EXPERIMENT NO. 3

To create a circular topology and implement a routing protocol using NS-2

Aim:

To create a larger network in NS-2 which include following features,

i. Creating large number of nodes and links between them.

ii. Implementing a routing protocol.

iii. Breaking and making links to demonstrate the working of the routing protocol.

Requirements:

Ubuntu Operating System, NS2

Procedure:

1. Start a new simulator.
2. Create the output files.
3. Write the finish procedure.
4. Create the topology as shown in Fig. 1 by
    a. Defining nodes and the links
    b. Creating, attaching, and connecting transport layer agents
    c. Creating and attaching application layer agent
    d. Implementing a routing protocol
    e. Scheduling the events (include breaking and making of links)
    f. Starting the simulation
5. Run the simulation
6. Observe the animated output in nam window.

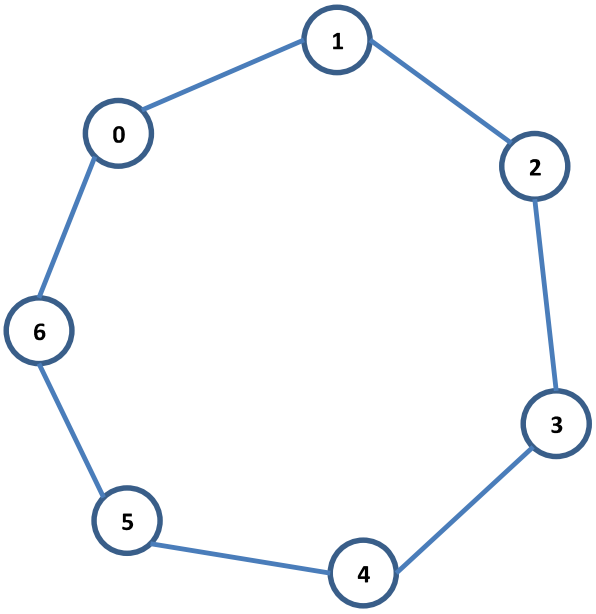


Fig.1

Implementation:

Different approach for creating larger number of nodes and linking them.

The following code creates seven nodes and stores them in the array n( ) using ‘for’ loop.

```
for {set i 0{ {$i < 7} {incr i} {
$ns duplex-link $n($i) $n({expr ($i+1)%7]) 1Mb 10ms DropTail
}
```

We can also connect the nodes using ‘for’ loop and for a circular topology, %' (modulo) operator can be used.

```
for {set I 0{ {$i < 7} {incr i} {
set n($i) [$ns node]
```

The topology in nam may look strange at times. Using, ‘re-layout’ button we can make the topology look regular.

For using dynamic routing, add the following line at the beginning of Tcl script, after the simulator object has been created.

```
$ns rtproto DV
```

Letting the links go down or up

We let the link between node 1 and 2 (which is being used by the traffic) go ‘down’ for a second

```
$ns rtmodel-at 1.0 down $n(1) $n(2)
```

And ‘up’ again after a second

```
$ns rtmodel-at 2.0 up $n(1) $n(2)
```

We can see the routing getting updated and traffic being re-routed.

Observation:

Take appropriate snapshots and write observations below each snapshot. Students are expected to take a minimum of four snap shots for different periods of simulations.

Post Experimental Exercise: *(take appropriate SS to support your answers)*

1. Break link between 2 and 3 at 2sec time interval and observe the flow of data packets. Note down the observations.
2. Modify the program to send packets from node 2 to node 5. Also observe the result by making the link between node 3 and 4 down for 1 minute.

