ELG 5142 Project proposal
Group ID: 12

Main article used:

Y.-C. Lai, A. Ali, M. S. Hossain, and Y.-D. Lin, "Performance modeling and analysis of TCP and UDP flows over software-defined networks," Journal of Network and Computer Applications, vol. 130, pp. 76-88, Jan. 2019. ISSN 1084-8045 Available: https://doi.org/10.1016/j.jnca.2019.01.010

I. Introduction

With the increasing adoption of Software Defined Networking (SDN) as a promising network paradigm, it has become crucial to evaluate its performance through analytical modeling. The paper by Y.-C. Lai et al. titled "Performance modeling and analysis of TCP and UDP flows over software-defined networks" addresses this need by developing analytical models for TCP and UDP flows in SDN architectures. Previous studies have demonstrated the effectiveness of SDN in improving network performance, particularly in data centers. However, there is a lack of comprehensive analytical models that consider flow-level arrivals and accurately predict the average performance. In this context, our project aims to investigate and implement analytical models to assess the performance of TCP and UDP flows in SDN. By focusing on the reactive SDN mode and considering flow-level arrivals. Our proposed models will account for various system parameters, such as flow arrival rate, flow termination rate, and controller service rate, to evaluate the steady-state performance of TCP and UDP flows. Through simulations, we will validate the proposed models and analyze the effects of different system parameters on the SDN performance.

II. Literature Review

The key article for our project is the 2019 paper by Yuan et al., titled "Performance modeling and analysis of TCP and UDP flows over software-defined networks," published in the Journal of Network and Computer Applications. This study compares the performance of TCP and UDP over software-defined networks (SDN) using average packet delay and packet loss probability as evaluation metrics.

Several other relevant articles contribute to our understanding of TCP and UDP performance. The 2004 study by He et al. examines the impact of factors such as packet aggregation and ingress buffering on the throughput and delay jitter of TCP and UDP. Furthermore, the 2008 paper by Gamess et al. presents an upper bound model for TCP and UDP throughput in both IPv4 and IPv6, providing insights into calculating the maximum theoretical throughput for these protocols. Lastly, the 2016 study by Shahrudin et al. compares various transport protocols, including TCP and UDP, over a 4G network, evaluating metrics such as throughput, packet loss, end-to-end delay, and average jitter.

III. Objectives of the Project

The primary objectives of this project are:

- To understand and analyze the scenarios used by Yuan et al (2019)
- Simple network topology with settings as close to the reality as possible. The underlying details such as buffer queue size or protocols, we will use the same for both protocols.
- We will be comparing TCP and UDP over IPv4 in a wired one-to-one host using throughput, average delay and average jitter as our performance indicators.

IV. Proposed Methodology

The chosen methodology for the project is to implement and simulate the TCP and UDP flows over SDN using the NS-3 simulator. The proposed methodology models TCP and UDP flows over SDN the assumption of both flow-level arrivals and packet-level. The steps to implement the methodology will involve developing a TCP and UDP flows over SDN in NS-3, configuring simulation parameters, and evaluating the performance metrics.

V. Simulation Setup

The simulation setup will utilize the NS-3 simulator, incorporating the developed TCP and UDP flows over software-defined networks. The specific tools and software used for the simulation will be NS-3. The simulation parameters for our project include data packet arrival rate per flow at switch (λP), flow arrival rate at switch (λF), service rate at switch (μS), flow termination rate (μF), service rate at controller (μC), switch queue size (KS), controller queue size (KC), Throughput, Average Jitter and propagation delay (DSC), will be set according to the recommendations from the main article.