also demonstrated high performance with throughput of 40.0–40.1 Kbps, RTT of 10.007–22.711 ms, and 0% packet loss. In contrast, the IP protocol showed lower performance, with throughput ranging from 39.4–39.9 Kbps, RTT reaching 26.502 ms in the worst scenario, and packet loss of up to 0.3%. This study confirms that NDN is more efficient, adaptive, and reliable in supporting communication over wireless ad-hoc networks without fixed infrastructure, making it highly relevant for tactical communication systems, disaster recovery scenarios, and remote area connectivity.

Keywords: *Named Data Networking, Wireless Ad-hoc, Caching, Throughput, RTT, Packet Loss.*