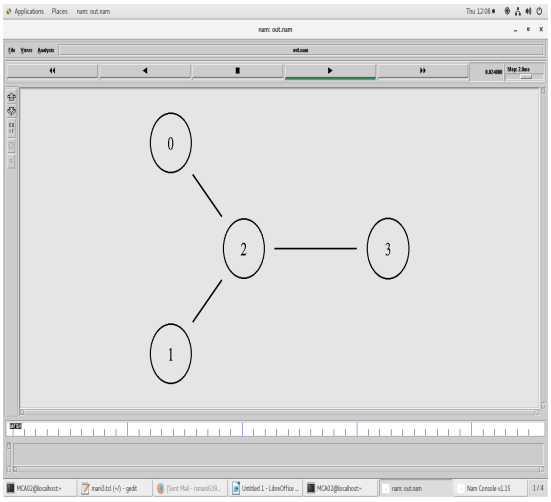
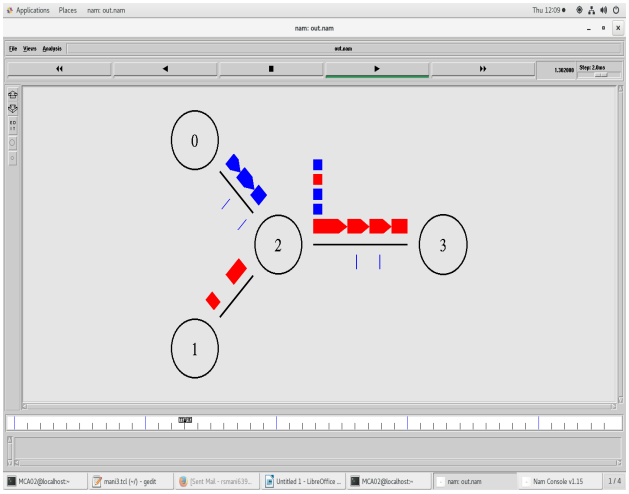
SIMPLE SIMULATION

```
set ns [new Simulator]
$ns color 1 Blue
$ns color 2 Red
set nf [open out.num 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]
$ns duplex-link $n0 $n2 2Mb 10ms DropTail
$ns duplex-link $n1 $n2 2Mb 10ms DropTail
$ns duplex-link $n2 $n3 1.7Mb 20ms DropTail
$ns queue-limit $n2 $n3 10
$ns duplex-link-op $n0 $n2 orient right-down
$ns duplex-link-op $n1 $n2 orient right-up
$ns duplex-link-op $n2 $n3 orient right
$ns duplex-link-op $n2 $n3 queuePos 0.5
set tcp [new Agent/TCP]
$tcp set class_ 2
$ns attach-agent $n0 $tcp
set sink [new Agent/TCPSink]
$ns attach-agent $n3 $sink
$ns connect $tcp $sink
$tcp set fid_ 1
set ftp [new Application/FTP]
$ftp attach-agent $tcp
$ftp set type_ FTP
set udp [new Agent/UDP]
$ns attach-agent $n1 $udp
set null [new Agent/Null]
$ns attach-agent $n3 $null
$ns connect $udp $null
$udp set fid_ 2
set cbr [new Application/Traffic/CBR]
$cbr attach-agent $udp
$cbr set type_ CBR
```

```
$cbr set packet_size_ 1000
$cbr set rate_ 1mb
$cbr set random_ false
$ns at 0.1 "$cbr start"
$ns at 1.0 "$ftp start"
$ns at 4.0 "$ftp stop"
$ns at 4.5 "$cbr stop"
$ns at 4.5 "$ns detach-agent $n0 $tcp ; $ns detach-agent $n3 $sink"
$ns at 5.0 "finish"
puts "CBR packet size = [$cbr set packet_size_]"
puts "CBR interval = [$cbr set interval_]"
$ns run
```





