CSN - 361

Lab Assignment - 4

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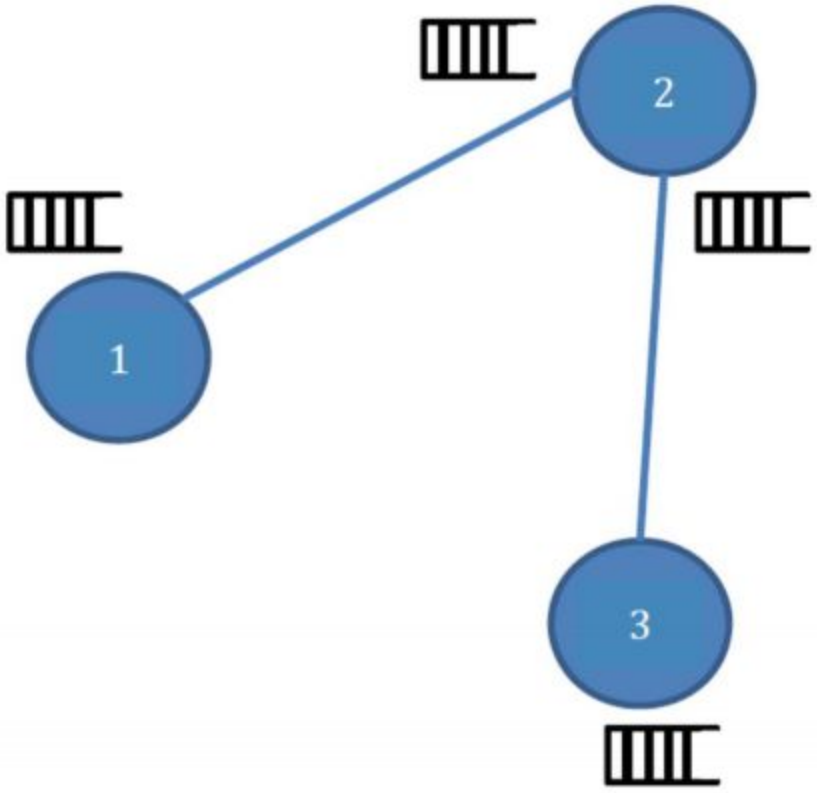
Problem Statement 1

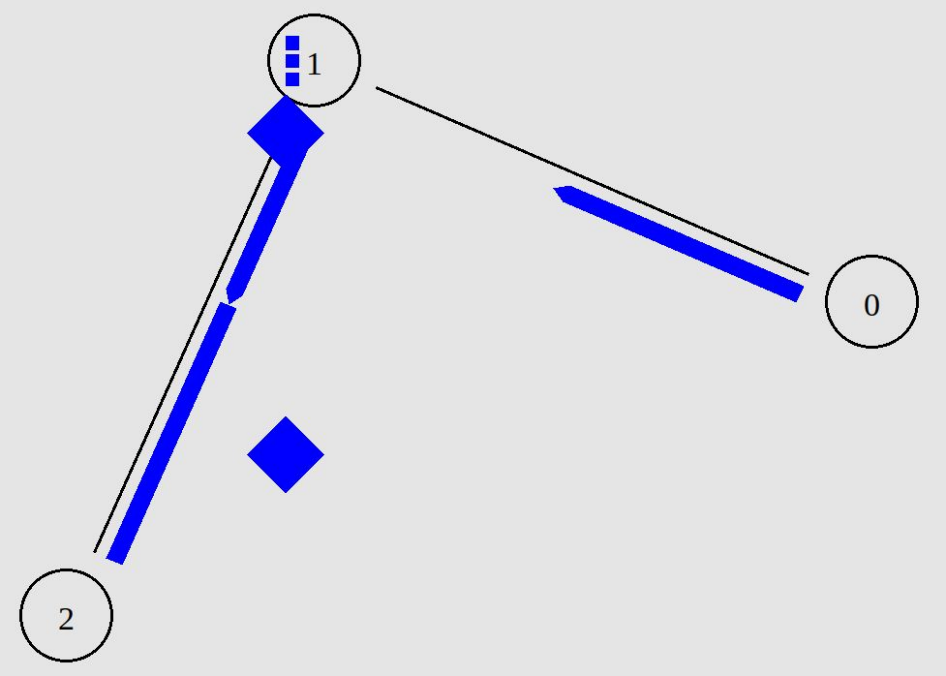
Write a Network Simulator (NS2) code to simulate a three node network with duplex links among them as shown in figure. Show the topology using NAM. Study the variation in number of packets dropped with the variation of the queue size in the nodes and with the variation of the bandwidth of the links.