Conclusion: *(to be handwritten on journal sheets)*

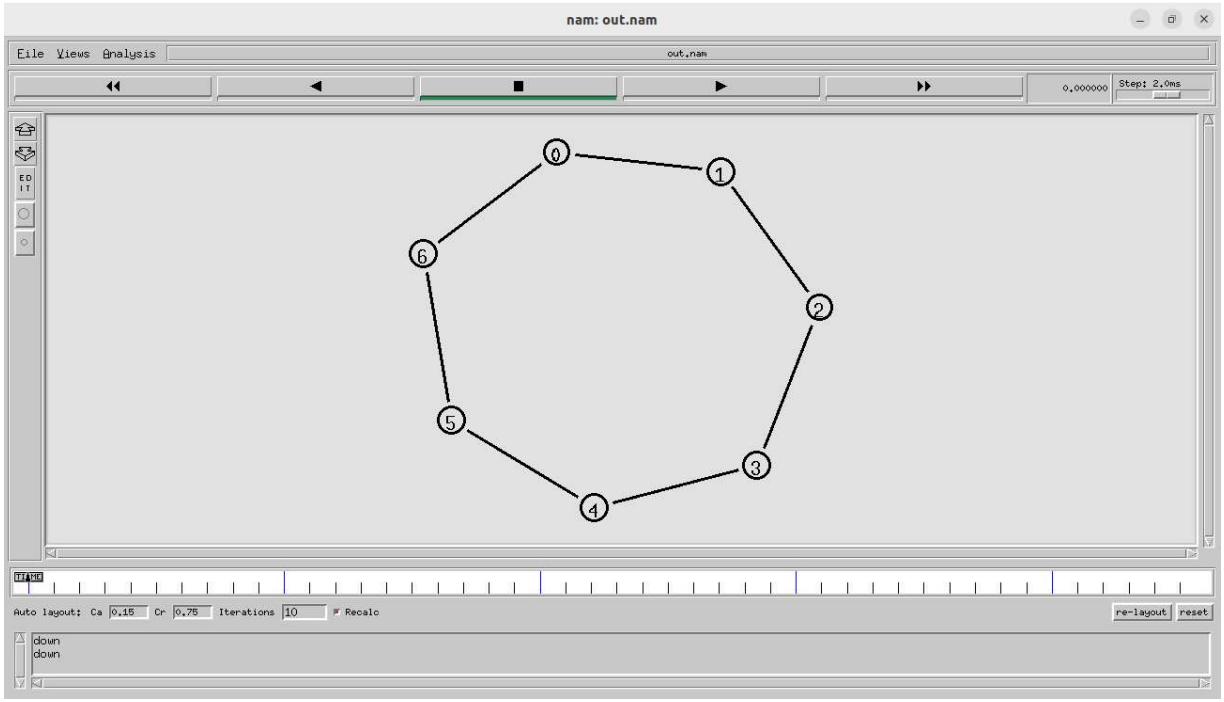
PROGRAM:

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

#Tell the simulator to use dynamic routing
$ns rtproto DV

#Open the 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
}

#Create seven nodes
for {set i 0} {$i < 7} {incr i} {
```

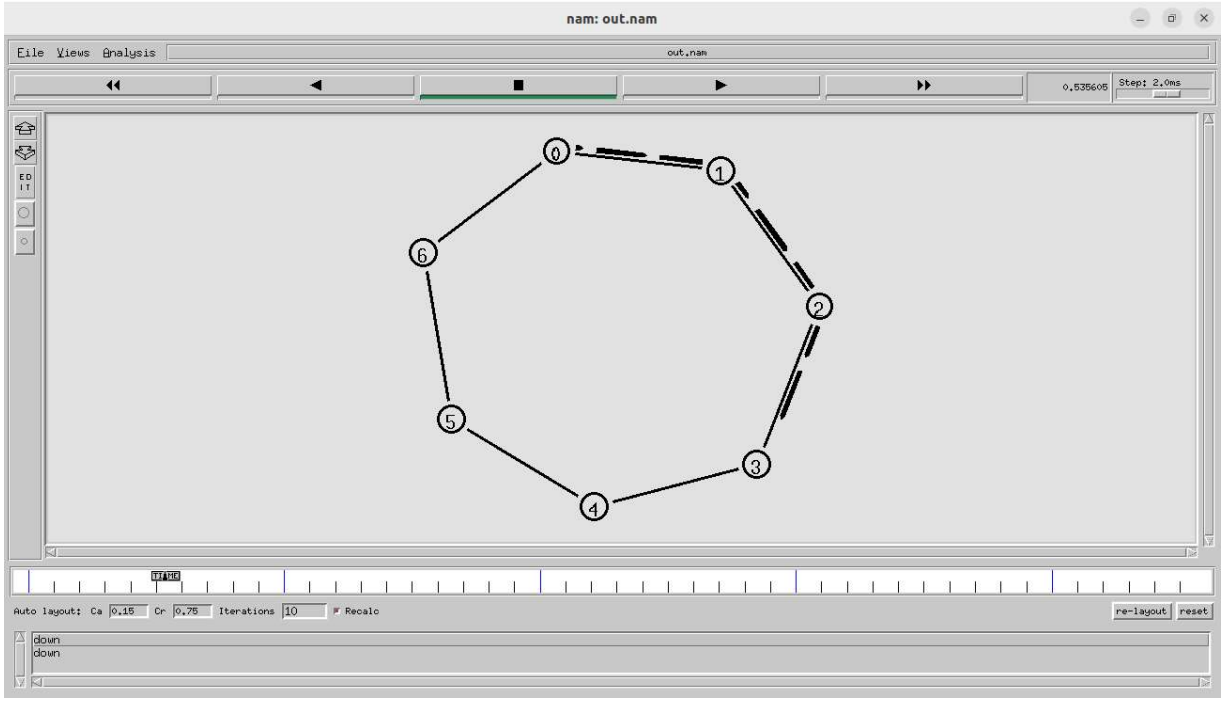
```
        set n($i) [$ns node]
}

