

Assignment 1

Delay and Throughput in Wired and Wireless Networks

Due: 08-09-2024

Basics

In this assignment, you'll get to learn and use iPerf tool to saturate the link with random data and owamp to measure the one-way delay and losses. You are to use iPerf (<https://iperf.fr>) and owamp (<http://software.internet2.edu/owamp/>) over Linux, MAC, or Windows. Your machine has to have wired and wireless interfaces.

This is an individual assignment and has to be done without the assistance of others. You should present your work to the class and expect technical discussion.

Preparing iPerf and owamp

iPerf is a well-known utility that gives some measurements on the maximum achievable bandwidth on IP networks. It has to be carefully used to tune different parameters related to timing, buffers, and protocols. You must study and understand the different traffic traces, inter-arrival time, traffic load, bandwidth, ...etc. Similarly, owamp is also a well-known tool that measures the round trip-based delay measurements.

To complete this assignment, you'll need to install or make sure that iPerf is working on your machine. Refer to <https://iperf.fr/iperf-doc.php> for knowing the differences between all the versions and to know to where you connect. Furthermore, owamp should also be installed (<http://software.internet2.edu/owamp/download.html>). You should expect to answer questions relevant to the tools itself.

Getting Started

iPerf tool, for networking research community, is very essential tool. If you have not used any of the networking tools, it is highly recommended that you read the following tutorial pages. <https://iperf.fr/iperf-doc.php>. It is essential to understand the input parameters, output parameters, and tuning parameters prior starting the assignment. You should read the owamp manual to understand the necessary functionality too. (<http://software.internet2.edu/owamp/owamp-cookbook.pdf>)

Assignment

Throughput is considered to be a “first-order” performance metric in a communications system. Delay is a “finer” metric, that in general is much more difficult to characterize and optimize.

Typically, delay refers to the amount of time that a message or “packet” takes to be transmitted from the source to its destination. Over a single-hop communication link, delay refers to the amount of time that elapses from the moment that the message arrives at the link, until it is delivered in its entirety across the link. In networking systems with random message arrivals, delay has two components queueing delay and transmission delay. Both queueing delay and transmission delays are directly impacted by the data rate used over the channel. In this assignment, you will explore this trade-off between data rate and the delay in networking systems with iPerf3. Your system has to connect to different geographical locations (iPerf servers) using both the wired and the wireless interfaces of your system. Your results have to show the average throughput, goodput, and delay on each network interface and over various geographical locations.

Deliverables

You are expected to demonstrate the network behavior and performance metrics as follows:

1. Observe and plot TCP throughput over the wired/wireless channel using different parameters of iPerf and explain the reason.
2. Observe and plot packet delay values generated from owamp. Observe the hop-counts.
3. Observe and plot different link rates vs. delay

Handing In

All of your scripts should be in a single application directory. It should be reasonably documented (e.g., explain, at a high level, what each function does if it's not very simple). The directory must have a README that describes your algorithm and how it works. Prepare a 5-8 presentation on the output results and submit a tarball of this directory to the instructor.