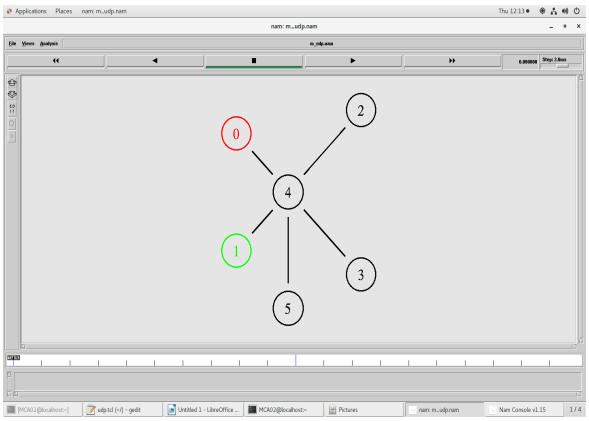
MULTIPLE UDP

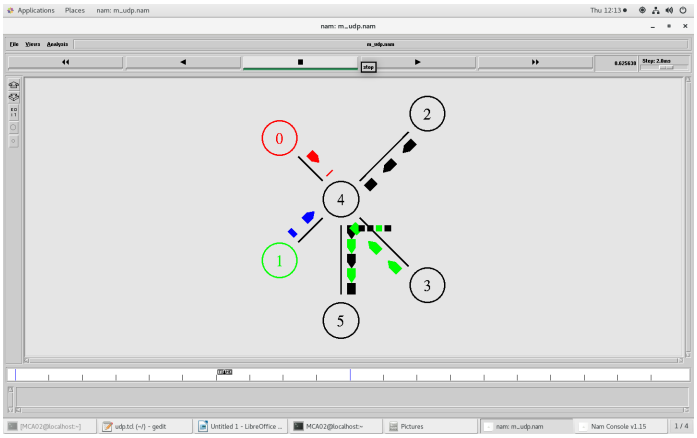
```
set ns [new Simulator]
$ns color 1 Black
$ns color 2 Blue
$ns color 3 Red
$ns color 4 Green
set nf [open m_udp.nam w]
$ns namtrace-all $nf
proc finish {} {
global ns nf
$ns flush-trace
```

```
close $nf
exec nam m_udp.nam &
exit 0
}
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]
$n0 color red
$n1 color green
$ns duplex-link $n0 $n4 2Mb 10ms DropTail
$ns duplex-link $n1 $n4 2Mb 10ms DropTail
$ns duplex-link $n2 $n4 1.7Mb 20ms DropTail
$ns duplex-link $n3 $n4 1.7Mb 20ms DropTail
$ns duplex-link $n4 $n5 1.9Mb 20ms DropTail
$ns queue-limit $n4 $n5 10
$ns duplex-link-op $n0 $n4 orient right-down
$ns duplex-link-op $n1 $n4 orient right-up
$ns duplex-link-op $n2 $n4 orient left-down
$ns duplex-link-op $n3 $n4 orient left-up
$ns duplex-link-op $n4 $n5 orient down
$ns duplex-link-op $n4 $n5 queuePos 0.5
set udp1 [new Agent/UDP]
$ns attach-agent $n0 $udp1
set null1 [new Agent/Null]
$ns attach-agent $n4 $null1
$ns connect $udp1 $null1
$udp1 set fid_ 1
set udp2 [new Agent/UDP]
$ns attach-agent $n1 $udp2
set null2 [new Agent/Null]
$ns attach-agent $n4 $null2
$ns connect $udp2 $null2
$udp2 set fid_ 2
set udp3 [new Agent/UDP]
$ns attach-agent $n2 $udp3
set null3 [new Agent/Null]
$ns attach-agent $n5 $null3
$ns connect $udp3 $null3
$udp1 set fid_ 3
set udp4 [new Agent/UDP]
$ns attach-agent $n3 $udp4
set null4 [new Agent/Null]
```

```
$ns attach-agent $n5 $null4
$ns connect $udp4 $null4
$udp4 set fid_ 4
set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $udp1
$cbr1 set type_ CBR
$cbr1 set packet_size_ 1000
$cbr1 set rate_ 1mb
$cbr1 set random_ false
set cbr2 [new Application/Traffic/CBR]
$cbr2 attach-agent $udp2
$cbr2 set type_ CBR
$cbr2 set packet_size_ 1000
$cbr2 set rate_ 1mb
$cbr2 set random_ false
set cbr3 [new Application/Traffic/CBR]
$cbr3 attach-agent $udp3
$cbr3 set type_ CBR
$cbr3 set packet_size_ 1000
$cbr3 set rate_ 1mb
$cbr3 set random_ false
set cbr4 [new Application/Traffic/CBR]
$cbr4 attach-agent $udp4
$cbr4 set type_ CBR
$cbr4 set packet_size_ 1000
$cbr4 set rate_ 1mb
$cbr4 set random_ false
$ns at 0.1 "$cbr1 start"
$ns at 0.2 "$cbr2 start"
$ns at 0.3 "$cbr3 start"
$ns at 0.5 "$cbr4 start"
$ns at 1.3 "$cbr1 stop"
$ns at 1.5 "$cbr2 stop"
$ns at 1.7 "$cbr3 stop"
$ns at 1.9 "$cbr4 stop"
$ns at 2.0 "finish"
puts "CBR packet size=[$cbr1 set packet_size_]"
puts "CBR interval=[$cbr1 set interval_]"
puts "CBR packet size=[$cbr2 set packet_size_]"
puts "CBR interval=[$cbr2 set interval_]"

puts "CBR packet size=[$cbr3 set packet_size_]"
puts "CBR interval=[$cbr3 set interval_]"
puts "CBR packet size=[$cbr4 set packet_size_]"
puts "CBR interval=[$cbr4 set interval_]"
```