SOLUTION:

```
#Create a simulator object
set ns [new Simulator]

$ns color 1 Blue

$ns rtproto DV

#Open the nam trace file
set nf [open out.nam w]
set tracefd [open traceout1.tr w]
$ns namtrace-all $nf
$ns trace-all $tracefd

#Define a 'finish' procedure
proc finish {} {
    global ns nf
    $ns flush-trace
    #Close the trace file
    close $nf
    #Executenam on the trace file
    exec nam out.nam &
    exit0
}

set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]

$ns duplex-link $n1 $n2 1.5Mb 10ms DropTail
$ns duplex-link $n2 $n3 1Mb 10ms DropTail

$ns queue-limit $n1 $n2 5
$ns duplex-link-op $n1 $n2 queuePos 0.5

$ns queue-limit $n2 $n3 5
$ns duplex-link-op $n2 $n3 queuePos 0.5

#Create a TCP agent and attach it to node n1
set tcp0 [new Agent/TCP]
$ns attach-agent $n1 $tcp0
#Create a TCP Sink agent (a traffic sink) for TCP and attach it to node n3
set sink0 [new Agent/TCPSink]
$ns attach-agent $n3 $sink0
#Connect the traffic sources with the traffic sink
$ns connect $tcp0 $sink0

$tcp0 set fid_ 1

# Create a CBR traffic source and attach it to tcp0
```

```
set cbr0 [new Application/Traffic/CBR]
$cbr0 attach-agent $tcp0

#Schedule events for the CBR agents
$ns at 0.5 "$cbr0 start"

$ns at 4.5 "$cbr0 stop"

#Call the finish procedure after 5 seconds of simulation time
$ns at 5.0 "finish"

#Run the simulation
$ns run
```



The above simulation generates a `traceout1.tr` file which contains information about the complete simulation. To parse through this file and count the number of drops, an `awk` script is used. The script is as follows:

```
BEGIN{ c=0;}
{
	if($1 == "d")
	{
		c++;
	}
}
END{printf("The number of packets dropped = %d\n",c);}
```

The awk script is run as follows:

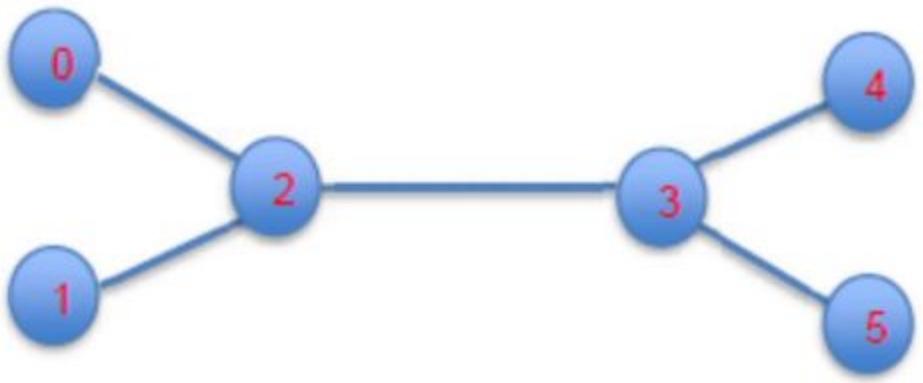
```
$ awk -f drops.awk traceout1.tr
```

The script was run for various values of Bandwidth and Queue Size and the number of drops was recorded as follows:

Bandwidth (Mb)	Queue Size	Number of Drops
1.25	5	19
0.75	5	15
0.25	5	12
1	10	8
1	5	15
1	2	19

Problem Statement 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.

