Throughput Measurement in NS-3

Introduction

This NS-3 simulation code measures the end-to-end throughput between two nodes in a simple topology with a point-to-point link. The latency of the link is varied, and the corresponding throughput is calculated and plotted. The simulation uses UDP client and server applications to generate traffic.

Topology Setup

The code sets up a simple topology consisting of two nodes, Node1 and Node2, connected by a point-to-point link. The link is configured with a data rate of 5 Mbps and a delay of 2 ms.

Internet Stack and IP Address Assignment

The Internet stack is installed on both nodes using the `InternetStackHelper` class. IP addresses are assigned to the network devices using the `Ipv4AddressHelper` class.

Routing Configuration

The code uses the `Ipv4GlobalRoutingHelper` class to configure global routing in the network. This ensures that packets can be properly routed between the nodes.

UDP Client and Server Applications

The code sets up a UDP server application on Node2 and a UDP client application on Node1. The client application generates UDP traffic and sends packets to the server at a fixed data rate. The server application receives the packets and measures the throughput.

Flow Monitoring

To collect statistics about the traffic flows in the network, the code creates a flow monitor using the `FlowMonitorHelper` class. The flow monitor is installed on the network to capture information about packet flows.

Simulation Execution

The simulation is executed for a duration of 10 seconds using the `Simulator` class. During the simulation, the client application sends UDP packets to the server application, and the flow monitor collects data about the flows.

Throughput Calculation

After the simulation, the code calculates the average throughput by dividing the total number of received bytes by the simulation duration. The throughput is measured in Mbps (megabits per second).

Plotting Latency vs Throughput

To visualize the relationship between latency and throughput, the code generates a plot using Gnuplot. The latency values are extracted from the point-to-point link, and the corresponding throughput values are plotted on the graph.

Summary

This NS-3 simulation code measures the end-to-end throughput between two nodes in a simple point-to-point topology. By varying the latency of the link, the code demonstrates the impact of latency on the achieved throughput. The average throughput is calculated, and a latency vs throughput plot is generated.

References

NS-3 Documentation: https://www.nsnam.org/documentation/
NS-3 Point-to-Point Channel:
https://www.nsnam.org/docs/release/3.10/manual/html/point-to-point.html
NS-3 UDP Client and Server Applications:
https://www.nsnam.org/docs/release/3.34/models/html/udp-client-server.html
NS-3 Flow Monitor: https://www.nsnam.org/docs/release/3.34/models/html/flow-monitor.html
Gnuplot: http://www.gnuplot.info/