$ns run



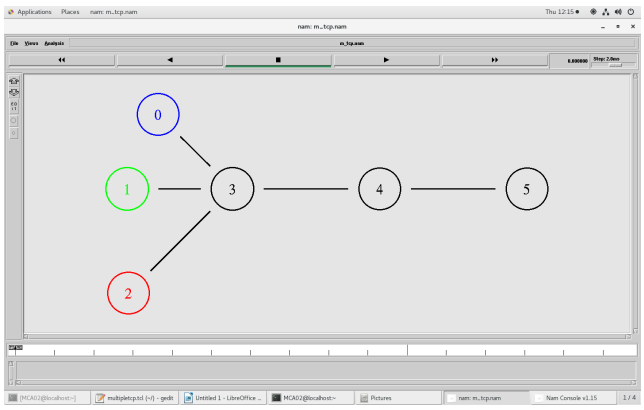


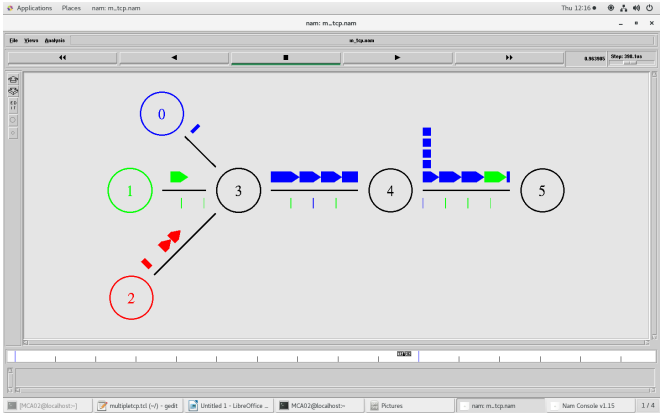
MULTIPLE TCP

```
set ns [new Simulator]
$ns color 1 Blue
$ns color 2 Green
$ns color 3 Red
set nf [open m_tcp.nam w]
$ns namtrace-all $nf
proc finish {} {
global ns nf
$ns flush-trace
close $nf
exec nam m_tcp.nam &
exit 0
}
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]
$n0 color Blue
$n1 color Green
$n2 color Red
$ns duplex-link $n0 $n3 2.9Mb 10ms DropTail
$ns duplex-link $n1 $n3 2Mb 10ms DropTail
$ns duplex-link $n2 $n3 2.7Mb 20ms DropTail
$ns duplex-link $n3 $n4 1.7Mb 20ms DropTail
$ns duplex-link $n4 $n5 1.6Mb 20ms DropTail
```

```
$ns queue-limit $n4 $n5 5
$ns duplex-link-op $n0 $n3 orient right-down
$ns duplex-link-op $n1 $n3 orient right
$ns duplex-link-op $n2 $n3 orient right-up
$ns duplex-link-op $n3 $n4 orient right
$ns duplex-link-op $n4 $n5 orient right
$ns duplex-link-op $n4 $n5 queuePos 0.5
set tcp1 [new Agent/TCP]
$tcp1 set class_ 1
$ns attach-agent $n0 $tcp1
set sink1 [new Agent/TCPSink]
$ns attach-agent $n5 $sink1
$ns connect $tcp1 $sink1
$tcp1 set fid_ 1

set tcp2 [new Agent/TCP]
$tcp2 set class_ 2
$ns attach-agent $n1 $tcp2
set sink2 [new Agent/TCPSink]
$ns attach-agent $n5 $sink2
$ns connect $tcp2 $sink2
$tcp2 set fid_ 2

set tcp3 [new Agent/TCP]
$tcp3 set class_ 3
$ns attach-agent $n2 $tcp3
set sink3 [new Agent/TCPSink]
$ns attach-agent $n5 $sink3
$ns connect $tcp3 $sink3
$tcp3 set fid_ 3

set ftp1 [new Application/FTP]
$ftp1 attach-agent $tcp1
$ftp1 set type_ FTP
set ftp2 [new Application/FTP]
$ftp2 attach-agent $tcp2
$ftp2 set type_ FTP
set ftp3 [new Application/FTP]
$ftp3 attach-agent $tcp3
$ftp3 set type_ FTP
$ns at 0.1 "$ftp1 start"
$ns at 0.3 "$ftp2 start"
$ns at 0.5 "$ftp3 start"
$ns at 1 "$ftp1 stop"
$ns at 1.2 "$ftp2 stop"
```

```
$ns at 1.4 "$ftp3 stop"
$ns at 1.6 "finish"
$ns run
```