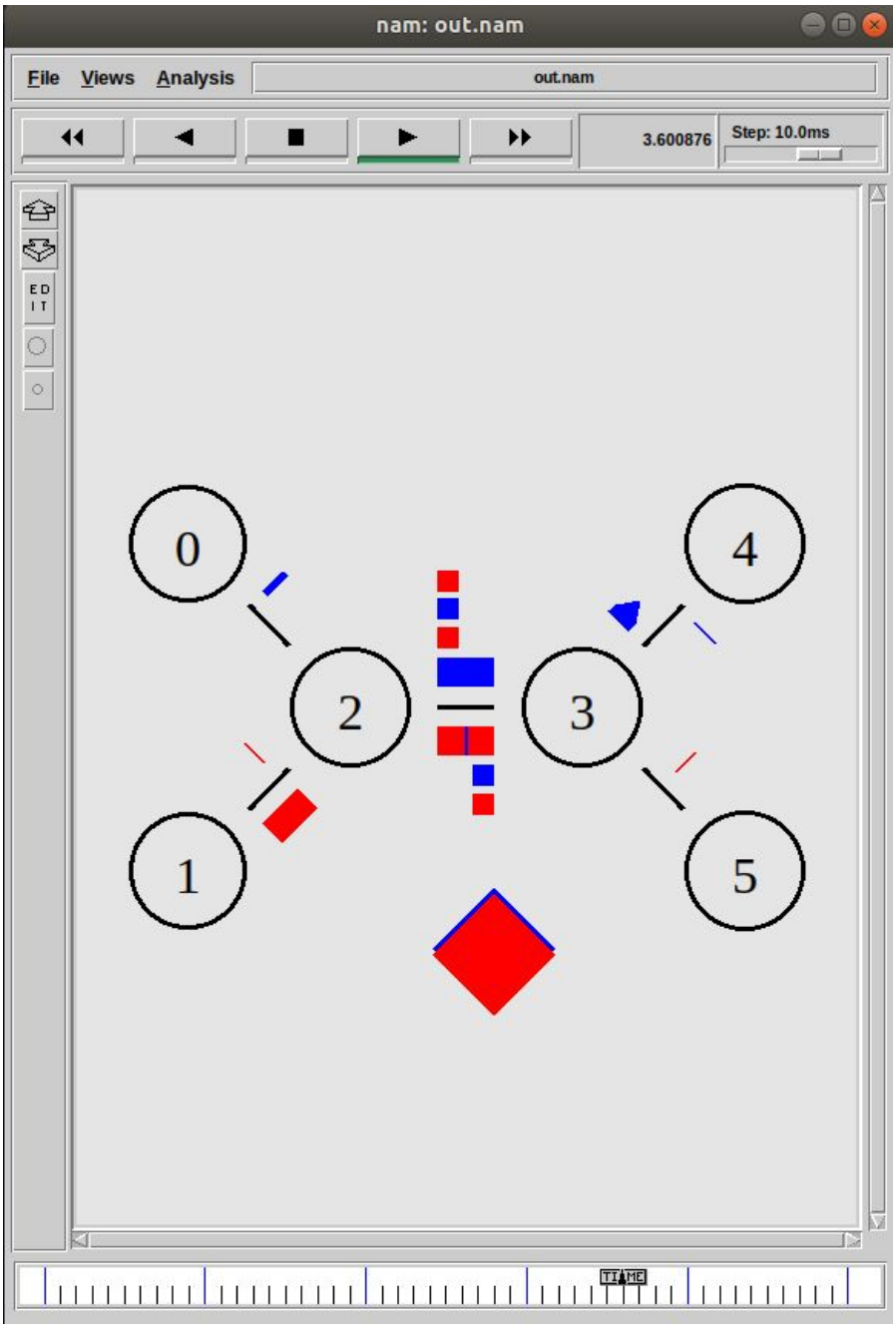


SOLUTION:

```
#Create a simulator object
set ns [new Simulator]

$ns color 1 Blue
$ns color 2 Red

$ns rtproto DV

#Open the nam trace file
set nf [open out.nam w]
set tracefd [open traceout2.tr w]
$ns namtrace-all $nf
$ns trace-all $tracefd

#Define a 'finish' procedure
proc finish {} {
    global ns nf
    $ns flush-trace
    #Close the trace file
    close $nf
    #Executenam on the trace file
    exec nam out.nam &
    exit0
}

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 1.5Mb 5ms DropTail
$ns duplex-link $n1 $n2 1.5Mb 5ms DropTail
$ns duplex-link $n2 $n3 1Mb 5ms DropTail
$ns duplex-link $n3 $n4 1.5Mb 5ms DropTail
$ns duplex-link $n3 $n5 1.5Mb 5ms DropTail

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

$ns queue-limit $n2 $n3 15
$ns duplex-link-op $n2 $n3 queuePos 0.5
```

```
$ns queue-limit $n3 $n2 15
$ns duplex-link-op $n3 $n2 queuePos 0.5

$ns queue-limit $n0 $n2 15
$ns duplex-link-op $n0 $n2 queuePos 0.5

$ns queue-limit $n3 $n4 15
$ns duplex-link-op $n3 $n4 queuePos 0.5

$ns queue-limit $n5 $n3 15
$ns duplex-link-op $n5 $n3 queuePos 0.5

$ns queue-limit $n2 $n0 15
$ns duplex-link-op $n2 $n0 queuePos 0.5

#Create a TCP agent and attach it to node n0
set tcp0 [new Agent/TCP]
$ns attach-agent $n0 $tcp0
