

LAB ASSIGNMENT-4

CSN-361 Computer Networks Laboratory

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Problem Statements

1. Write a Network Simulator (NS2) code to simulate a three node network with duplex links among them as shown in figure. Show the topology using NAM. Study the variation in number of packets dropped with the variation of the queue size in the nodes and with the variation of the bandwidth of the links.
2. Write a Network Simulator (NS2) code to simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion. Study the variation in number of packets dropped with the variation of the queue size in the nodes and with the variation of the bandwidth of the links. Nodes are connected as follows: 0-2, 1-2, 2-3, 3-4 and 3-5 Packet transmissions: 0-4 and 5-1.

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Implementations details

I have written ns2 code to simulate a three node network with duplex links among them as given and studied the variation in number of packets dropped with the variation of the queue size in the nodes and with the variation of the bandwidth of the links.

I have also visualized it using nam.

Steps -

1. Event Scheduler Object creation.
2. Creating trace objects and nam objects.
3. Create the network.
4. Creating Duplex-Link.
5. Finish.

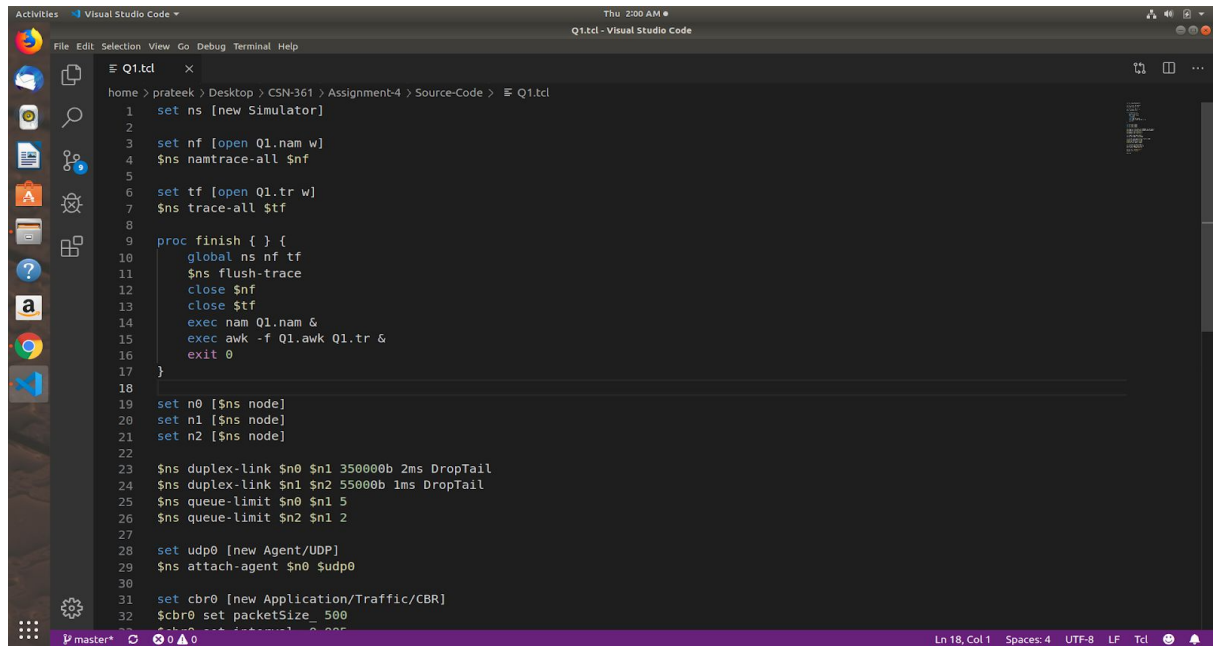
Variations -

Bandwidth-1	Bandwidth-2	Queue Size-1	Queue Size-2	n
300000b	50000b	5	3	115
200000b	40000b	6	4	130
210000b	41000b	5	4	129
250000b	25000b	5	3	121
350000b	55000b	5	2	113
320000b	60000b	5	3	112