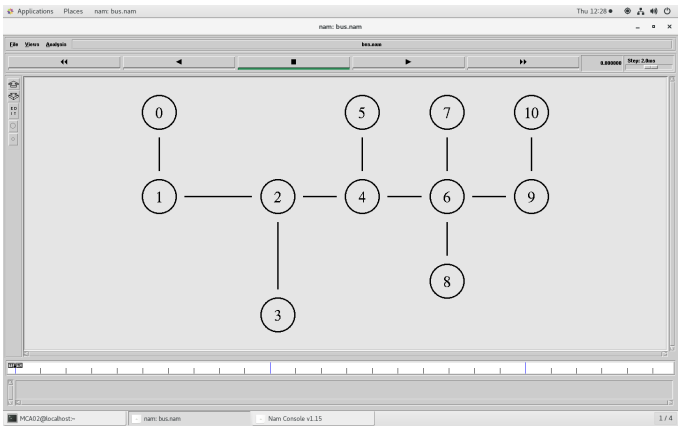
Simulation Using for Bus Topology

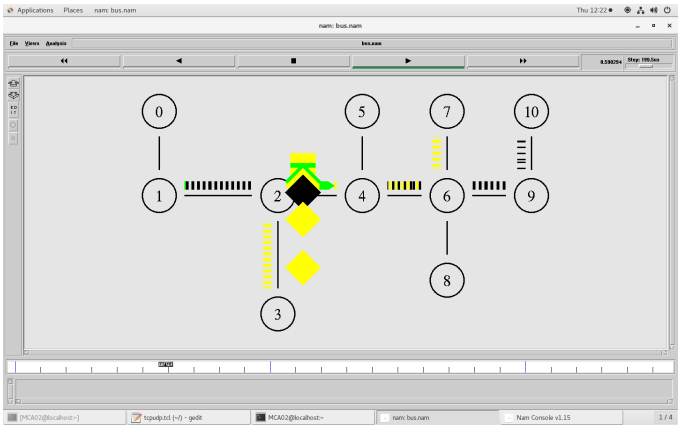
```
set ns [new Simulator]
$ns color 1 Blue
$ns color 2 Green
$ns color 3 Red
$ns color 4 Yellow
set nf [open bus.nam w]
$ns namtrace-all $nf
proc finish {} {
global ns nf
$ns flush-trace
close $nf
exec nam bus.nam &
exit 0
}
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
```

```
set n4 [$ns node]
set n5 [$ns node]
set n6 [$ns node]
set n7 [$ns node]
set n8 [$ns node]
set n9 [$ns node]
set n10 [$ns node]

$ns duplex-link $n0 $n1 2.9Mb 10ms DropTail
$ns duplex-link $n1 $n2 2Mb 20ms DropTail
$ns duplex-link $n2 $n3 2Mb 20ms DropTail
$ns duplex-link $n2 $n4 1.9Mb 10ms DropTail
$ns duplex-link $n4 $n5 2.7Mb 10ms DropTail
$ns duplex-link $n4 $n6 2.4Mb 10ms DropTail
$ns duplex-link $n6 $n7 2Mb 10ms DropTail
$ns duplex-link $n6 $n8 2.3Mb 10ms DropTail
$ns duplex-link $n6 $n9 1.9Mb 10ms DropTail
$ns duplex-link $n9 $n10 3.9Mb 10ms DropTail

$ns queue-limit $n2 $n4 3
$ns queue-limit $n6 $n8 3

$ns duplex-link-op $n0 $n1 orient down
$ns duplex-link-op $n1 $n2 orient right
$ns duplex-link-op $n2 $n3 orient down
$ns duplex-link-op $n2 $n4 orient right
$ns duplex-link-op $n4 $n5 orient up
$ns duplex-link-op $n4 $n6 orient right
$ns duplex-link-op $n6 $n7 orient up
$ns duplex-link-op $n6 $n8 orient down
$ns duplex-link-op $n6 $n9 orient right
$ns duplex-link-op $n9 $n10 orient up
$ns duplex-link-op $n2 $n4 queuePos 0.5
$ns duplex-link-op $n6 $n8 queuePos 0.5

set tcp1 [new Agent/TCP]
$tcp1 set class_ 1
$ns attach-agent $n0 $tcp1
set sink1 [new Agent/TCPSink]
$ns attach-agent $n5 $sink1
$ns connect $tcp1 $sink1
$tcp1 set fid_ 1
set tcp2 [new Agent/TCP]
$tcp1 set class_ 2
$ns attach-agent $n2 $tcp2
```

```
set sink2 [new Agent/TCPSink]
$ns attach-agent $n8 $sink2
$ns connect $tcp2 $sink2
$tcp2 set fid_ 2

set ftp1 [new Application/FTP]
$ftp1 attach-agent $tcp1
$ftp1 set type_ FTP
set ftp2 [new Application/FTP]
$ftp2 attach-agent $tcp2
$ftp2 set type_ FTP

set udp1 [new Agent/UDP]
$ns attach-agent $n3 $udp1
set null1 [new Agent/Null]
$ns attach-agent $n7 $null1
$ns connect $udp1 $null1
$udp1 set fid_ 3
set udp2 [new Agent/UDP]
$ns attach-agent $n1 $udp2
set null2 [new Agent/Null]
$ns attach-agent $n10 $null2
$ns connect $udp2 $null2
$udp1 set fid_ 4

set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $udp1
$cbr1 set type_ CBR
$cbr1 set packet_ size_ 1000
$cbr1 set rate_ 1mb
$cbr1 set random_ false

set cbr2 [new Application/Traffic/CBR]
$cbr2 attach-agent $udp2
$cbr2 set type_ CBR
$cbr2 set packet_ size_ 1000
$cbr2 set rate_ 1mb
$cbr2 set random_ false

$ns at 0.1 "$ftp1 start"
$ns at 0.2 "$cbr1 start"
$ns at 0.3 "$ftp2 start"
$ns at 0.5 "$cbr2 start"
$ns at 1.7 "$ftp1 stop"
$ns at 1.9 "$cbr1 stop"
```

```
$ns at 2.0 "$ftp1 stop"
$ns at 2.4 "$cbr1 stop"


$ns at 2.5 "finish"

puts "CBR packet size=[$cbr1 set packet_size_]"
puts "CBR interval=[$cbr1 set interval_]"
puts "CBR packet size=[$cbr2 set packet_size_]"
puts "CBR interval=[$cbr2 set interval_]"

$ns run
```