#Create a TCP Sink agent (a traffic sink) for TCP and attach it to node n2
set sink0 [new Agent/TCPSink]
$ns attach-agent $n4 $sink0
#Connect the traffic sources with the traffic sink
$ns connect $tcp0 $sink0

#Create a TCP agent and attach it to node n5
set tcp1 [new Agent/TCP]
$ns attach-agent $n5 $tcp1
#Create a TCP Sink agent (a traffic sink) for TCP and attach it to node n1
set sink1 [new Agent/TCPSink]
$ns attach-agent $n1 $sink1
#Connect the traffic sources with the traffic sink
$ns connect $tcp1 $sink1

$tcp0 set fid_ 1
$tcp1 set fid_ 2

# Create a CBR traffic source and attach it to tcp0
set cbr0 [new Application/Traffic/CBR]
$cbr0 attach-agent $tcp0

# Create a FTP and attach it to tcp1
set ftp0 [new Application/FTP]
$ftp0 attach-agent $tcp1

#Schedule events for the CBR agents
$ns at 0.1 "$cbr0 start"
$ns at 0.2 "$ftp0 start"

$ns at 4.0 "$ftp0 stop"
$ns at 4.5 "$cbr0 stop"

#Call the finish procedure after 5 seconds of simulation time
```

```
$ns at 5.0 "finish"

#Run the simulation
$ns run
```



The same awk script was run on the file `traceout2.tr` generated by this simulation. The script was run for various values of Bandwidth and Queue Size and the number of drops was recorded as follows:

Bandwidth (Mb)	Queue Size	Number of Drops
1	5	35
0.75	5	38
0.5	5	43
1	15	23
1	5	35
1	2	57