

**Lab Assignment-4**

**Indian Institute of Technology Roorkee Department of Computer Science and Engineering**

**CSN-361: Computer Networks Laboratory (Autumn 2019-2020)**

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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.**

### Data Structure and Functions used:-

- In ns2 nodes can be connected in two ways, simplex and duplex. Simplex connection allows one-way communication and duplex connection allow two-way communication. Each type require bandwidth, delay and type of queue for configuration.
- queue\_limit to limit the number of packets for a link.  
Bandwidth is specified in Mbps(Mb) and delay is specified in milli seconds (ms).
- Agent Class :-For every node transport mechanism need to be defined to send data. These transport mechanism in ns2 defined using agent. For example FTP application requires TCP transport protocol, that's why TCP agent need to be associated with sending node. All agents are subclass of Agent class.
- In ns2 there are two type of applications are available one is traggic generator, second is simulated application. These applications are attached to agent which is attached to node. New application can be added in ns2.
- Traffic Generator generate traffic and there are four types of traffic generator.
- Exponential Traffic Generator
- Pareto Traffic Generator
- CBR
- Trace

### Application/Traffic/CBR

CBR objects generate packets at a constant bit rate.

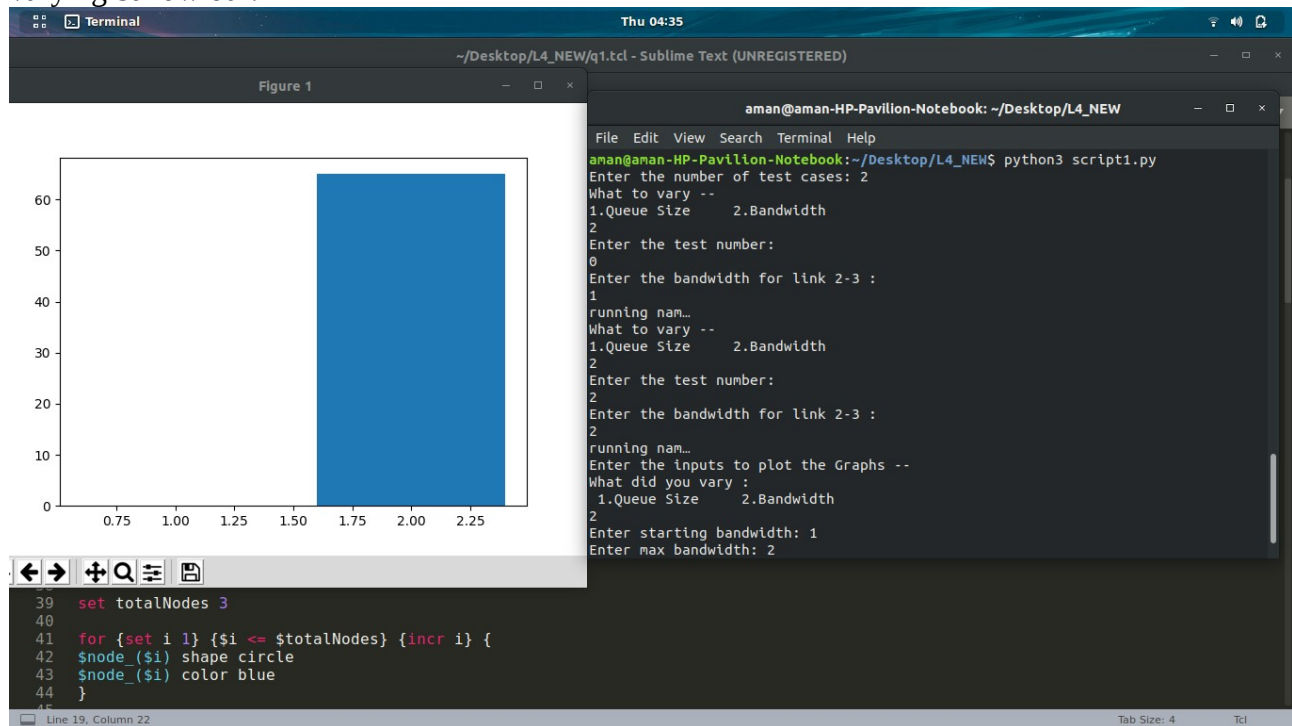
- \$cbr start Causes the source to start generating packets.
- \$cbr stop Causes the source to stop generating packets.

