Performance Evaluation of TCP and UDP in NS2

AIM

To write a TCL script that simulates the performance of TCP and UDP traffic sharing a bottleneck link, comparing their behaviours in terms of throughput and packet loss.

Questions

1. Create six nodes and the links between the nodes as
   a. 0 → 2 2Mb 10 ms duplex link
   b. 1→2 2Mb 10 ms duplex link
   c. 2→3 0.3Mb 100ms simplex link
   d. 3 →2 0.3Mb 100ms simplex link (link 2→3 is a bottleneck)
   e. 3→4 0.5Mb 40ms duplex link
   f. 3→ 5 0.5Mb 40ms duplex link
2. Align the nodes properly.
3. Set Queue Size of link (n2-n3) to 10 (or) 5.
4. Setup a TCP connection over 0 and 4 and its flow id, window size, packet size
5. Setup a UDP connection over 1 and 5 with flow id, type, packet size, rate, randomfields
6. Set different colors for TCP and UDP.
7. Run the simulation for 5 seconds and show the simulation in network animatorand in trace file.

Analyze the performance of TCP and UDP from the simulation with respect to throughput and packet loss.

Algorithm:

1. Create a simulator object and open a trace file to record the simulation events.
2. Set colors to differentiate TCP (Blue) and UDP (Red) flows in Network Animator (NAM).
3. Define a finish procedure to flush traces, close the trace file, open NAM, and exit the simulation.
4. Define six nodes (n0 to n5) to represent the network topology.
5. Establish Links between the nodes
6. Set the orientation of each link for clarity in NAM.

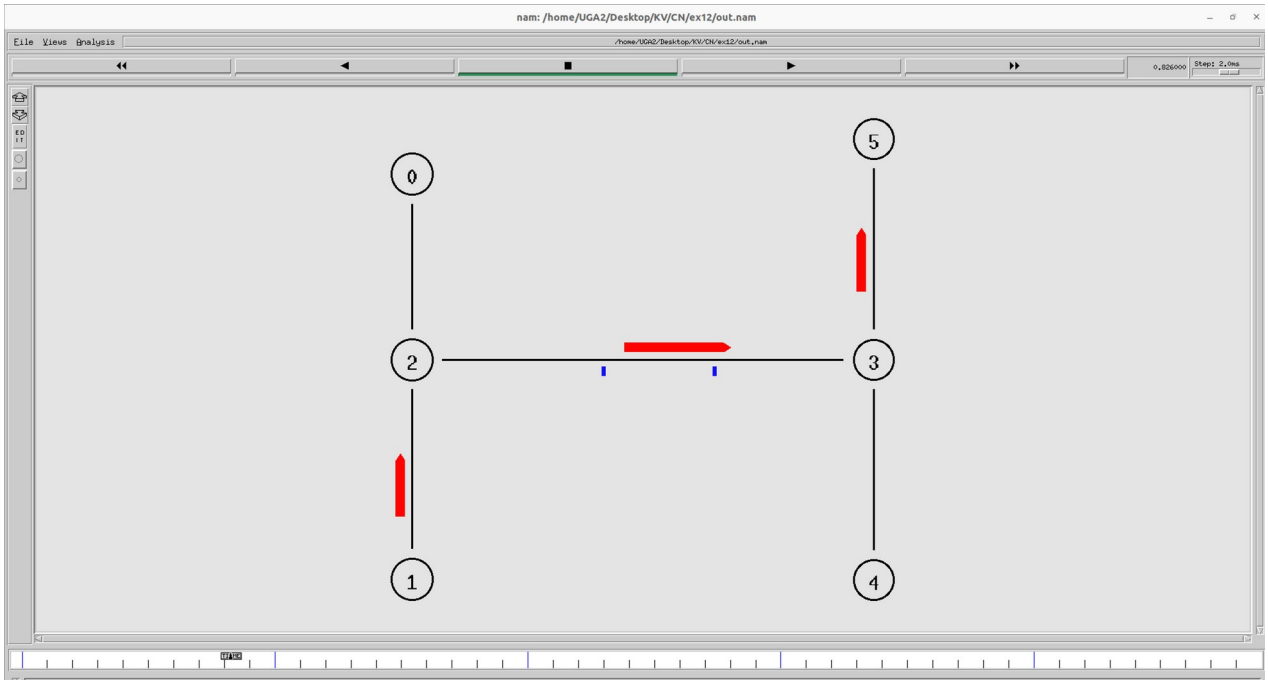
7. Set the queue size of the bottleneck link (n2-n3) to 10 (or 5) to control congestion and simulate a bottleneck.
8. Create a TCP agent on n0 and a TCP sink on n4.
9. Set TCP parameters, Flow ID to 1 and attach an FTP application to the TCP agent and configure packet size and rate
10. Create a UDP agent on n1 and a null agent on n5 as the receiving endpoint.
11. Set UDP parameters Flow ID to 2 and attach a CBR (Constant Bit Rate) traffic source to the UDP agent and configure packet size, rate, and interval.
12. Start the UDP traffic at 0.1 seconds and the TCP traffic at 0.2 seconds.
13. Stop the TCP traffic at 4.4 seconds and UDP traffic at 4.5 seconds.
14. Schedule the finish procedure to run at 5.0 seconds, which will conclude the simulation and open NAM.