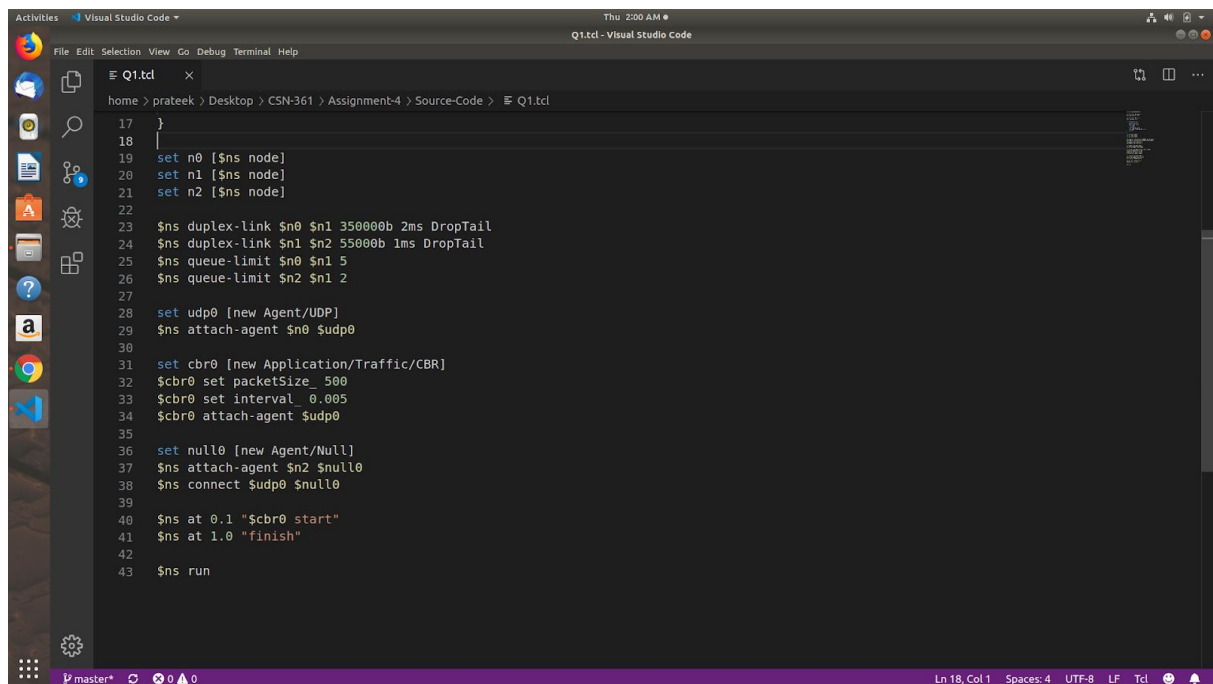
Data Structures used

- Nodes, Agent
- No other major Data Structure used

Code Snippets

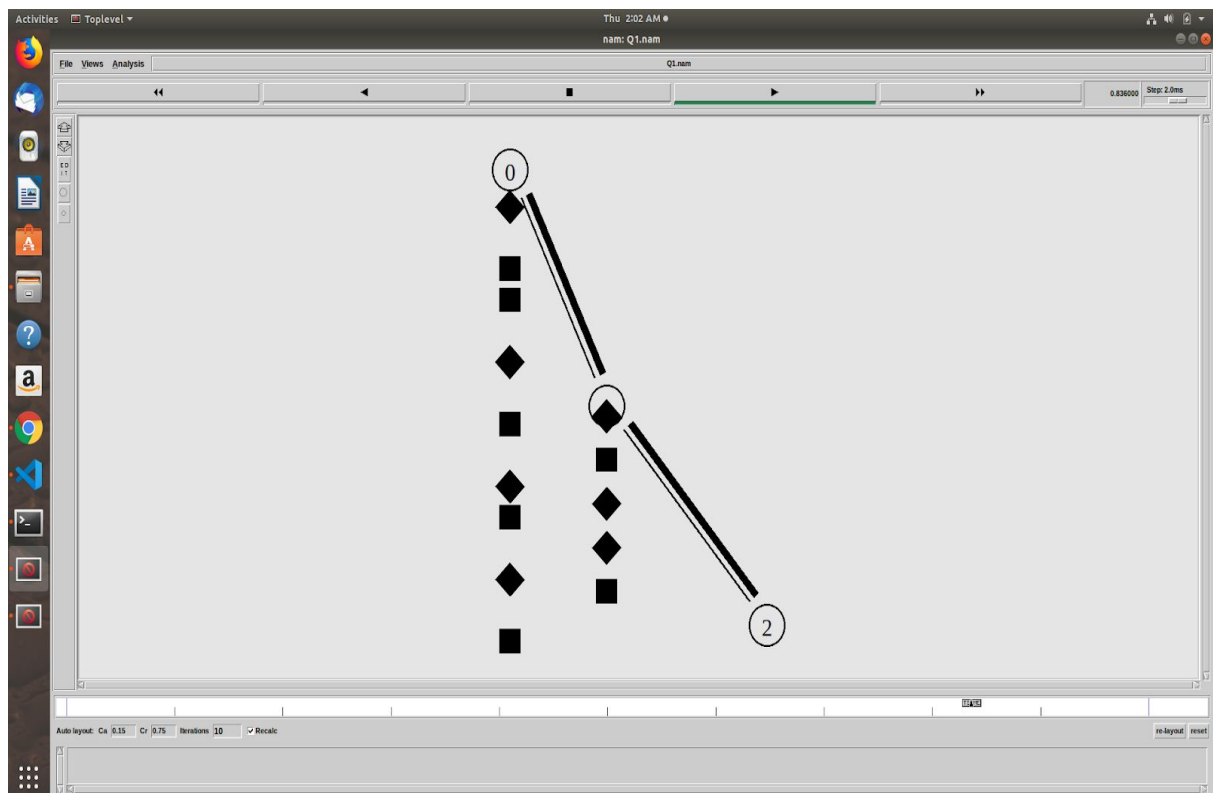
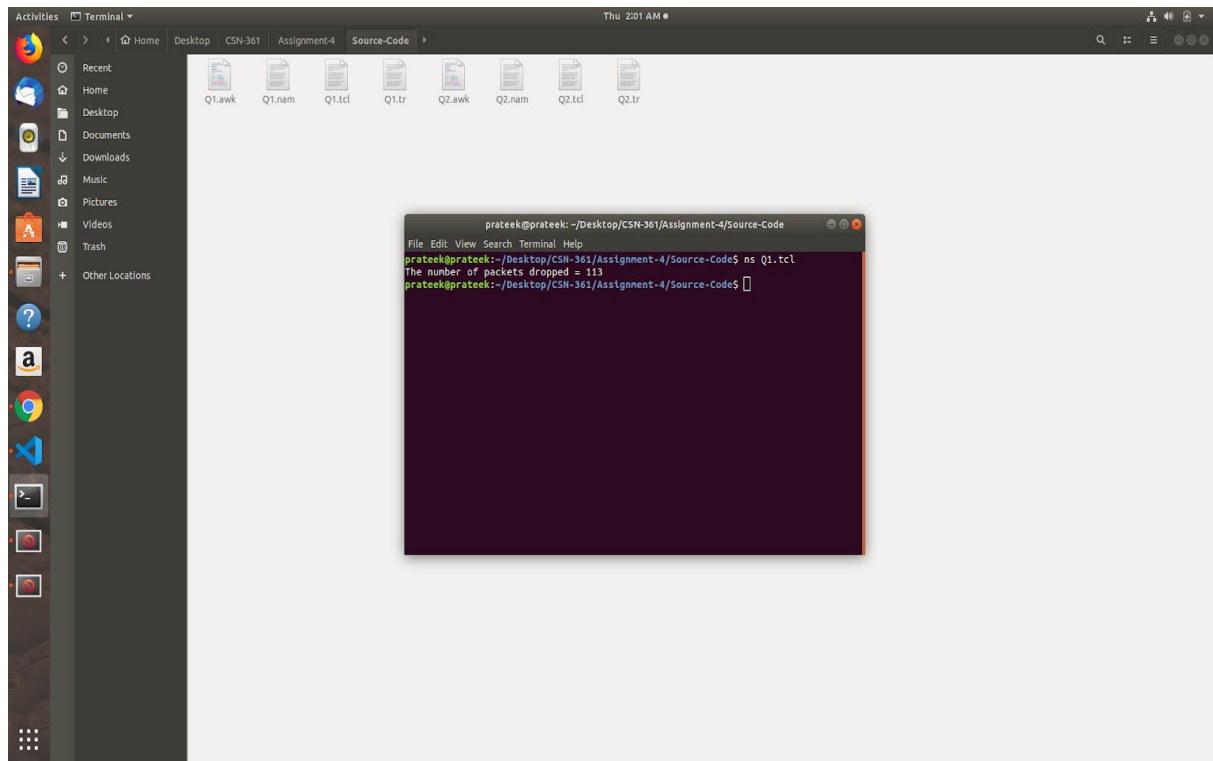


```
1 set ns [new Simulator]
2
3 set nf [open Q1.nam w]
4 $ns namtrace-all $nf
5
6 set tf [open Q1.tr w]
7 $ns trace-all $tf
8
9 proc finish { } {
10     global ns nf tf
11     $ns flush-trace
12     close $nf
13     close $tf
14     exec nam Q1.nam &
15     exec awk -f Q1.awk Q1.tr &
16     exit 0
17 }
18
19 set n0 [$ns node]
20 set n1 [$ns node]
21 set n2 [$ns node]
22
23 $ns duplex-link $n0 $n1 350000b 2ms DropTail
24 $ns duplex-link $n1 $n2 55000b 1ms DropTail
25 $ns queue-limit $n0 $n1 5
26 $ns queue-limit $n2 $n1 2
27
28 set udp0 [new Agent/UDP]
29 $ns attach-agent $n0 $udp0
30
31 set cbr0 [new Application/Traffic/CBR]
32 $cbr0 set packetSize_ 500
```



```
17 }
18
19 set n0 [$ns node]
20 set n1 [$ns node]
21 set n2 [$ns node]
22
23 $ns duplex-link $n0 $n1 350000b 2ms DropTail
24 $ns duplex-link $n1 $n2 55000b 1ms DropTail
25 $ns queue-limit $n0 $n1 5
26 $ns queue-limit $n2 $n1 2
27
28 set udp0 [new Agent/UDP]
29 $ns attach-agent $n0 $udp0
30
31 set cbr0 [new Application/Traffic/CBR]
32 $cbr0 set packetSize_ 500
33 $cbr0 set interval_ 0.005
34 $cbr0 attach-agent $udp0
35
36 set null0 [new Agent/Null]
37 $ns attach-agent $n2 $null0
38 $ns connect $udp0 $null0
39
40 $ns at 0.1 "$cbr0 start"
41 $ns at 1.0 "finish"
42
43 $ns run
```