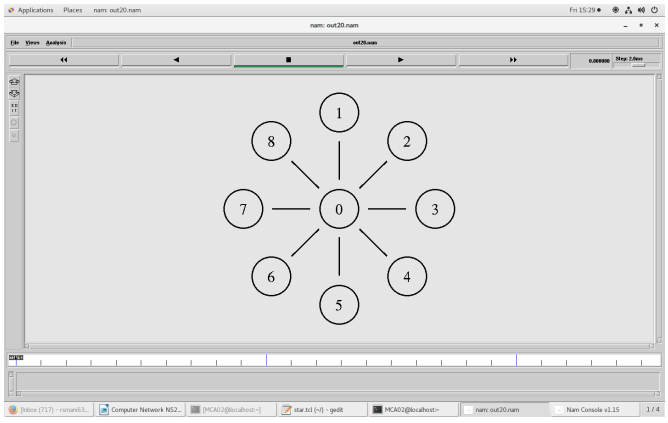
Simulation using Star Topology

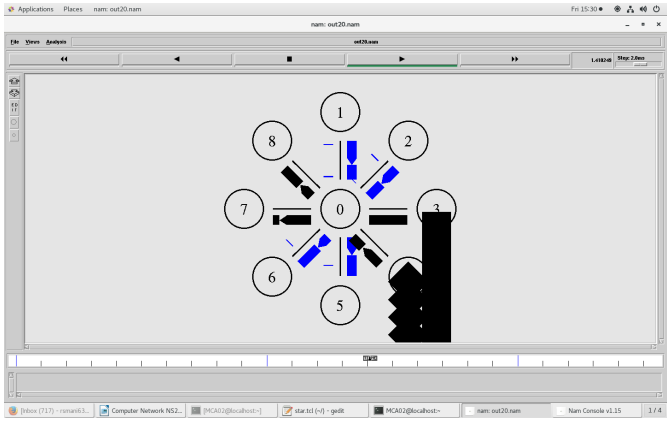
```
set ns [new Simulator]
#Open file for nam tracing
set nf [open out20.nam w]
$ns namtrace-all $nf
#Set up different colors for dataflow
$ns color 1 Red
```

```
$ns color 2 Blue
$ns color 3 Green
$ns color 4 Yellow
$ns color 5 Violet
$ns color 6 Pink
$ns color 7 Brown
$ns color 8 White
#Define a 'finish' procedure
proc finish {} {
global ns nf
$ns flush-trace
#close the trace file
close $nf
#Execute nam on the trace file
exec nam out20.nam &
exit 0
}
#Create Nodes for the simulation
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]
set n6 [$ns node]
set n7 [$ns node]
set n8 [$ns node]
#Create a duplex link between the links
$ns duplex-link $n0 $n1 1Mb 10ms DropTail
$ns duplex-link $n0 $n2 1Mb 10ms DropTail
$ns duplex-link $n0 $n3 1Mb 10ms DropTail
$ns duplex-link $n0 $n4 1Mb 10ms DropTail
$ns duplex-link $n0 $n5 1Mb 10ms DropTail
$ns duplex-link $n0 $n6 1Mb 10ms DropTail
$ns duplex-link $n0 $n7 1Mb 10ms DropTail
$ns duplex-link $n0 $n8 1Mb 10ms DropTail
#orientation of links
$ns duplex-link-op $n0 $n1 orient up
$ns duplex-link-op $n0 $n2 orient up-right
$ns duplex-link-op $n0 $n3 orient right
$ns duplex-link-op $n0 $n4 orient down-right
$ns duplex-link-op $n0 $n5 orient down
$ns duplex-link-op $n0 $n6 orient down-left
$ns duplex-link-op $n0 $n7 orient left
$ns duplex-link-op $n0 $n8 orient up-left
```

```
#tcp set up
set tcp1 [new Agent/TCP]
$tcp1 set class_ 1
$ns attach-agent $n1 $tcp1
set sink1 [new Agent/TCPSink]
$ns attach-agent $n5 $sink1
$ns connect $tcp1 $sink1
$tcp1 set fid_ 1
set tcp2 [new Agent/TCP]
$tcp2 set class_ 2
$ns attach-agent $n2 $tcp2
set sink2 [new Agent/TCPSink]
$ns attach-agent $n6 $sink2
$ns connect $tcp2 $sink2
$tcp1 set fid_ 2
#ftp set up
set ftp1 [new Application/FTP]
$ftp1 attach-agent $tcp1
$ftp1 set type_ FTP
set ftp2 [new Application/FTP]
$ftp2 attach-agent $tcp2
$ftp2 set type_ FTP
set udp1 [new Agent/UDP]
$ns attach-agent $n3 $udp1
set null1 [new Agent/Null]
$ns attach-agent $n7 $null1
$ns connect $udp1 $null1
set udp2 [new Agent/UDP]
$ns attach-agent $n4 $udp2
set null2 [new Agent/Null]
$ns attach-agent $n8 $null2
$ns connect $udp2 $null2
set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $udp1
$cbr1 set type_ CBR
$cbr1 set packet_size_ 1000
$cbr1 set rate_ 2mb
$cbr1 set random_ false
set cbr2 [new Application/Traffic/CBR]
$cbr2 attach-agent $udp2
$cbr2 set type_ CBR
$cbr2 set packet_size_ 1000
$cbr2 set rate_ 2mb
$cbr2 set random_ false
$ns at 0.1 "$ftp1 start"
```

```
$ns at 0.4 "$cbr1 start"
$ns at 0.6 "$ftp2 start"
$ns at 0.9 "$cbr2 start"
$ns at 1.3 "$ftp1 stop"
$ns at 1.6 "$cbr1 stop"
$ns at 1.9 "$ftp2 stop"
$ns at 2.2 "$cbr2 stop"
$ns at 2.5 "finish"
puts "CBR packet size = [$cbr1 set packet_size_]"
puts "CBR interval = [$cbr1 set interval_]"
puts "CBR packet size = [$cbr2 set packet_size_]"
puts "CBR interval = [$cbr2 set interval_]"
$ns run
```





