Networking Lab
Experiment 3

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Aim - Write an ns2 script to test Simulated Application and Traffic generator application on Different Transport layer protocols

Code:

Shell Command:
>ns simple_network.tcl

1. CBR over UDP

```
#create new simulator object
set ns [new Simulator]

#open nam trace file

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

#define a finish procedure
proc finish {} {
        global ns nf
        $ns flush-trace

        #close the trace file
        close $nf

        #execute nam on the trace file
        exec nam out.nam &
        exit 0
}

#creating 2 nodes

set n0 [$ns node]
set n1 [$ns node]

#create a duplex link between the nodes
$ns duplex-link $n0 $n1 1Mb 10ms DropTail
```

```
#create a udp agent and attach it to node n0
set udp0 [new Agent/UDP]
$ns attach-agent $n0 $udp0

#create a Null agent (a traffic sink) and attach it to node n1
set null0 [new Agent/Null]
$ns attach-agent $n1 $null0

#Create a CBR traffic source and attach it to udp0
set cbr0 [new Application/Traffic/CBR]
$cbr0 set packetSize_ 500
$cbr0 set interval_ 0.005
$cbr0 attach-agent $udp0

#Connect traffic source to the sink

$ns connect $udp0 $null0

#Schedule events for CBR traffic
$ns at 0.5 "$cbr0 start"
$ns at 4.5 "$cbr0 stop"

#call the finish procedure after 5 sec of simulated time
$ns at 5.0 "finish"

#run the simulation
$ns run
```
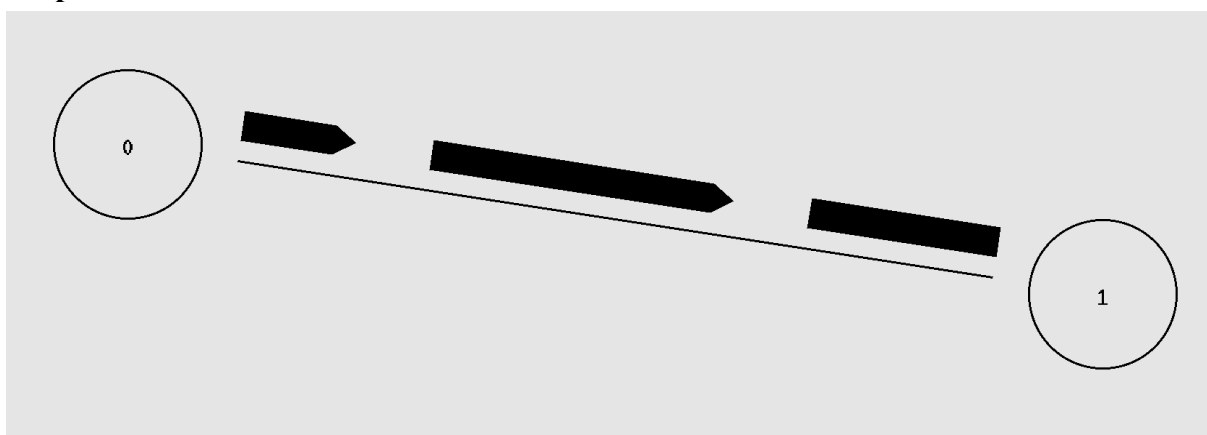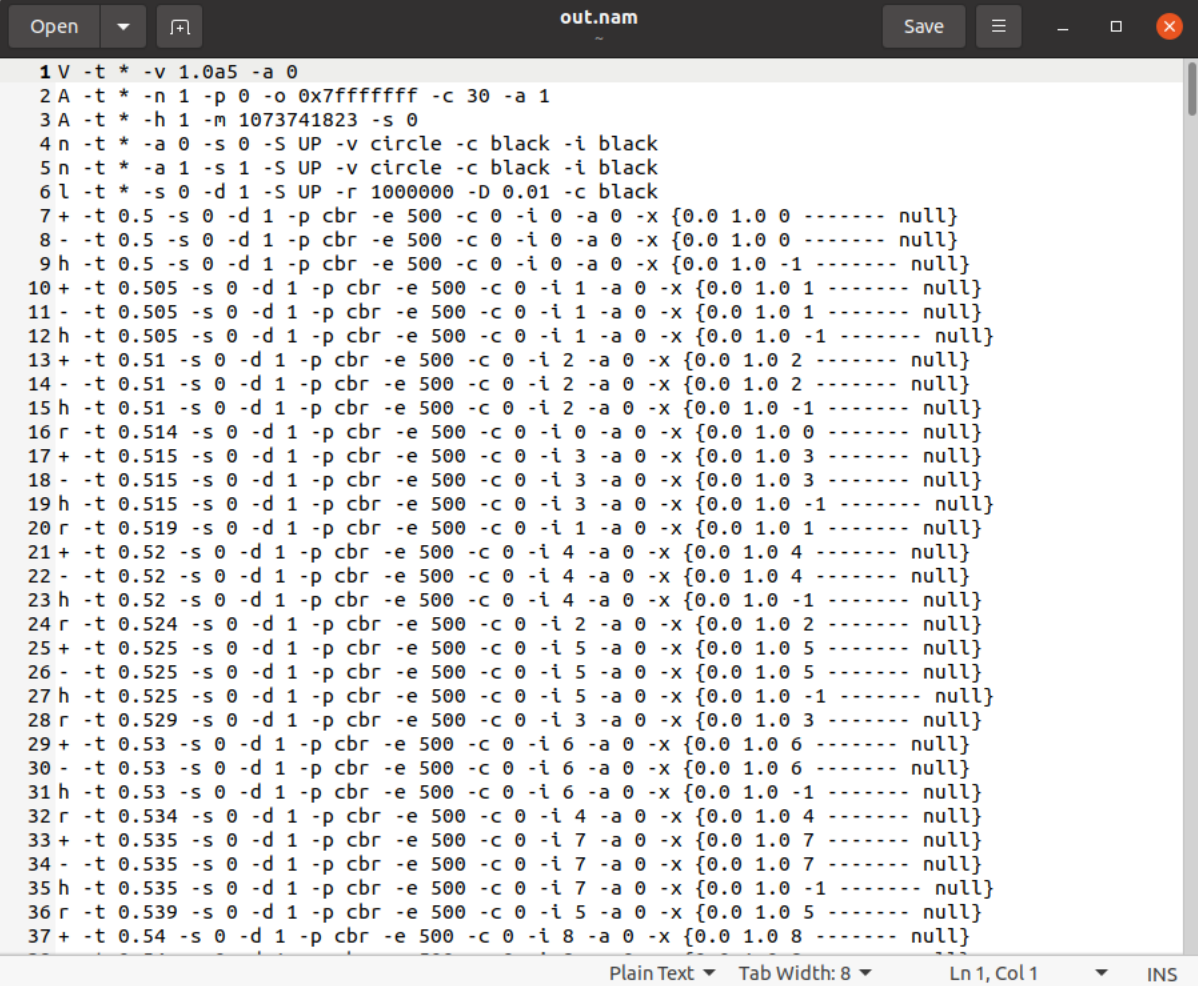
Output:

Trace file:

```
 1 V -t * -v 1.0a5 -a 0
 2 A -t * -n 1 -p 0 -o 0x7fffffff -c 30 -a 1
 3 A -t * -h 1 -m 1073741823 -s 0
 4 n -t * -a 0 -s 0 -S UP -v circle -c black -i black
 5 n -t * -a 1 -s 1 -S UP -v circle -c black -i black
 6 l -t * -s 0 -d 1 -S UP -r 1000000 -D 0.01 -c black
 7 + -t 0.5 -s 0 -d 1 -p cbr -e 500 -c 0 -i 0 -a 0 -x {0.0 1.0 0 ------- null}
 8 - -t 0.5 -s 0 -d 1 -p cbr -e 500 -c 0 -i 0 -a 0 -x {0.0 1.0 0 ------- null}
 9 h -t 0.5 -s 0 -d 1 -p cbr -e 500 -c 0 -i 0 -a 0 -x {0.0 1.0 -1 ------- null}
10 + -t 0.505 -s 0 -d 1 -p cbr -e 500 -c 0 -i 1 -a 0 -x {0.0 1.0 1 ------- null}
11 - -t 0.505 -s 0 -d 1 -p cbr -e 500 -c 0 -i 1 -a 0 -x {0.0 1.0 1 ------- null}
12 h -t 0.505 -s 0 -d 1 -p cbr -e 500 -c 0 -i 1 -a 0 -x {0.0 1.0 -1 ------- null}
13 + -t 0.51 -s 0 -d 1 -p cbr -e 500 -c 0 -i 2 -a 0 -x {0.0 1.0 2 ------- null}
14 - -t 0.51 -s 0 -d 1 -p cbr -e 500 -c 0 -i 2 -a 0 -x {0.0 1.0 2 ------- null}
15 h -t 0.51 -s 0 -d 1 -p cbr -e 500 -c 0 -i 2 -a 0 -x {0.0 1.0 -1 ------- null}
16 r -t 0.514 -s 0 -d 1 -p cbr -e 500 -c 0 -i 0 -a 0 -x {0.0 1.0 0 ------- null}
17 + -t 0.515 -s 0 -d 1 -p cbr -e 500 -c 0 -i 3 -a 0 -x {0.0 1.0 3 ------- null}
18 - -t 0.515 -s 0 -d 1 -p cbr -e 500 -c 0 -i 3 -a 0 -x {0.0 1.0 3 ------- null}
19 h -t 0.515 -s 0 -d 1 -p cbr -e 500 -c 0 -i 3 -a 0 -x {0.0 1.0 -1 ------- null}
20 r -t 0.519 -s 0 -d 1 -p cbr -e 500 -c 0 -i 1 -a 0 -x {0.0 1.0 1 ------- null}
21 + -t 0.52 -s 0 -d 1 -p cbr -e 500 -c 0 -i 4 -a 0 -x {0.0 1.0 4 ------- null}
22 - -t 0.52 -s 0 -d 1 -p cbr -e 500 -c 0 -i 4 -a 0 -x {0.0 1.0 4 ------- null}
23 h -t 0.52 -s 0 -d 1 -p cbr -e 500 -c 0 -i 4 -a 0 -x {0.0 1.0 -1 ------- null}
24 r -t 0.524 -s 0 -d 1 -p cbr -e 500 -c 0 -i 2 -a 0 -x {0.0 1.0 2 ------- null}
25 + -t 0.525 -s 0 -d 1 -p cbr -e 500 -c 0 -i 5 -a 0 -x {0.0 1.0 5 ------- null}
26 - -t 0.525 -s 0 -d 1 -p cbr -e 500 -c 0 -i 5 -a 0 -x {0.0 1.0 5 ------- null}
27 h -t 0.525 -s 0 -d 1 -p cbr -e 500 -c 0 -i 5 -a 0 -x {0.0 1.0 -1 ------- null}
28 r -t 0.529 -s 0 -d 1 -p cbr -e 500 -c 0 -i 3 -a 0 -x {0.0 1.0 3 ------- null}
29 + -t 0.53 -s 0 -d 1 -p cbr -e 500 -c 0 -i 6 -a 0 -x {0.0 1.0 6 ------- null}
30 - -t 0.53 -s 0 -d 1 -p cbr -e 500 -c 0 -i 6 -a 0 -x {0.0 1.0 6 ------- null}
31 h -t 0.53 -s 0 -d 1 -p cbr -e 500 -c 0 -i 6 -a 0 -x {0.0 1.0 -1 ------- null}
32 r -t 0.534 -s 0 -d 1 -p cbr -e 500 -c 0 -i 4 -a 0 -x {0.0 1.0 4 ------- null}
33 + -t 0.535 -s 0 -d 1 -p cbr -e 500 -c 0 -i 7 -a 0 -x {0.0 1.0 7 ------- null}
34 - -t 0.535 -s 0 -d 1 -p cbr -e 500 -c 0 -i 7 -a 0 -x {0.0 1.0 7 ------- null}
35 h -t 0.535 -s 0 -d 1 -p cbr -e 500 -c 0 -i 7 -a 0 -x {0.0 1.0 -1 ------- null}
36 r -t 0.539 -s 0 -d 1 -p cbr -e 500 -c 0 -i 5 -a 0 -x {0.0 1.0 5 ------- null}
37 + -t 0.54 -s 0 -d 1 -p cbr -e 500 -c 0 -i 8 -a 0 -x {0.0 1.0 8 ------- null}
```