Snapshot of running code



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Implementations details

I have written a Network Simulator ns2 code to simulate the transmission of ping messages over a network topology consisting of 6 nodes as given and found the number of packets dropped due to congestion.

Steps -

1. Event Scheduler Object creation.
2. Creating trace objects and nam objects.
3. Create the network.
4. Creating Duplex-Link.
5. Finish.

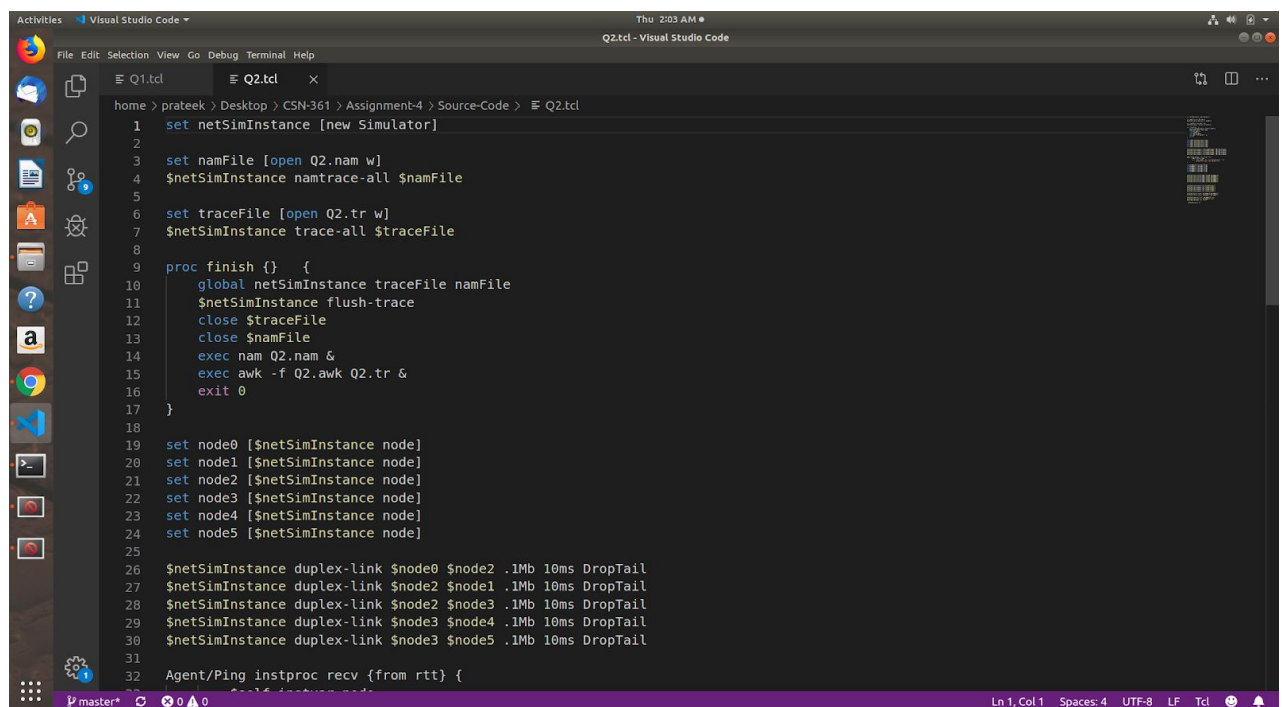
Variations -

Not much variations observed.