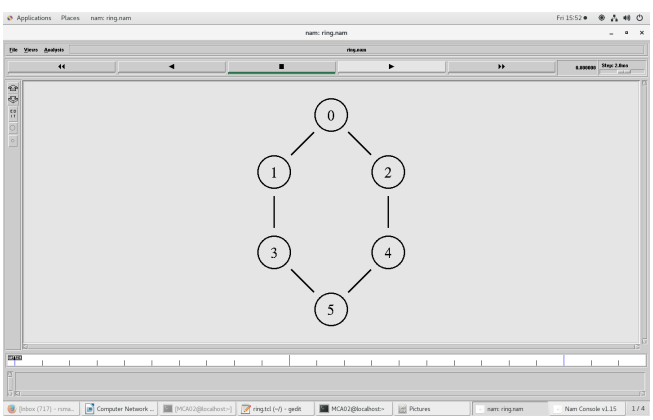
Simulation of Ring Topology

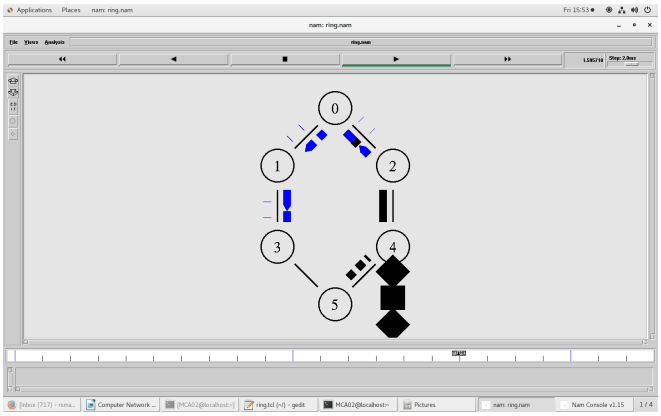
```
set ns [new Simulator]
#Open file for nam tracing
set nf [open ring.nam w]
$ns namtrace-all $nf
#Set up different colors for dataflow
$ns color 1 Red
$ns color 2 Blue
$ns color 3 Green
$ns color 4 Yellow

#Define a 'finish' procedure
proc finish {} {
global ns nf
```

```
$ns flush-trace
#close the trace file
close $nf
#Execute nam on the trace file
exec nam ring.nam &
exit 0
}
#Create Nodes for the simulation
set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]

#Create a duplex link between the links
$ns duplex-link $n0 $n1 2Mb 10ms DropTail
$ns duplex-link $n0 $n2 2Mb 10ms DropTail
$ns duplex-link $n1 $n3 1.7Mb 20ms DropTail
$ns duplex-link $n2 $n4 1.7Mb 20ms DropTail
$ns duplex-link $n3 $n5 1.6Mb 20ms DropTail
$ns duplex-link $n4 $n5 1.6Mb 20ms DropTail
$ns queue-limit $n4 $n5 3


#orientation of links
$ns duplex-link-op $n0 $n1 orient left-down
$ns duplex-link-op $n0 $n2 orient right-down
$ns duplex-link-op $n1 $n3 orient down
$ns duplex-link-op $n2 $n4 orient down
$ns duplex-link-op $n3 $n5 orient right-down
$ns duplex-link-op $n4 $n5 orient left-down
$ns duplex-link-op $n4 $n5 queuePos 0.5
#tcp set up
set tcp1 [new Agent/TCP]
$tcp1 set class_ 1
$ns attach-agent $n0 $tcp1
set sink1 [new Agent/TCPSink]
$ns attach-agent $n5 $sink1
$ns connect $tcp1 $sink1
$tcp1 set fid_ 1
set tcp2 [new Agent/TCP]
$tcp2 set class_ 2
$ns attach-agent $n2 $tcp2
set sink2 [new Agent/TCPSink]
```

```
$ns attach-agent $n3 $sink2
$ns connect $tcp2 $sink2
$tcp1 set fid_ 2
#ftp set up
set ftp1 [new Application/FTP]
$ftp1 attach-agent $tcp1
$ftp1 set type_ FTP
set ftp2 [new Application/FTP]
$ftp2 attach-agent $tcp2
$ftp2 set type_ FTP

set udp1 [new Agent/UDP]
$ns attach-agent $n5 $udp1
set null1 [new Agent/Null]
$ns attach-agent $n2 $null1
$ns connect $udp1 $null1
set udp2 [new Agent/UDP]
$ns attach-agent $n4 $udp2
set null2 [new Agent/Null]
$ns attach-agent $n0 $null2
$ns connect $udp2 $null2
set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $udp1
$cbr1 set type_ CBR
$cbr1 set packet_size_ 1000
$cbr1 set rate_ 2mb
$cbr1 set random_ false
set cbr2 [new Application/Traffic/CBR]
$cbr2 attach-agent $udp2
$cbr2 set type_ CBR
$cbr2 set packet_size_ 1000
$cbr2 set rate_ 2mb
$cbr2 set random_ false
$ns at 0.1 "$ftp1 start"
$ns at 0.4 "$cbr1 start"
$ns at 0.6 "$ftp2 start"
$ns at 0.9 "$cbr2 start"
$ns at 1.3 "$ftp1 stop"
$ns at 1.6 "$cbr1 stop"
$ns at 1.9 "$ftp2 stop"
$ns at 2.2 "$cbr2 stop"
$ns at 2.5 "finish"
puts "CBR packet size = [$cbr1 set packet_size_]"
puts "CBR interval = [$cbr1 set interval_]"
puts "CBR packet size = [$cbr2 set packet_size_]"
```

```
puts "CBR interval = [$cbr2 set interval_]"
$ns run
```