### Configuration parameters are:

- PacketSize\_ constant size of packets generated.
- Rate\_ sending rate.
- Interval\_ (optional) interval between packets.
- Random\_ whether or not to introduce random noise in the scheduled departure times. default is off.
- Maxpkts\_ maximum number of packets to send.
- 5. In ns2 two type of simulated applications are available
  1. FTP:-  
FTP objects produce bulk data for a TCP object to send.
  - \$ftp start Causes the source to produce maxpkts\_ packets.
  - \$ftp produce n Causes the FTP object to produce n packets instantaneously.

- maxpkts The maximum number of packets generated by the source.
- 2. Telnet:-.

varying bandwidth:-

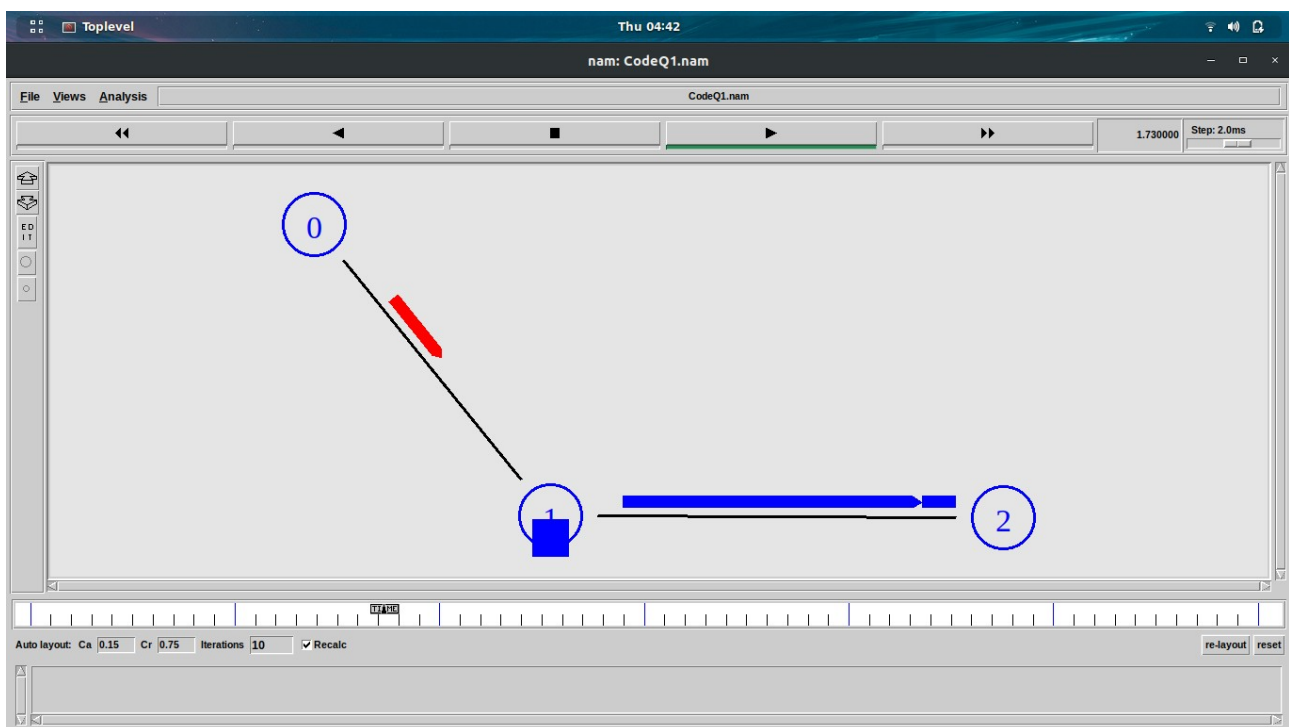


```

88 $cbr(1) set interval 0.01
89 $cbr(1) attach-agent $tcp(1)
90
91 set cbr(2) [new Application/Traffic/CBR]
92 $cbr(2) set packetSize 1000 # in Bytes
93 $cbr(2) set interval 0.01
94 $cbr(2) attach-agent $tcp(2)
95
96 #---finish procedure---#
97
98 proc finish {} {
99     global ns nf nt
100     $ns flush-trace
101     close $nt
102     puts "running nam..."
103     #exec nam CodeQ1.nam &
104     exit 0
105 }
106
107
108 # data packet generation starting time
109 $ns at 0.5 "$cbr(1) start"
110 $ns at 1.0 "$cbr(2) start"
111
112 # data packet generation ending time
113 $ns at 5.0 "$cbr(1) stop"
114 $ns at 4.5 "$cbr(2) stop"
115
116 #Calling finish procedure
117 $ns at 6.0 "finish"
118 $ns run
  
