

LAB 6 Introduction to TCP(Transmission Control Protocol) and Analysis using Netsim

1 Introduction

NetSim provides various features to analyze mechanisms of TCP and different parameters. TCP is connection oriented, reliable, secure and bidirectional protocol. To provide this characteristics TCP have different mechanism like Connection Establishment and termination, flow control, congestion control, types of acknowledgement etc.

2 Connection Establishment and Connection Termination policy

As TCP Connection oriented protocol, TCP uses the Connection establishment before data transmission and Connection Termination after successful data transmission. Whenever session expires, TCP reestablish connection for next session until both devices finish their communication.

2.1 How to analyze connection establishment using packet trace file.

Whenever any device in wired network wants to communicate, Connection will be establish using three way handshaking as shown in figure 1. Mechanism of three way handshaking consider fix set of flags for all devices,

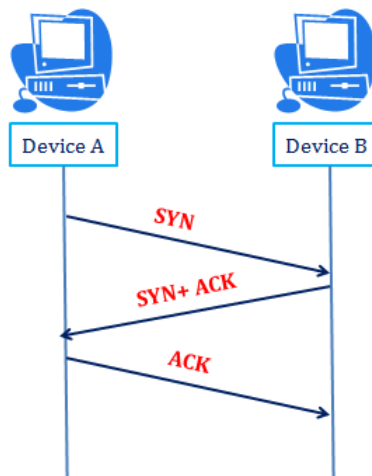


Figure 1: Connection Establishment: Three way handshaking

who are going to participate in communication.

1. Device A, who wants to start communication, sends SYN flag to Device B.

2. Device B sends SYN flag with an acknowledgement within a single packet to Device A.
3. At last, Device A acknowledged by sending ACK to Device B.

2.1.1 Experiment

To encounter three way handshaking perform the steps mention below.

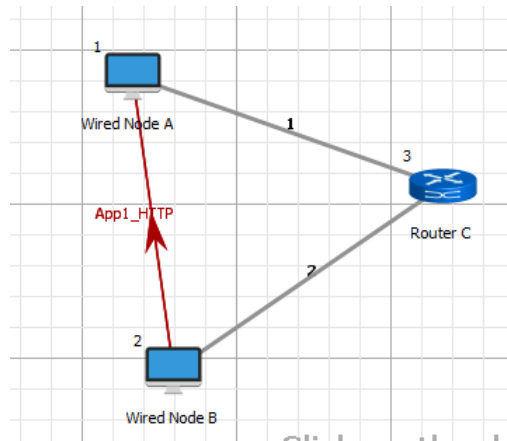


Figure 2: Topology of Network

1. Establish topology shown in figure 2, with two wired node, one router with HTTP application between two nodes.
2. Set parameters for application: Application_Method: Unicast and END_Time(s): 10
3. Run simulation for 5 second.
4. Open packet trace file and Consider following Columns: PACKET_ID, PACKET_TYPE, CONTROL_PACKET_TYPE, DESTINATION_ID, TRANSMITTER_ID, RECEIVER_ID, SEQ_NO, is_Syn, is_Ack, is_Fin, SEGMENT_LEN, Remove rest of the columns.
5. Filter PACKET_TYPE by selecting only Control Packets.
6. After filter, you can see the SYN flag transmitted from Node 2 to Node 1 through Router, analyze the value of is_Syn and is_Ack columns.

2.2 How to analyze Connection Termination using packet trace file

After Successful data transmission, Connection will be terminate by all device as shown in figure 3.

2.2.1 Experiment

To encounter connection termination, follow the steps mention below.

1. After connection establishment, continue with the same packet trace file, Add one more filter, CONTROL_PACKET_TYPE: TCP_ACK and TCP_FIN.
2. You can see the FIN flag transmitted over destination through router, analyze the value of is_Fin and is_Ack.