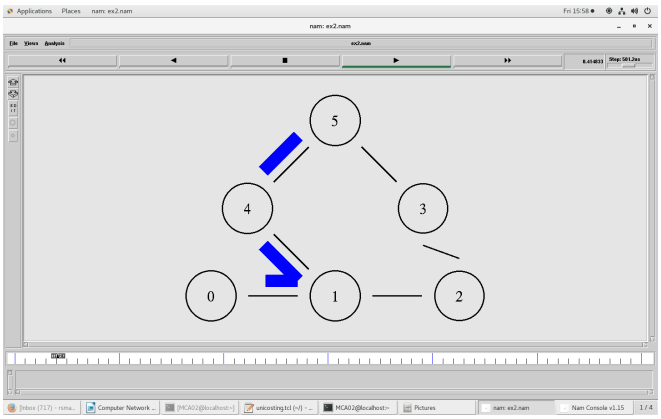


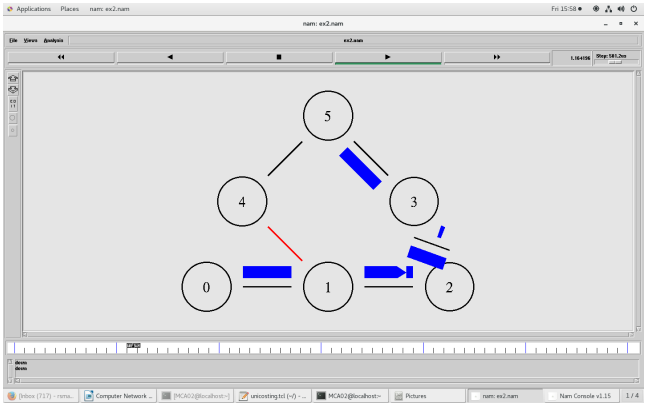


Unicasting

```
set ns [new Simulator]
$ns color 1 Blue
$ns color 2 Red
set file1 [open ex2.tr w]
$ns trace-all $file1
set file2 [open ex2.nam w]
$ns namtrace-all $file2
proc finish {} {
global ns file1 file2
$ns flush-trace
close $file1
close $file2
exec nam ex2.nam &
exit 0
}
$ns rtproto DV
set n0 [$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 $n1 0.3Mb 10ms DropTail
$ns duplex-link $n1 $n2 0.3Mb 10ms DropTail
$ns duplex-link $n2 $n3 0.3Mb 10ms DropTail
$ns duplex-link $n1 $n4 0.3Mb 10ms DropTail
$ns duplex-link $n3 $n5 0.5Mb 10ms DropTail
$ns duplex-link $n4 $n5 0.5Mb 10ms DropTail
```

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

set tcp [new Agent/TCP/Newreno]
$ns attach-agent $n0 $tcp
set sink [new Agent/TCPSink/DelAck]
$ns attach-agent $n5 $sink
$ns connect $tcp $sink
$tcp set fid_ 1
set ftp [new Application/FTP]
$ftp attach-agent $tcp
$ftp set type_ FTP
$ns rtmodel-at 1.0 down $n1 $n4
$ns rtmodel-at 4.5 up $n1 $n4
$ns at 0.1 "$ftp start"
$ns at 6.0 "finish"
$ns run
```



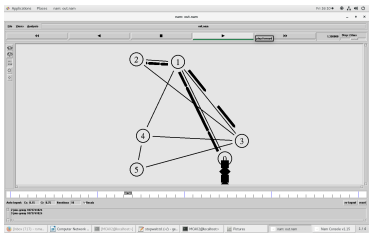


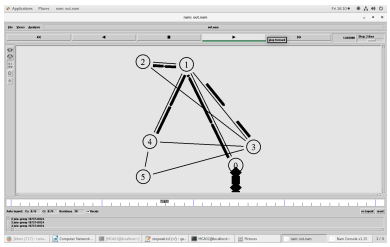
Multicasting

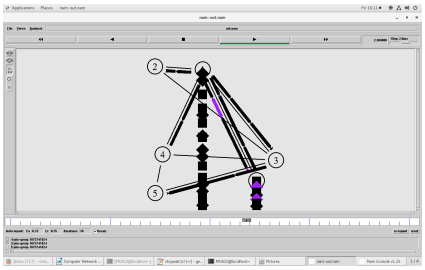
```
set ns [new Simulator]
$ns multicast
set f [open out.tr w]
$ns trace-all $f
```

