Experiment No 10

Aim: Illustration of Hidden Terminal Problem (NS-2)

Theory:

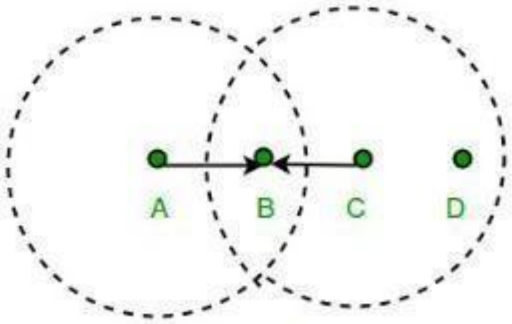
A wireless network with lack of centralized control entity, sharing of wireless bandwidth among network access nodes i.e. medium access control (MAC) nodes must be organized in decentralized manner. The hidden terminal problem occurs when a terminal is visible from a wireless access point (APs), but not from other nodes communicating with that AP. This situation leads the difficulties in medium access control sublayer over wireless networking.

In a formal way hidden terminal are nodes in a wireless network that are out of range of other node or a collection of nodes. Consider a wireless networking, each node at the far edge of the access point's range, which is known as A, can see the access point, but it is unlikely that the same node can see a node on the opposite end of the access point's range, C. These nodes are known as hidden. The problem is when nodes A and C start to send packets simultaneously to the access point B. Because the nodes A and C are out of range of each other and so cannot detect a collision while transmitting, Carrier sense multiple access with collision detection (CSMA/CD) does not work, and collisions occur, which then corrupt the data received by the access point. To overcome the hidden node problem, RTS/CTS handshaking (IEEE 802.11 RTS/CTS) is implemented in conjunction with the Carrier sense multiple accesses with collision avoidance (CSMA/CA) scheme. The same problem exists in a MANET.

The transmission range of access point A reaches at B, but not at access point C, similarly transmission range of access point C reaches B, but not at A. These nodes are known as hidden terminals. The problem occurs when nodes A and C start to send data packets simultaneously to the access point B. Because the access points A and C are out of range of each other and resultant they cannot detect a collision while transmitting, Carrier sense multiple access with collision detection (CSMA/CD) does not work, and collisions occur, which then corrupt the data received by the access point B due to the hidden terminal problem.

The hidden terminal analogy is described as follows:

- Terminal A sends data to B, terminal C cannot hear A
- Terminal C wants to send data to B, terminal C senses a "free" medium (CS fails) and starts transmitting
- Collision at B occurs, A cannot detect this collision (CD fails) and continues with its transmission to B
- Terminal A is "hidden" from C and vice versa.



Hidden Node Problem

The solution of hidden terminal problem is as follows.

When A wants to send a packet to B, A first sends a Request-to-send (RTS) to B. On receiving RTS, B responds by sending Clear-to-Send (CTS). When C overhears a CTS, it keeps quiet for the duration of the transfer. Transfer duration is included in both RTS and CTS. RTS and CTS are short frames, reduces collision chance.

Code:

```
 BEGIN{
   sim
   _en
   d =
   200;
   i=0;
   while (i<=sim_end) {sec[i]=0; i+=1;};
}


{
if ($1=="r" && $7=="cbr"&&
   $3=="_0_") { sec[int($2)]+=$8;
   };
}


END{
   i=0;
   while (i<=sim_end) {print i " " sec[i]; i+=1;};
}# Define options

set val(chan)   Channel/WirelessChannel  ;# channel type
set val(prop)              Propagation/FreeSpace ;# radio-
propagation model set val(netif)  Phy/WirelessPhy
         ;# network interface type set val(mac)
         Mac/802_11        ;# MAC type
set val(ifq)               Queue/DropTail/PriQueue ;# interface
queue type set val(ll)     LL        ;# link layer type
set val(ant)      Antenna/OmniAntenna     ;# antenna
model set val(ifqlen)              10000              ;#
```