2. FTP over TCP

```
#create new simulator object
set ns [new Simulator]

#open nam trace file
set nf [open out2.nam w]
$ns namtrace-all $nf

#define a finish procedure
proc finish {} {
        global ns nf
        $ns flush-trace

        #close the trace file
        close $nf
```

```
        #execute nam on the trace file
        exec nam out2.nam &
        exit 0
}

#creating 2 nodes

set n0 [$ns node]
set n1 [$ns node]

#create a duplex link between the nodes
$ns duplex-link $n0 $n1 1Mb 10ms DropTail

#create a tcp agent and attach it to node n0
set tcp0 [new Agent/TCP]
$ns attach-agent $n0 $tcp0

#Attach an FTP application to this TCP agent
set ftp [new Application/FTP]
$ftp attach-agent $tcp0

#create a TCP Sink Agent (a traffic sink) and attach it to node n1
set tcp1 [new Agent/TCPSink]
$ns attach-agent $n1 $tcp1

#Connect traffic source to the sink

$ns connect $tcp0 $tcp1

#Schedule events for CBR traffic
$ns at 0.5 "$ftp start"
$ns at 4.5 "$ftp stop"

#call the finish procedure after 5 sec of simulated time
$ns at 5.0 "finish"

#run the simulation
$ns run
```
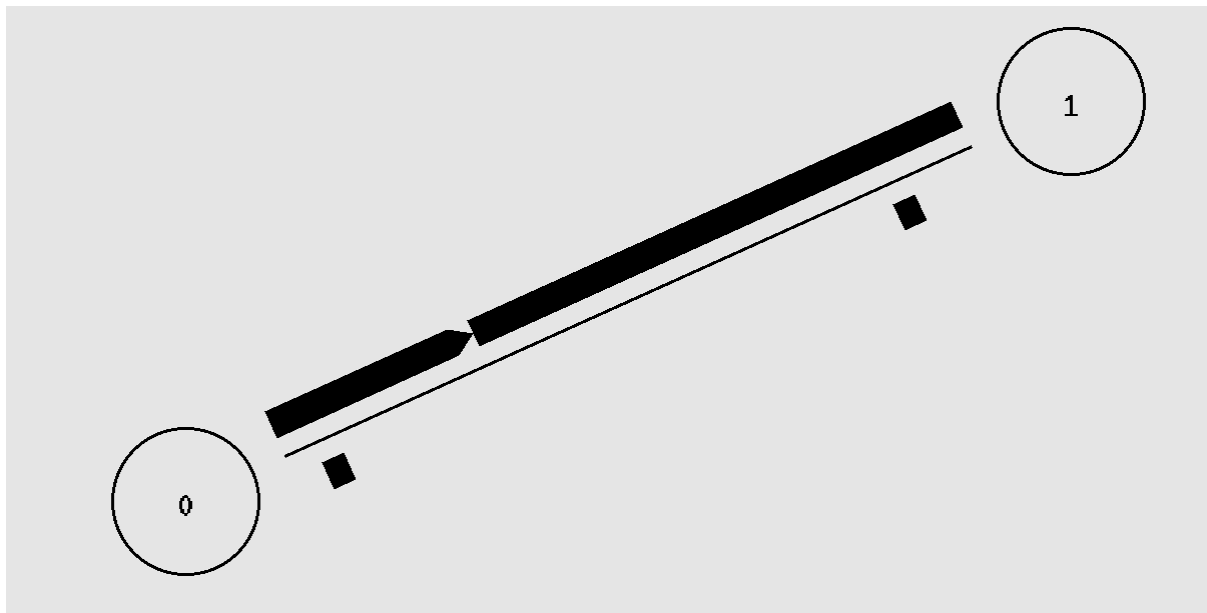
Output:

Trace File:


```
1 V -t * -v 1.0a5 -a 0
2 A -t * -n 1 -p 0 -o 0x7fffffff -c 30 -a 1
3 A -t * -h 1 -m 1073741823 -s 0
4 n -t * -a 0 -s 0 -S UP -v circle -c black -i black
5 n -t * -a 1 -s 1 -S UP -v circle -c black -i black
6 l -t * -s 0 -d 1 -S UP -r 1000000 -D 0.01 -c black
7 + -t 0.5 -s 0 -d 1 -p tcp -e 40 -c 0 -i 0 -a 0 -x {0.0 1.0 0 ------- null}
8 - -t 0.5 -s 0 -d 1 -p tcp -e 40 -c 0 -i 0 -a 0 -x {0.0 1.0 0 ------- null}
9 h -t 0.5 -s 0 -d 1 -p tcp -e 40 -c 0 -i 0 -a 0 -x {0.0 1.0 -1 ------- null}
10 r -t 0.51032 -s 0 -d 1 -p tcp -e 40 -c 0 -i 0 -a 0 -x {0.0 1.0 0 ------- null}
11 + -t 0.51032 -s 1 -d 0 -p ack -e 40 -c 0 -i 1 -a 0 -x {1.0 0.0 0 ------- null}
12 - -t 0.51032 -s 1 -d 0 -p ack -e 40 -c 0 -i 1 -a 0 -x {1.0 0.0 0 ------- null}
13 h -t 0.51032 -s 1 -d 0 -p ack -e 40 -c 0 -i 1 -a 0 -x {1.0 0.0 -1 ------- null}
14 r -t 0.52064 -s 1 -d 0 -p ack -e 40 -c 0 -i 1 -a 0 -x {1.0 0.0 0 ------- null}
15 + -t 0.52064 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 2 -a 0 -x {0.0 1.0 1 ------- null}
16 - -t 0.52064 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 2 -a 0 -x {0.0 1.0 1 ------- null}
17 h -t 0.52064 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 2 -a 0 -x {0.0 1.0 -1 ------- null}
18 + -t 0.52064 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 3 -a 0 -x {0.0 1.0 2 ------- null}
19 - -t 0.52896 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 3 -a 0 -x {0.0 1.0 2 ------- null}
20 h -t 0.52896 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 3 -a 0 -x {0.0 1.0 -1 ------- null}
21 r -t 0.53896 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 2 -a 0 -x {0.0 1.0 1 ------- null}
22 + -t 0.53896 -s 1 -d 0 -p ack -e 40 -c 0 -i 4 -a 0 -x {1.0 0.0 1 ------- null}
23 - -t 0.53896 -s 1 -d 0 -p ack -e 40 -c 0 -i 4 -a 0 -x {1.0 0.0 1 ------- null}
24 h -t 0.53896 -s 1 -d 0 -p ack -e 40 -c 0 -i 4 -a 0 -x {1.0 0.0 -1 ------- null}
25 r -t 0.54728 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 3 -a 0 -x {0.0 1.0 2 ------- null}
26 + -t 0.54728 -s 1 -d 0 -p ack -e 40 -c 0 -i 5 -a 0 -x {1.0 0.0 2 ------- null}
27 - -t 0.54728 -s 1 -d 0 -p ack -e 40 -c 0 -i 5 -a 0 -x {1.0 0.0 2 ------- null}
28 h -t 0.54728 -s 1 -d 0 -p ack -e 40 -c 0 -i 5 -a 0 -x {1.0 0.0 -1 ------- null}
29 r -t 0.54928 -s 1 -d 0 -p ack -e 40 -c 0 -i 4 -a 0 -x {1.0 0.0 1 ------- null}
30 + -t 0.54928 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 6 -a 0 -x {0.0 1.0 3 ------- null}
31 - -t 0.54928 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 6 -a 0 -x {0.0 1.0 3 ------- null}
32 h -t 0.54928 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 6 -a 0 -x {0.0 1.0 -1 ------- null}
33 + -t 0.54928 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 7 -a 0 -x {0.0 1.0 4 ------- null}
34 r -t 0.5576 -s 1 -d 0 -p ack -e 40 -c 0 -i 5 -a 0 -x {1.0 0.0 2 ------- null}
35 + -t 0.5576 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 8 -a 0 -x {0.0 1.0 5 ------- null}
36 + -t 0.5576 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 9 -a 0 -x {0.0 1.0 6 ------- null}
37 - -t 0.5576 -s 0 -d 1 -p tcp -e 1040 -c 0 -i 7 -a 0 -x {0.0 1.0 4 ------- null}
```