#Create links between the nodes
for {set i 0} {$i < 7} {incr i} {
        $ns duplex-link $n($i) $n([expr ($i+1)%7]) 1Mb 10ms DropTail
}

#Create a UDP agent and attach it to node n(0)
set udp0 [new Agent/UDP]
$ns attach-agent $n(0) $udp0

# 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

#Create a Null agent (a traffic sink) and attach it to node n(3)
set null0 [new Agent/Null]
$ns attach-agent $n(3) $null0

#Connect the traffic source with the traffic sink
$ns connect $udp0 $null0
```

```
#Schedule events for the CBR agent and the network dynamics
$ns at 0.5 "$cbr0 start"
$ns rtmodel-at 1.0 down $n(1) $n(2)
$ns rtmodel-at 2.0 up $n(1) $n(2)
$ns at 4.5 "$cbr0 stop"

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

#Run the simulation
$ns run
```

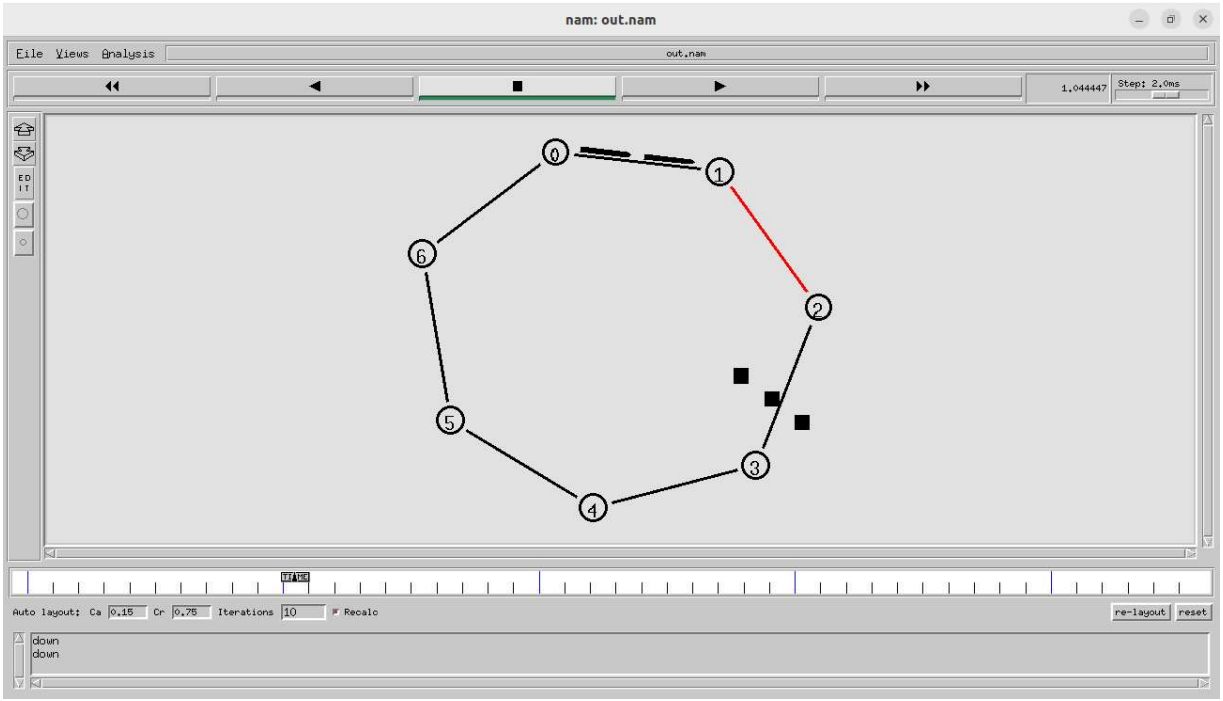
Observation