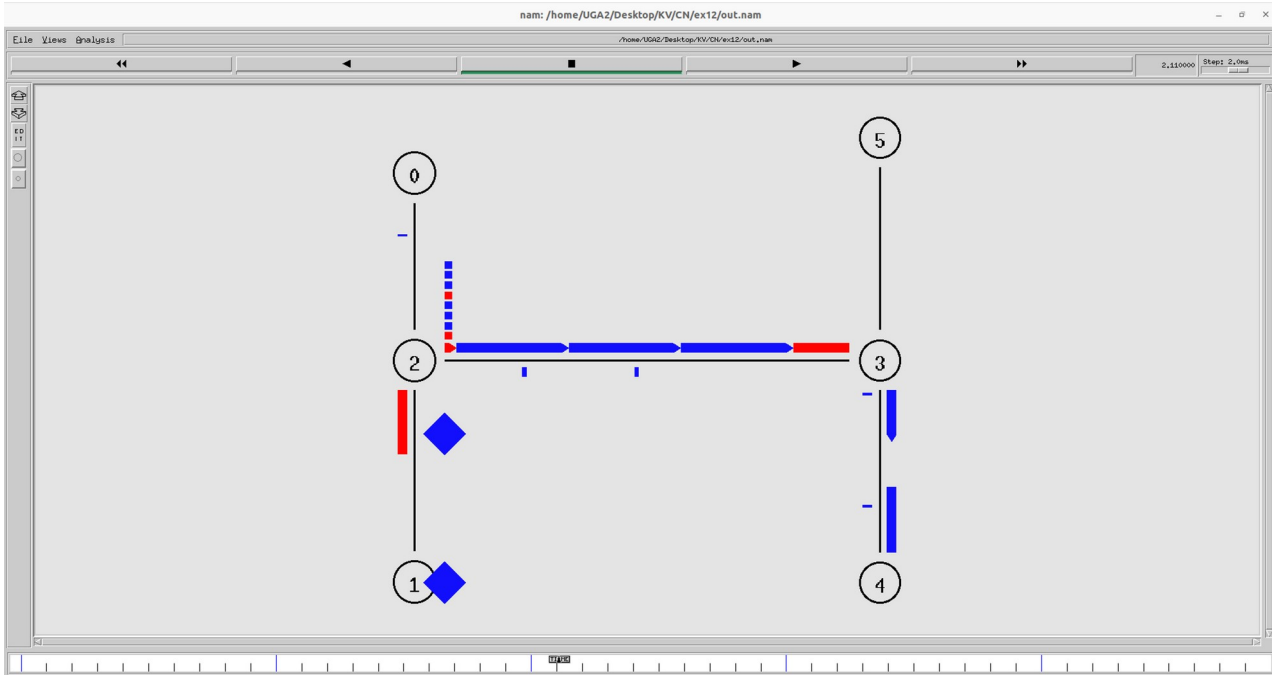
TCL Code :