```

```

aman@aman-HP-Pavillon-Notebook:~$ cd Desktop/L4_NEW/
aman@aman-HP-Pavillon-Notebook:~/Desktop/L4_NEW$ python3 script1.py
Enter the number of test cases: 5
What to vary --
1.Queue Size      2.Bandwidth
2
Enter the test number:
0
Enter the bandwidth for link 2-3 :
1
running nam...
What to vary --
1.Queue Size      2.Bandwidth
2
Enter the test number:
1
Enter the bandwidth for link 2-3 :
2
running nam...
What to vary --
1.Queue Size      2.Bandwidth
2
Enter the test number:
2
  
```



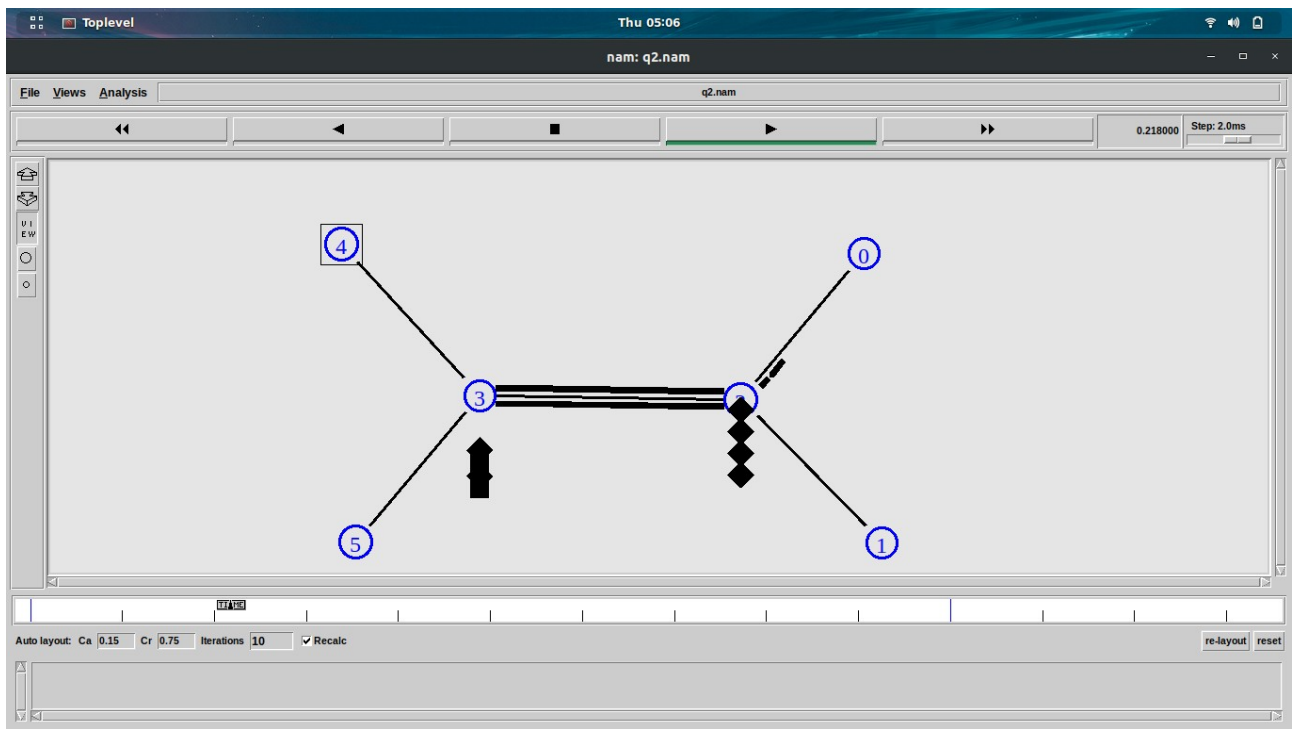
## Problem Statement 2:

**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.**

- Data Structure and Functions used:-

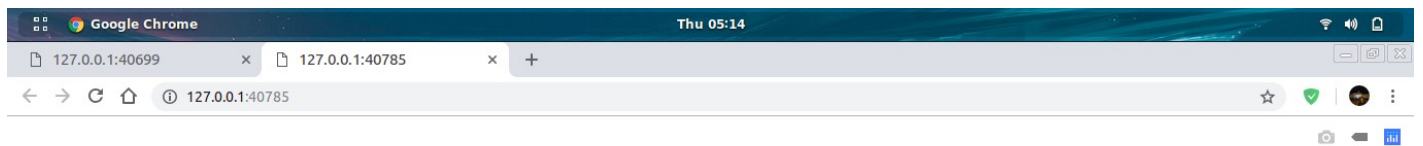
1. by stdin taking input from user no nodes and no pairs k. Also storing each pair in two array a and b.
2. In ns2 nodes can be connected in two ways, simplex and duplex. Simplex connection allows one-way communication and duplex connection allow two-way communication. Each type require bandwidth, delay and type of queue for configuration. Bandwidth is specified in Mbps(Mb) and delay is specified in milli seconds (ms).
3. Agent Class :-For every node transport mechanism need to be defined to send data. These transport mechanism in ns2 defined using agent. For example FTP application requires TCP transport protocol, that's why TCP agent need to be associated with sending node. All agents are subclass of Agent class.
4. In ns2 there are two type of applications are available one is traggic generator, second is simulated application. These applications are attached to agent which is attached to node. New application can be added in ns2.
5. queue\_limit to limit the number of packets for a link.
6. Agent/Ping to send ping requests and receive ping answer by creating ping\_agents. where 12 fields of the trace string are as follows.
  - 1. Type Identifier:
    - “+”: a packet enqueue event
    - “-”: a packet dequeue event
    - “r”: a packet reception event
    - “d”: a packet drop (e.g., sent to drop Head\_) event
    - “c”: a packet collision at the MAC level
  - 2. Time: at which the packet tracing string is created.
  - 3-4. Source Node and Destination Node: denote the IDs of the source and the destination nodes of the tracing object.
  - 5. Packet Name: Name of the packet type
  - 6. Packet Size: Size of the packet in bytes.
  - 7. Flags: A 7-digit flag string
    - “-”: disable
    - 1st = “E”: ECN (Explicit Congestion Notification) echo is enabled.
    - 2nd = “P”: the priority in the IP header is enabled.
    - 3rd : Not in use
    - 4th = “A”: Congestion action
    - 5th = “E”: Congestion has occurred.
    - 6th = “F”: The TCP fast start is used.
    - 7th = “N”: Explicit Congestion Notification (ECN) is on.
  - 8. Flow ID
  - 9-10. Source Address and Destination Address: the format of these two fields is “a.b”, where “a” is the address and “b” is the port.
  - 11. Sequence Number
  - 12. Packet Unique ID-





varitation with differen parameters shown using plotly:-





packets	queue length 0-2	queue length 2-3	queue length 3-4	queue length 5-3	queue length 3-2	queue length 2-1	bandwidth 0-2	bandwidth 2-3	bandwidth 3-4	bandwidth 5-3	bandwidth 2-1	drops
10	11	3	2	11	3	10	5Mb	0.5Mb	0.1Mb	10Mb	1Mb	15
20	14	4	8	14	2	6	11Mb	5Mb	0.5Mb	3Mb	2Mb	18
30	20	15	3	4	6	8	2Mb	10Mb	5Mb	8Mb	9Mb	36
40	12	2	4	5	9	5	5Mb	19Mb	6Mb	4Mb	3Mb	63

github link:-<https://github.com/jaiswalaman/Assignment-4-CSN-361>