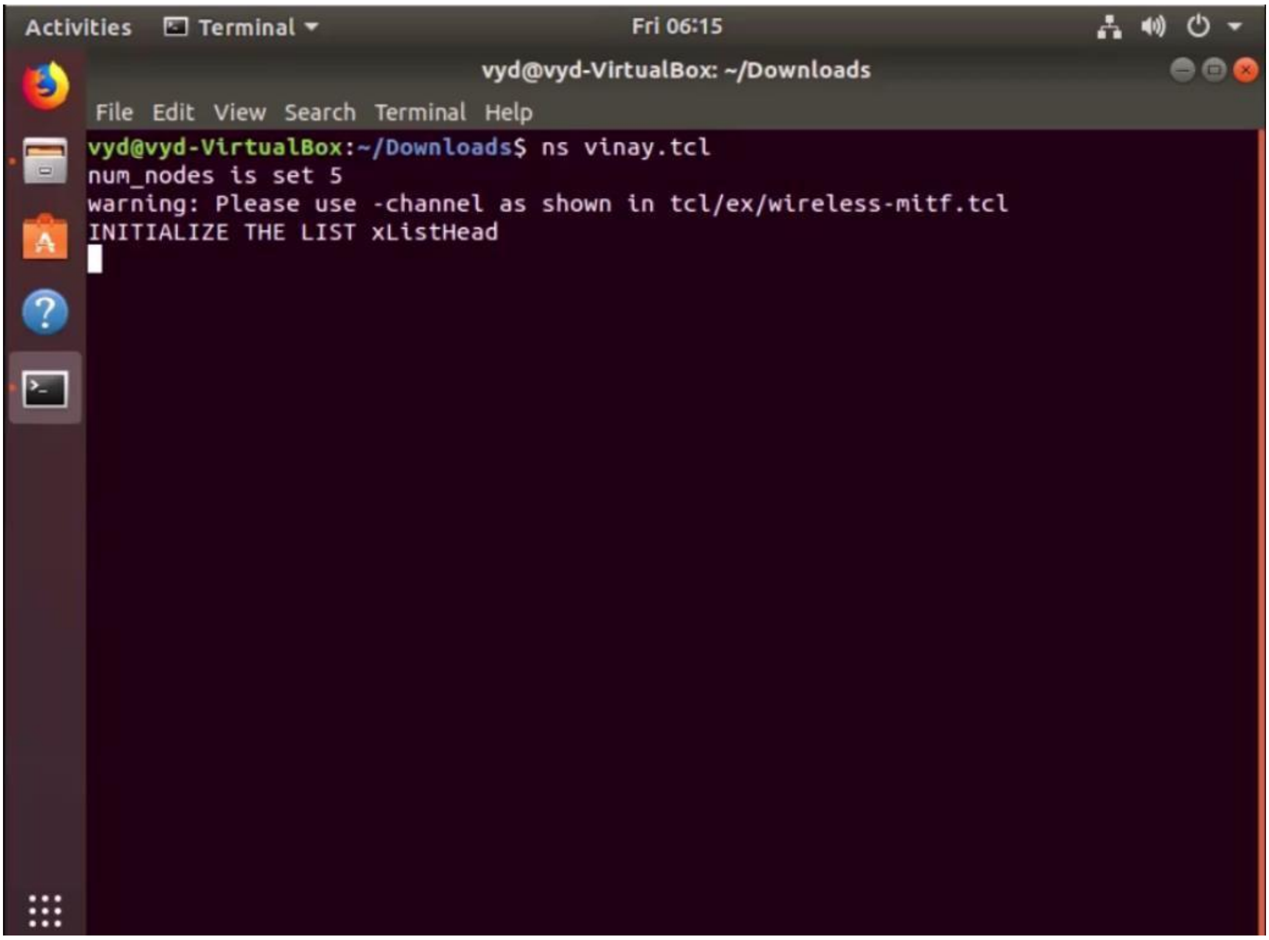
```
max packet in ifq set val(nn)       5           ;# number
of mobilenodes
set val(rp)        DSR       ;# routing protocol
set val(x)                             600
                   ;# X dimension of topography set
val(y)             600                 ;# Y dimension
of topography set val(stop)            100         ;# time
of simulation end
set val(R)         300
set opt(tr)        out.tr
set ns [new
Simulator] set
tracefd [open
$opt(tr) w]
set windowVsTime2 [open
win.tr w] set namtrace
        [open simwrls.nam
w] Mac/802_11 set
dataRate_          1.2e6
Mac/802_11 set
RTSThreshold_ 100
$ns trace-
all
$tracefd
#$ns use-
newtrace
$ns namtrace-all-wireless $namtrace $val(x) $val(y)

# set up topography object
set topo           [new Topography]

$topo load_flatgrid

$val(x) $val(y) create-

god $val(nn)

#
# Create nn mobilenodes [$val(nn)] and attach them to
the channel. #

# configure the nodes


   $ns node-config -adhocRouting $val(rp) \
        -llType $val(ll) \
        -macType $val(mac) \
        -ifqType $val(ifq) \
        -ifqLen $val(ifqlen) \
        -antType $val(ant) \
        -propType $val(prop) \
        -phyType $val(netif) \
        -channelType $val(chan) \
        -topoInstance $topo \
        -agentTrace ON \
        -routerTrace ON \
        -macTrace ON \
        -movementTrace ON
```