Observations:

1. **What is the noticeable difference between the TCP and UDP simulations?**

   In the second simulation over TCP, we get an acknowledgement from node 1 for every packet transfer, unlike the first simulation over UDP.

2. **Can FTP be run over UDP?**

   No, FTP cannot run over UDP.

3. **Can TCP run over simplex channels?**

   Yes, TCP can run over simplex channels. However, two simplex links will be needed for to-and-fro communication between both nodes.

4. **Describe the trace file and the trace in the nam format.**

   When we trace our output, it's traced in an ASCII file, organized in 12 different fields of data.
   They are as mentioned:

Event	Time	From Node	To Node	Packet Type	Packet Size	Flags	Flow ID	Src Addr	Dest Addr	Seq No.	Packet ID

   The trace file provides data about every event which occurred on the network in the given time frame. It has data about the input and output nodes at which a particular event occurred, the type of packet that was transmitted/shared, the time, the size of the packet, flags, the Flow ID (colour of packets), source and destination addresses, packet sequence numbers and the packet ID.

5. **Can you run FTP over UDP? Justify your answer.**

   No, we cannot run FTP over UDP. It is because FTP makes use of a data connection and it has to ensure that the file has reached the destination and it is session-oriented. Since UDP is unreliable, FTP is ideally used over TCP because of its reliability and control throughout the transfer.