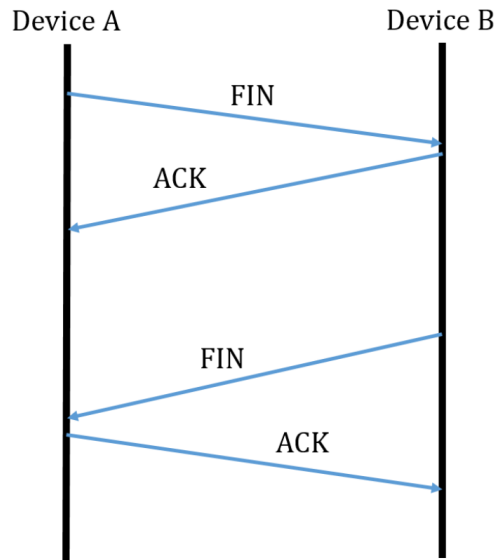


Figure 3: Connection Termination of TCP

Data transmission have been done between these Establishment and Termination. TCP provides reliability and security via acknowledgement to each packet including control packets and re transmitting errored packets. To facilitate this mechanism fluently TCP uses Sequence number for every packets and acknowledgement. Although TCP have its own mechanism for sequence number. To analysis this mechanism, attempt the following exercise.

2.3 Exercise

1. What is the Sequence number of the 1st SYN control packet and its acknowledgement?
2. What is the sequence number of the 1st FIN control packet and its acknowledgement?
3. Draw the Diagram of Connection establishment and termination as shown in figure 1 and 3 only with sequence number of each packet in you log book..
4. Why TCP uses 4 way finishing for connection termination instead of 3way like connection establishment?
5. How many sessions it takes to transfer all data in this application?
6. Save this experiment as EX:1 for further lab session.
7. Start new experiment. Consider the same topology and configuration of EX: 1. Modify the property of link 1 according to this, Set Uplink Bit Error Rate and Download Bit Error Rate: 0.00001, Uplink Propagation Delay and Download Propagation Delay: 10 microsecond. Run the simulation for 10 seconds. Observe all rows of PACKET_ID:1 with SEGMENT_ID 1,2. Draw the diagram of transmission of packet id 1 for segment no 1 and 2 until successfully received with sequence number and acknowledgement number.
8. The data transfer initiated by from node 1 to node 2. If SYN packet have sequence number 5460, there were 5000 bytes of total data transmitted through network in one session, maximum segment size were 1500 bytes then what will be the sequence number of last packet and FIN packet?

3 Measuring throughput of TCP

TCP throughput, which is the rate that data is successfully delivered over a TCP connection, is an important metric to measure the quality of a network connection.

3.1 Experiment

1. Open Experiment Ex:1
2. Run simulation for 2 seconds.
3. Open packet trace file. filter the field CONTROL_PACKET_TYPE: APP1_HTTP, HTTP_REQUEST
4. Consider PHYSICAL_LAYER_END_TIME, APPLICATION_LAYER_ARRIVAL_TIME, PHY_LAYER_PAYLOAD
5. Calculate throughput:
 - Fix throughput: Calculate total payload and divide by total difference of time. $(APPLICATION_LAYER_ARRIVAL_TIME - PHYSICAL_LAYER_END_TIME)$.
 - Moving average throughput
 - (a) Except APPLICATION_LAYER_ARRIVAL_TIME, PHYSICAL_LAYER_END_TIME, PHY_LAYER_PAYLOAD, you can clear all other columns for convince.
 - (b) Calculate time difference. $(APPLICATION_LAYER_ARRIVAL_TIME - PHYSICAL_LAYER_END_TIME)$ of 1st 10 rows and respectively sum of total payload of 1st 10 rows and copy both values in two separate columns A and B.
 - (c) Similarly calculate time difference for 2nd to 11th rows and total payload for same rows, then for 3rd to 12th, 4th to 13th, 5th to 14th, 6th to 15th up to 11th to 20th rows respectively.
 - (d) In third column C calculate the throughput by dividing total payload bytes (column B) by time difference (column A).
 - (e) Select Column C and select the scatter graph with smooth lines and markers.

3.2 Exercise

1. What is the maximum throughput value, consider the graph.
2. Calculate average throughput for same experiment with simulation time 10 seconds. Is there any difference? why?
3. Consider data transmission between 2 device A and B. A have sent total 1000 bytes of data, Maximum segment size will be 150bytes. Sending rate of packet 10bytes/second will be Packet number 2, 4, and 5 got errored. But before termination, Device B have received all 1000 bytes. Calculate the average throughput in unit bits/second.