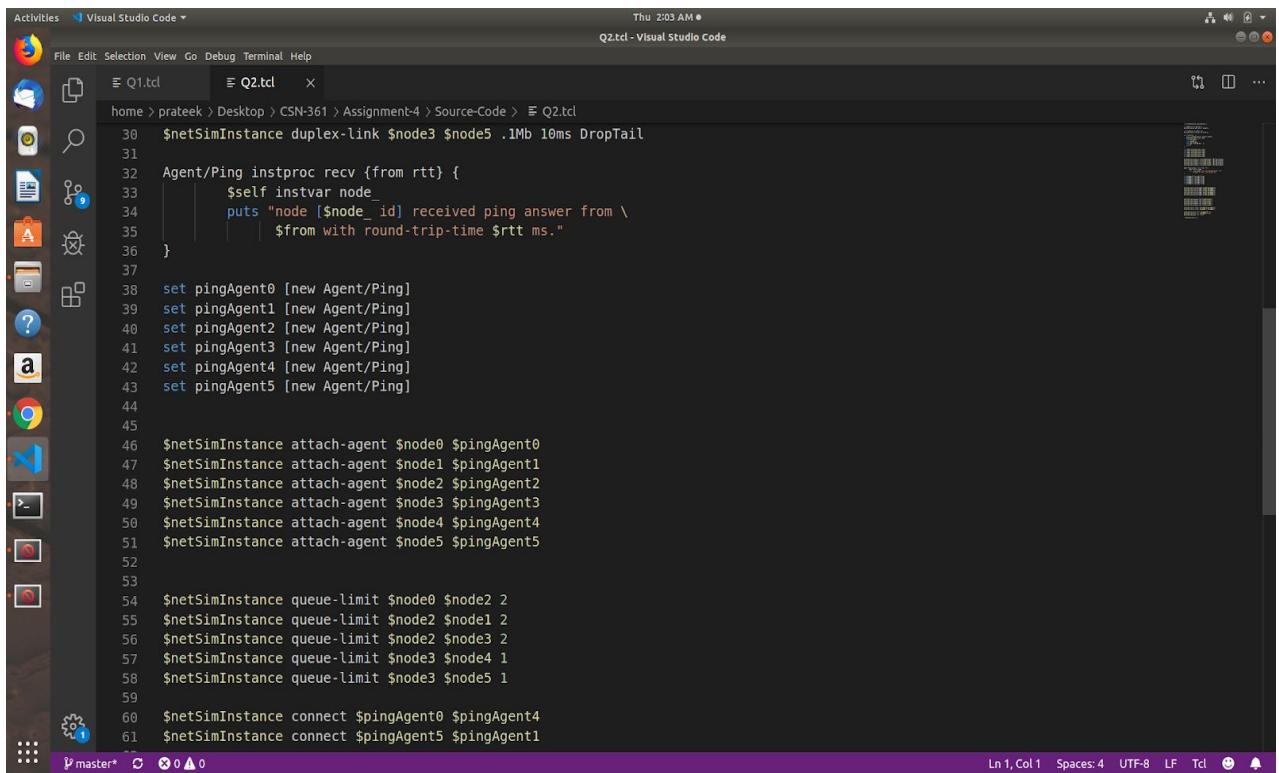
Data Structures used

- Nodes, Nodes Array, Agent.

Code Snippets

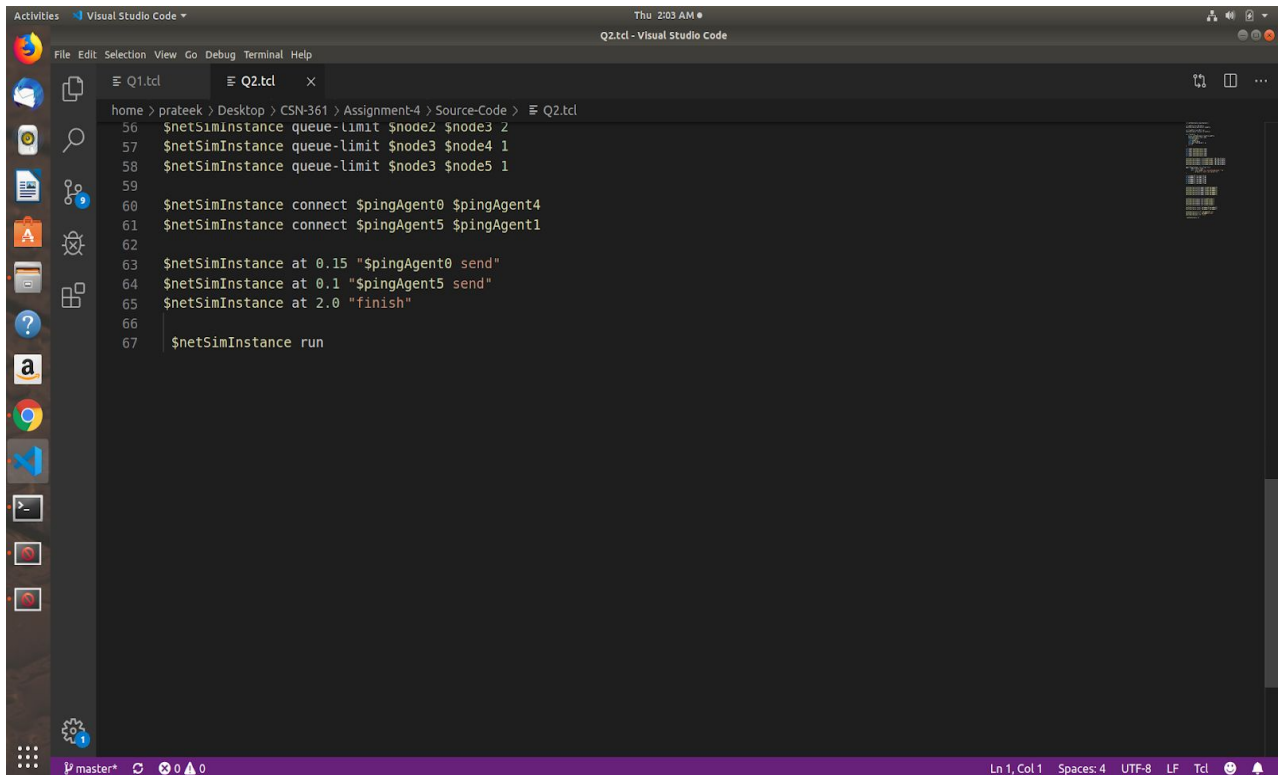
A screenshot of the Visual Studio Code editor interface. The top status bar shows 'Thu 2:03 AM' and 'Q2.tcl - Visual Studio Code'. The main editor window displays a Tcl script named 'Q2.tcl'. The script defines a 'finish' procedure that sets up a network topology with 6 nodes (node0 to node5) and connects them in a mesh-like structure using 'duplex-link'. It also sets up trace files and a ping agent. The script is as follows:

```
1 set netSimInstance [new Simulator]
2
3 set namFile [open Q2.nam w]
4 $netSimInstance namtrace-all $namFile
5
6 set traceFile [open Q2.tr w]
7 $netSimInstance trace-all $traceFile
8
9 proc finish {} {
10     global netSimInstance traceFile namFile
11     $netSimInstance flush-trace
12     close $traceFile
13     close $namFile
14     exec nam Q2.nam &
15     exec awk -f Q2.awk Q2.tr &
16     exit 0
17 }
18
19 set node0 [$netSimInstance node]
20 set node1 [$netSimInstance node]
21 set node2 [$netSimInstance node]
22 set node3 [$netSimInstance node]
23 set node4 [$netSimInstance node]
24 set node5 [$netSimInstance node]
25
26 $netSimInstance duplex-link $node0 $node2 .1Mb 10ms DropTail
27 $netSimInstance duplex-link $node2 $node1 .1Mb 10ms DropTail
28 $netSimInstance duplex-link $node2 $node3 .1Mb 10ms DropTail
29 $netSimInstance duplex-link $node3 $node4 .1Mb 10ms DropTail
30 $netSimInstance duplex-link $node3 $node5 .1Mb 10ms DropTail
31
32 Agent/Ping instproc recv {from rtt} {
```



