

ABSTRACT

The increased use of the internet and data applications globally in the digital world has led to significant congestion in information data networks, highlighting the urgent need for high-speed internet services. In addressing this issue, 5G technology has been identified as a solution capable of reducing transmission congestion and improving the Quality of Service (QoS) in the adoption of digital services, including mobile banking and other applications. To avoid data transmission congestion by circumventing critical failure points, effective design is required, where the Bellman-Ford algorithm has proven successful in analyzing data communication by avoiding traffic and nodes, thus enhancing QoS aspects such as output, packet delivery rates, and minimizing end-to-end data loss. PT. XYZ, a company operating in the digital field with its communication network, also faces similar problems and has found that the use of the Bellman-Ford algorithm provides a sufficiently accurate solution to the problems encountered. Adding new links as a strategy for topology optimization significantly improves the efficiency and QoS of PT XYZ's network. The evaluation of simulation results shows that the use of the Bellman-Ford algorithm and the Graph Metric Average Betweenness centrality, which suggests adding new links at congestion points, can improve network performance with indications of packet loss reduction ranging from 54.5% to 61%, depending on the scenario of the number of new links added, and also enhance network resilience.

Keywords: *Bellman-Ford Algorithm, Quality of Service (QoS), Network congestion, Topology Optimization*