

Multi-Parameter Approach to Performance optimization in Software Defined Networking

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Abstract

Software Defined Networking (SDN) represents a transformative shift in network design, where network control and configuration are managed centrally through software-based applications rather than being distributed across individual devices. By separating the control plane from the data plane, SDN offers enhanced flexibility, automation, and programmability. This separation enables efficient traffic management, resource allocation, and improved Quality of Service (QoS) compared to traditional network architectures. The primary objective of this research is to analyze the performance of SDN by focusing on four key QoS parameters: Response Time, Throughput, Bandwidth Isolation, and Number of Queue Impact. These parameters are critical for evaluating network responsiveness, data handling capacity, resource isolation, and queue-based performance variations. The significance of this study lies in addressing performance aspects particularly bandwidth isolation and queue impact that have been underexplored in previous research. For this purpose, a single Linear Topology was implemented using the Mininet network emulator on a Linux platform (Ubuntu 24.04.2 LTS). The network setup was created using Python, and performance measurements were conducted by generating both ICMP (ping) and TCP traffic under varying bandwidth and queue configurations. Experiments were performed across multiple operational levels to capture comprehensive performance trends. The results demonstrate how adjustments in bandwidth and queue size significantly affect the studied QoS parameters. This research provides valuable insights for network engineers and SDN practitioners to optimize network performance and develop more efficient QoS-aware SDN deployments.

Keywords: Software Defined Networking (SDN), Quality of Service (QoS), Throughput, Response Time, Bandwidth Isolation