```
$ns namtrace-all [open out.nam w]
$ns color 1 Red
$ns color 30 Purple
$ns color 31 Green
set group [Node allocaddr]
set nod 6
for {set i 1} {$i<=$nod} {incr i} {
set n($i) [$ns node]
}
$ns duplex-link $n(1) $n(2) 0.3Mb 10ms DropTail
$ns duplex-link $n(2) $n(3) 0.3Mb 10ms DropTail
$ns duplex-link $n(2) $n(4) 0.5Mb 10ms DropTail
$ns duplex-link $n(2) $n(5) 0.3Mb 10ms DropTail
$ns duplex-link $n(3) $n(4) 0.3Mb 10ms DropTail
$ns duplex-link $n(4) $n(5) 0.5Mb 10ms DropTail
$ns duplex-link $n(4) $n(6) 0.5Mb 10ms DropTail
$ns duplex-link $n(5) $n(6) 0.5Mb 10ms DropTail

DM set CacheMissMode dvmrp
set mproto DM
set mrthandle [$ns mrtproto $mproto]

set udp1 [new Agent/UDP]
set udp2 [new Agent/UDP]

$ns attach-agent $n(1) $udp1
$ns attach-agent $n(2) $udp2

set src1 [new Application/Traffic/CBR]
$src1 attach-agent $udp1
$udp1 set dst_addr_ $group
$udp1 set dst_port_ 0
$src1 set random_ false


set src2 [new Application/Traffic/CBR]
$src2 attach-agent $udp2
$udp2 set dst_addr_ $group
$udp2 set dst_port_ 0
$src2 set random_ false

set rcvr [new Agent/LossMonitor]

$ns at 0.6 "$n(3) join-group $rcvr $group"
$ns at 1.3 "$n(4) join-group $rcvr $group"
```

```
$ns at 1.6 "$n(5) join-group $rcvr $group"
$ns at 1.9 "$n(4) join-group $rcvr $group"
$ns at 2.3 "$n(6) join-group $rcvr $group"
$ns at 3.5 "$n(3) join-group $rcvr $group"

$ns at 0.4 "$src1 start"
$ns at 2.0 "$src2 start"
$ns at 4.0 "finish"

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







Stop and Wait Protocal

```
set ns [new Simulator]

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

$ns at 0.0 "$n0 label sender"
```

```
$ns at 0.0 "$n1 label receiver"

set nf [open A1-stop-n-wait.nam w]
$ns namtrace-all $nf

set f [open A1-stop-n-wait.tr w]
$ns trace-all $f

$ns duplex-link $n0 $n1 0.2Mb 200ms DropTail
$ns duplex-link-op $n0 $n1 orient right
$ns queue-limit $n0 $n1 10

Agent/TCP set namtracevar_ true

set tcp [new Agent/TCP]
$tcp set window_ 1
$tcp set maxcwnd_ 1
$ns attach-agent $n0 $tcp

set sink [new Agent/TCPSink]
$ns attach-agent $n1 $sink
$ns connect $tcp $sink

set ftp [new Application/FTP]
$ftp attach-agent $tcp

$ns add-agent-trace $tcp tcp
$ns monitor-agent-trace $tcp
$tcp tracevar cwnd_

$ns at 0.1 "$ftp start"
$ns at 3.0 "$ns detach-agent $n0 $tcp; $ns detach-agent $n1 $sink"
$ns at 3.5 "finish"

$ns at 0.0  "$ns trace-annotate \"Stop and Wait normal operation\""
$ns at 0.05 "$ns trace-annotate \"FTP starts at 0.1\""
$ns at 0.11 "$ns trace-annotate \"Send packet_0\""
$ns at 0.35 "$ns trace-annotate \"Receive Ack_0\""
$ns at 0.56 "$ns trace-annotate \"Send packet_1\""
$ns at 0.79 "$ns trace-annotate \"Receive Ack_1\""
$ns at 0.99 "$ns trace-annotate \"Send packet_2\""
$ns at 1.23 "$ns trace-annotate \"Receive Ack_2\""
$ns at 1.43 "$ns trace-annotate \"Send packet_3\""
$ns at 1.67 "$ns trace-annotate \"Receive Ack_3\""
$ns at 1.88 "$ns trace-annotate \"Send packet_4\""
```

```
$ns at 2.11 "$ns trace-annotate \"Receive Ack_4\""
$ns at 2.32 "$ns trace-annotate \"Send packet_5\""
$ns at 2.55 "$ns trace-annotate \"Receive Ack_5\""
$ns at 2.75 "$ns trace-annotate \"Send packet_6\""
$ns at 2.99 "$ns trace-annotate \"Receive Ack_6\""

$ns at 3.1 "$ns trace-annotate \"FTP stops\""

proc finish {} {
global ns nf
$ns flush-trace
close $nf
exec nam A1-stop-n-wait.nam &
exit 0
}

$ns run
```