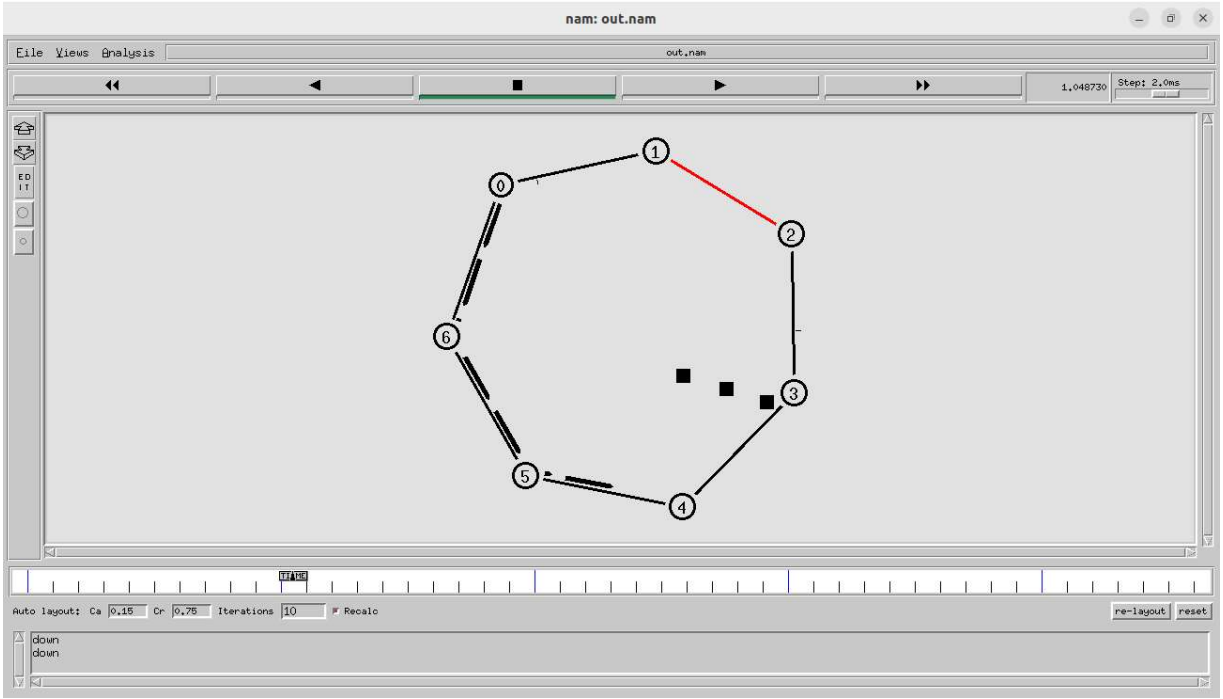
There are 7 nodes in this simulation which are connected to its neighboring nodes, i.e Ring Topology



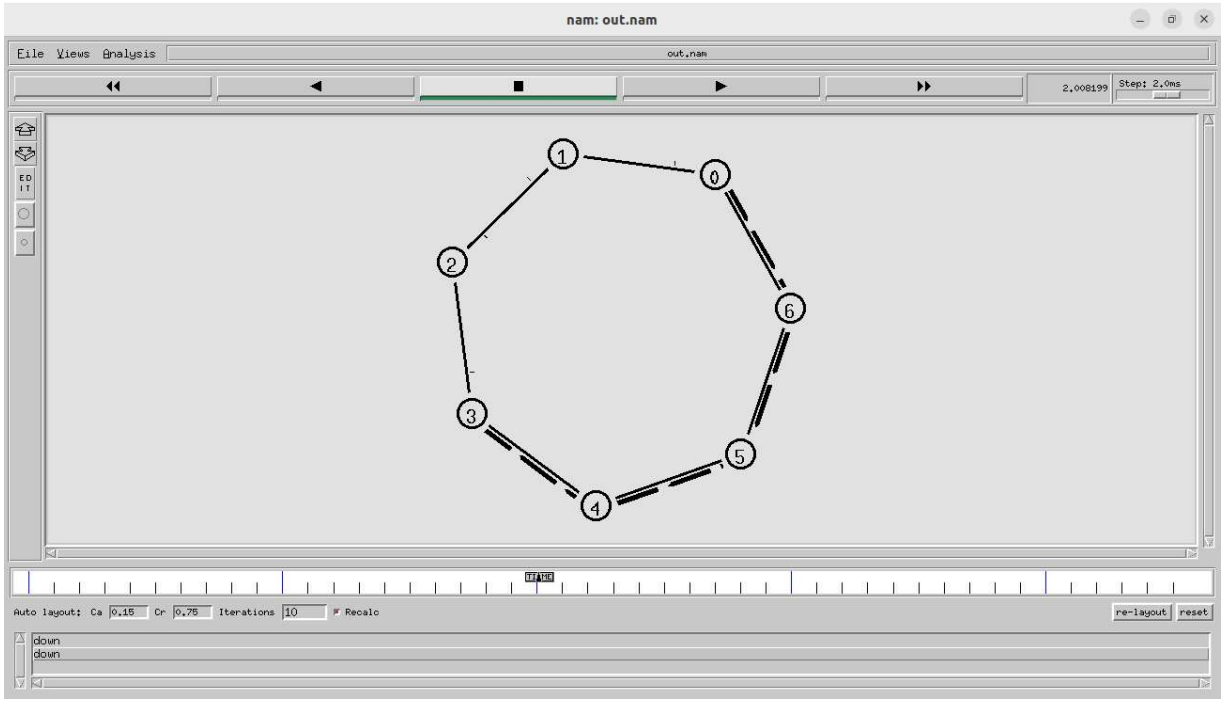
The transmission of the packets starts at 0.5 seconds from node 0 (sender) as written in the program.



The link between 1-2 is going down at 1 second as a result the packets from node 0 are unable to reach node 3.



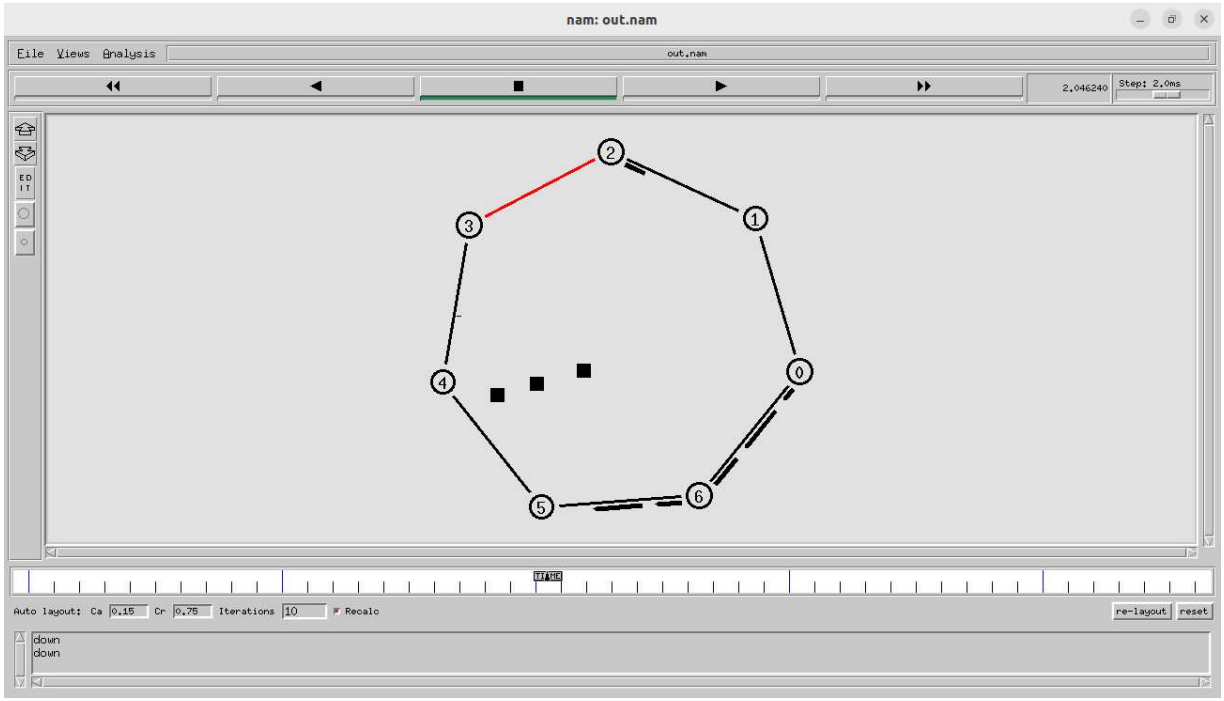