Visual Studio Code editor showing the Q2.tcl file. The file contains NetSim configuration for a duplex-link, agents, and queue limits.

```
home > prateek > Desktop > CSN-361 > Assignment-4 > Source-Code > Q2.tcl
30 $netSimInstance duplex-link $node3 $node5 .1Mb 10ms DropTail
31
32 Agent/Ping instproc rcv {from rtt} {
33     $self instvar node
34     puts "node [$node_id] received ping answer from \
35         $from with round-trip-time $rtt ms."
36 }
37
38 set pingAgent0 [new Agent/Ping]
39 set pingAgent1 [new Agent/Ping]
40 set pingAgent2 [new Agent/Ping]
41 set pingAgent3 [new Agent/Ping]
42 set pingAgent4 [new Agent/Ping]
43 set pingAgent5 [new Agent/Ping]
44
45
46 $netSimInstance attach-agent $node0 $pingAgent0
47 $netSimInstance attach-agent $node1 $pingAgent1
48 $netSimInstance attach-agent $node2 $pingAgent2
49 $netSimInstance attach-agent $node3 $pingAgent3
50 $netSimInstance attach-agent $node4 $pingAgent4
51 $netSimInstance attach-agent $node5 $pingAgent5
52
53
54 $netSimInstance queue-limit $node0 $node2 2
55 $netSimInstance queue-limit $node2 $node1 2
56 $netSimInstance queue-limit $node2 $node3 2
57 $netSimInstance queue-limit $node3 $node4 1
58 $netSimInstance queue-limit $node3 $node5 1
59
60 $netSimInstance connect $pingAgent0 $pingAgent4
61 $netSimInstance connect $pingAgent5 $pingAgent1
```



Visual Studio Code editor showing the Q2.tcl file. The file contains NetSim configuration for a duplex-link, agents, and queue limits.

```
home > prateek > Desktop > CSN-361 > Assignment-4 > Source-Code > Q2.tcl
56 $netSimInstance queue-limit $node2 $node3 2
57 $netSimInstance queue-limit $node3 $node4 1
58 $netSimInstance queue-limit $node3 $node5 1
59
60 $netSimInstance connect $pingAgent0 $pingAgent4
61 $netSimInstance connect $pingAgent5 $pingAgent1
62
63 $netSimInstance at 0.15 "$pingAgent0 send"
64 $netSimInstance at 0.1 "$pingAgent5 send"
65 $netSimInstance at 2.0 "finish"
66
67 $netSimInstance run
```

Snapshots of running code