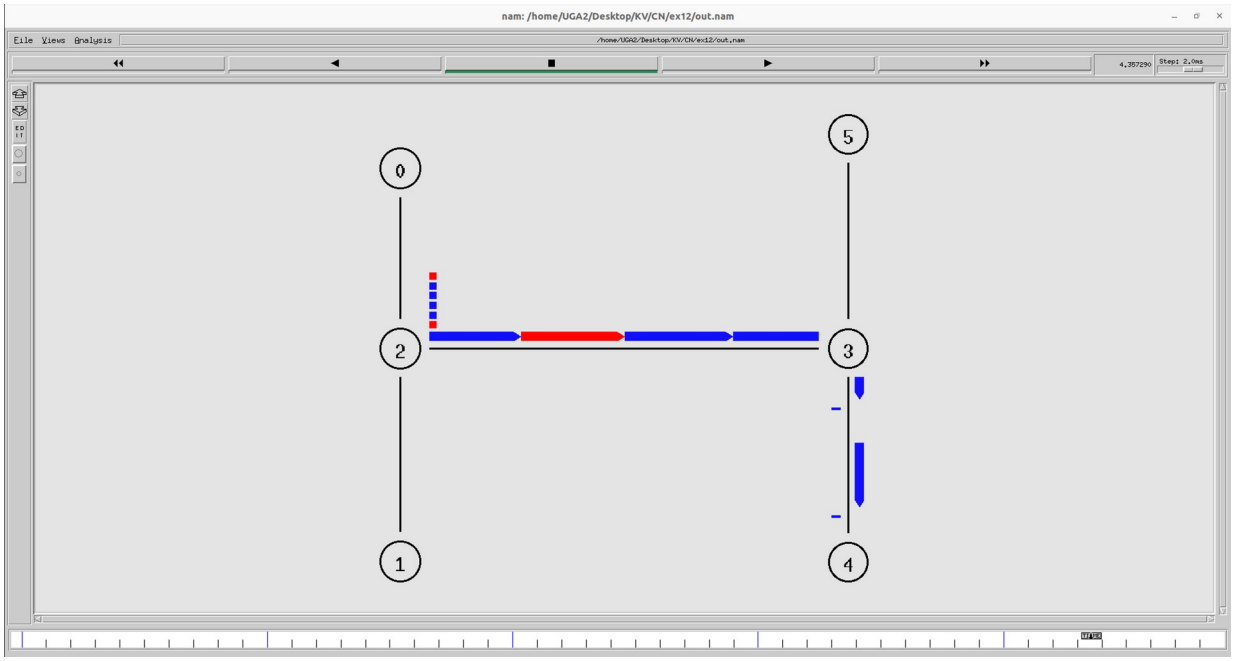
```
set ns [new Simulator]

$ns color 1 Blue
$ns color 2 Red

set nf [open out.nam w]
$ns namtrace-all $nf

proc finish {} {
  global ns nf
  $ns flush-trace
  close $nf
  exec nam out.nam &
  exit 0
}

set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]

$ns duplex-link $n0 $n2 2Mb 10ms DropTail
$ns duplex-link $n1 $n2 2Mb 10ms DropTail
$ns simplex-link $n2 $n3 0.3Mb 100ms DropTail
$ns simplex-link $n3 $n2 0.3Mb 100ms DropTail
$ns duplex-link $n3 $n4 0.5Mb 40ms DropTail
```

```
$ns duplex-link $n3 $n5 0.5Mb 40ms DropTail

$ns duplex-link-op $n0 $n2 orient down
$ns duplex-link-op $n1 $n2 orient up
$ns simplex-link-op $n2 $n3 orient right
$ns duplex-link-op $n3 $n4 orient down
$ns duplex-link-op $n3 $n5 orient up

$ns queue-limit $n2 $n3 10
$ns simplex-link-op $n2 $n3 queuePos 0.5

set tcp [new Agent/TCP]
$ns attach-agent $n0 $tcp
set sink [new Agent/TCPSink]
$ns attach-agent $n4 $sink

$ns connect $tcp $sink
$tcp set class_ 1
$tcp set fid_ 1

set ftp [new Application/FTP]
$ftp attach-agent $tcp
$ftp set type_ FTP
$ftp set packetSize_ 1000
$ftp set rate_ 0.1mb
$ftp set random_ false

set udp [new Agent/UDP]
$ns attach-agent $n1 $udp
set null [new Agent/Null]
$ns attach-agent $n5 $null

$ns connect $udp $null
$udp set fid_ 2

set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp
$cbr set type_ FTP
$cbr set packetSize_ 1000
$cbr set rate_ 0.1mb
$cbr set random_ false

$ns at 0.1 "$cbr start"
$ns at 0.2 "$ftp start"
$ns at 4.4 "$ftp stop"
$ns at 4.5 "$cbr stop"

$ns at 5.0 "finish"
$ns run
```

EXECUTION SNAPSHOTS:







Learning Outcomes:

1. Learnt how bottlenecks affect the performance of TCP and UDP in a network and how congestion impacts packet delivery.
2. Learnt to set up TCP and UDP connections with specified parameters, such as packet size and rate.
3. Understood the significance of queue size in congestion scenarios

Best Practices:

1. Assign different colors to TCP and UDP flows for easy differentiation in the Network Animator.
2. Ensure proper closure of files and processes
3. Choose a queue size that represents realistic scenarios but can still demonstrate bottleneck effects.