When we use dynamic routing, upon failure of a transmission link we can see the nodes sending tiny handshake packets to all the nodes to inform about the failure followed by the switching of the transmission direction.



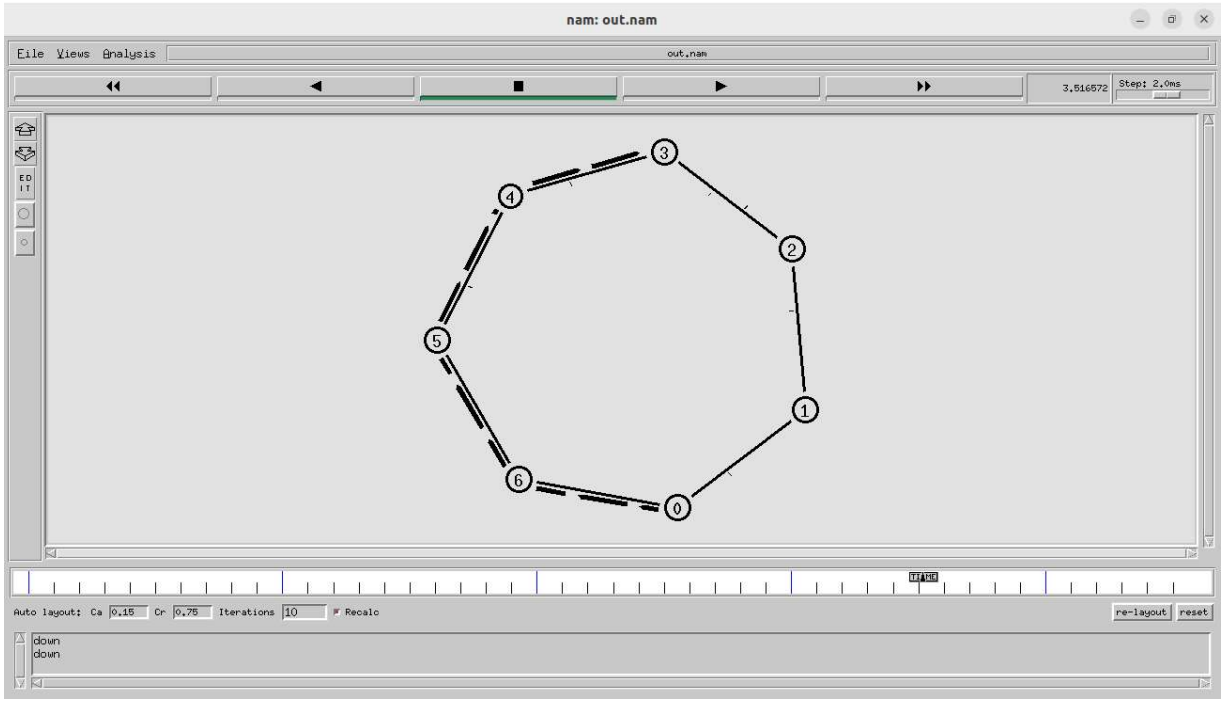
At 2 seconds the transmission link between node 1 to 2 is up again and the route is switched from changed path to optimal path.

Post Experimental Exercise:

Q1

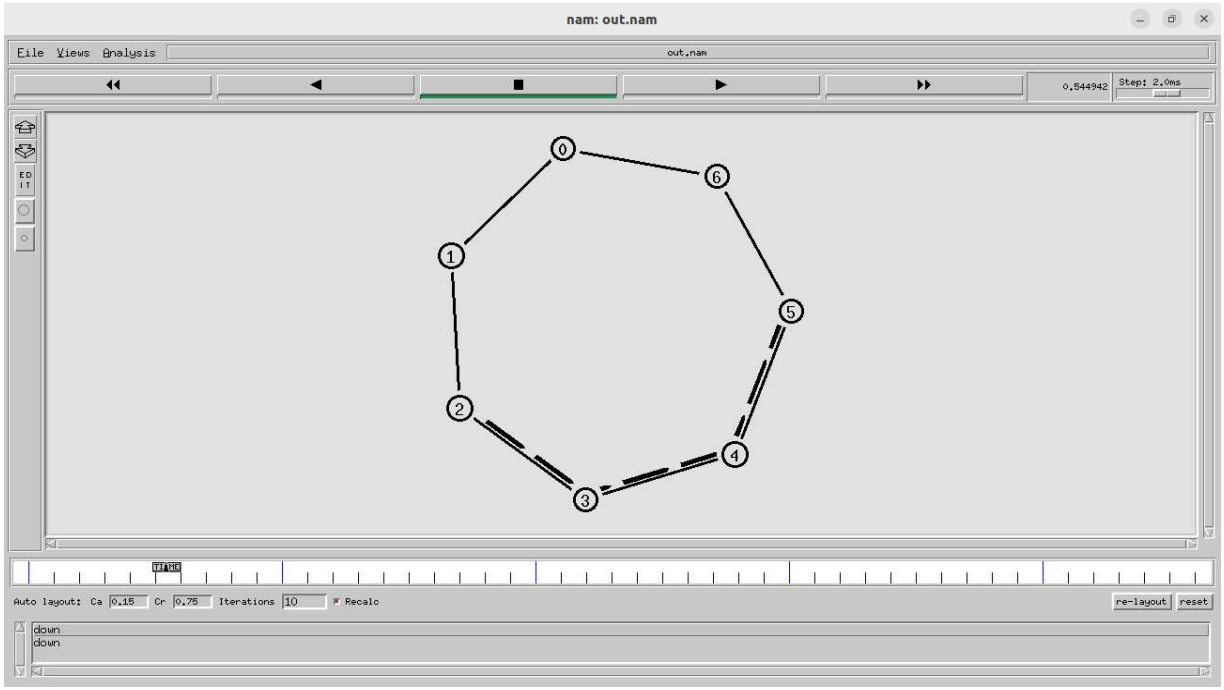


The transmission link between node 2 and node 3 is down causing disruption is the packet transmission

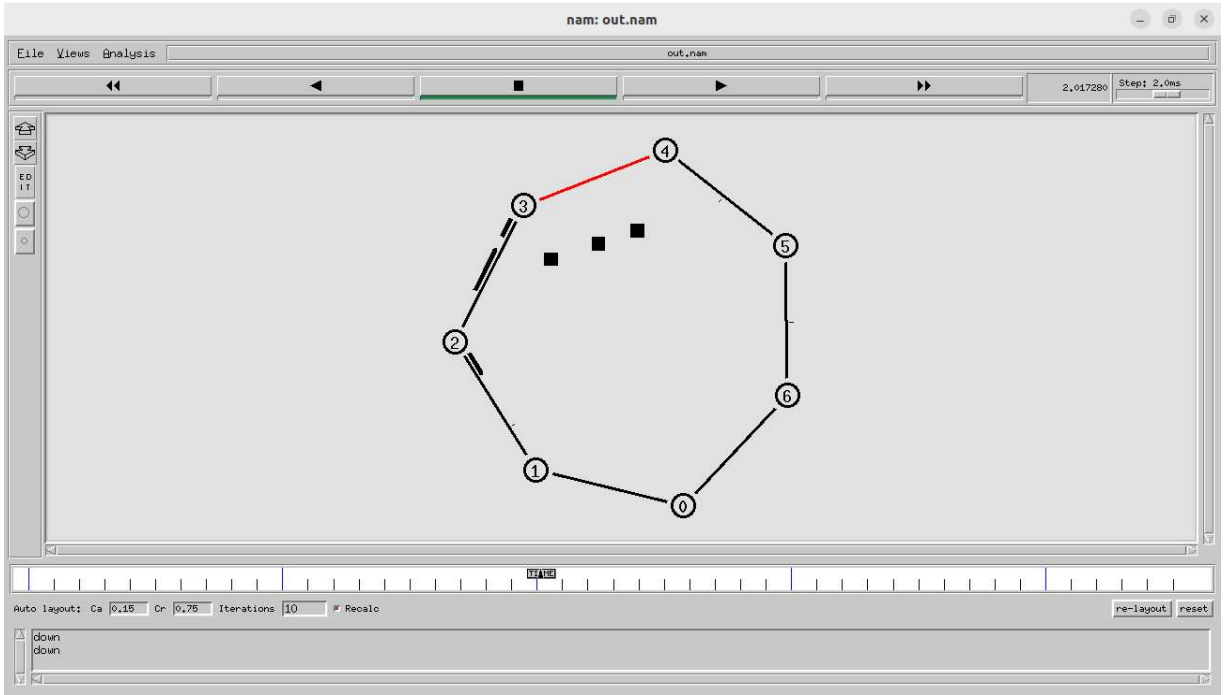


As we are using dynamic routing, an alternate route from node 0 to node 3 is taken.

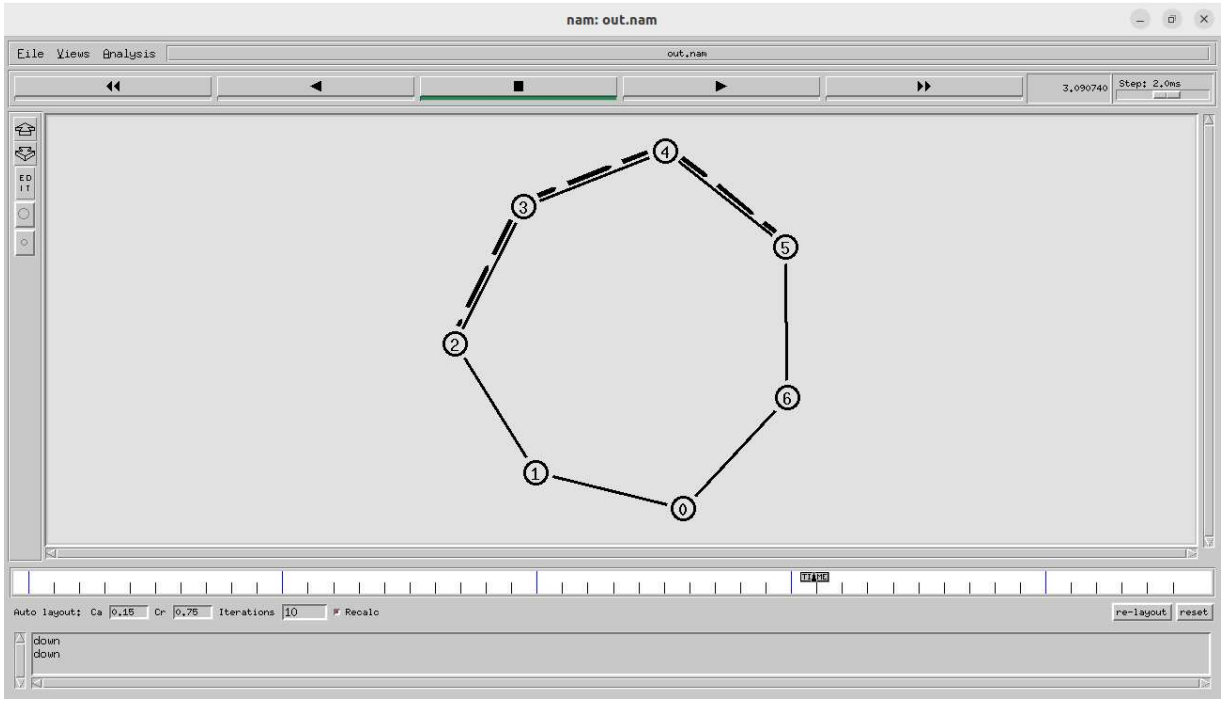
Q.2]



Here we have changed the traffic source (sender node) and traffic sink (receiver node) to node 2 and node 5 respectively and we can observe the changes made in the simulation.



In 2 seconds we can observe the connection between node 3-4 is down and nodes sending handshake packets to neighboring nodes to find an alternative route for data transmission.



Connecting between nodes 3-4 is back up again after a minute and as a result we can see the networking switching from alternate route back to optimal route.