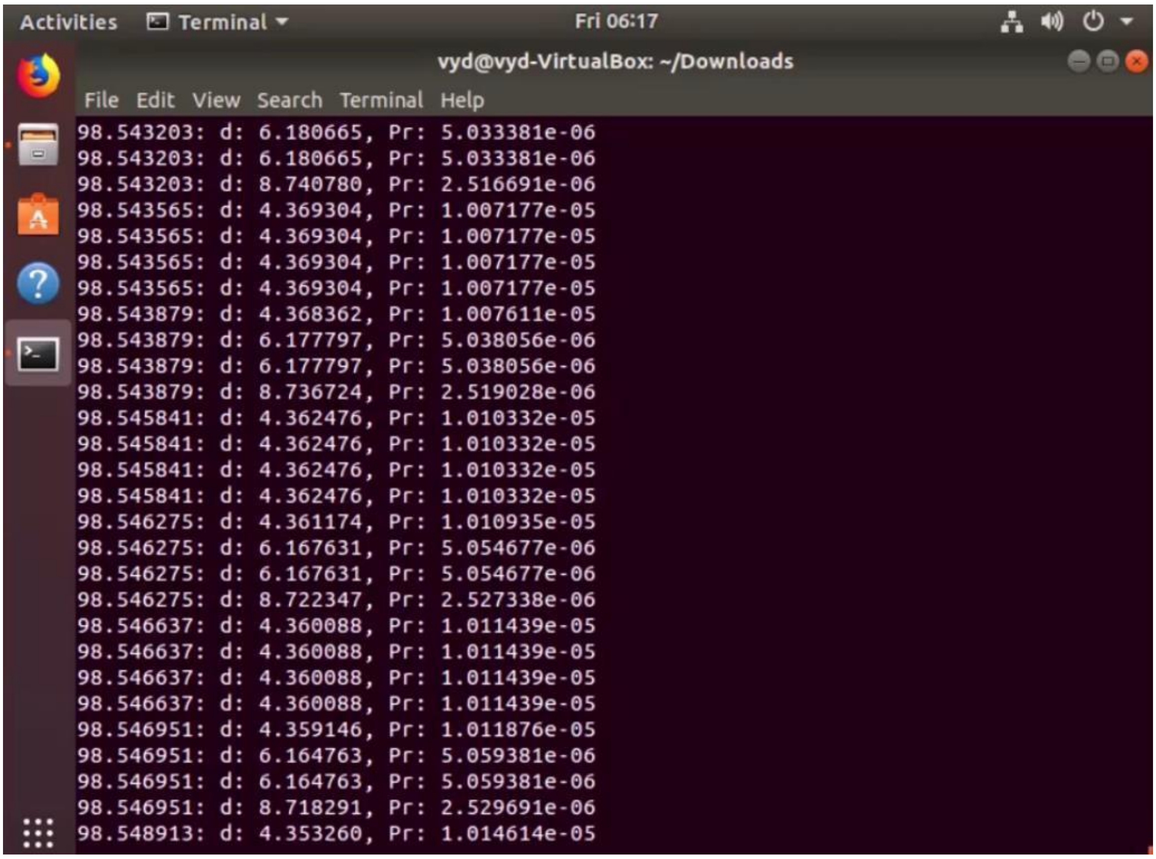
```
Phy/Wireles Phy

setCSThresh 30.5e-10




for {set i 0} {$i < $val(nn) } {
    incr i } { set node_($i) [$ns
    node]
    }
$node_(0) set X_ $val(R)
$node_(0) set Y_ $val(R)
$node_(0) set Z_ 0
$node_(1) set X_ $val(R)
$node_(1) set Y_ 0
$node_(1) set Z_ 0
$node_(2) set X_ 0
$node_(2) set Y_ $val(R)
$node_(2) set Z_ 0
$node_(3) set X_ [expr $val(R) *2]
$node_(3) set Y_ $val(R)
$node_(3) set Z_ 0
$node_(4) set X_ $val(R)
$node_(4) set Y_ [expr $val(R) *2]
$node_(4) set Z_ 0
 for {set i 0} {$i<$val(nn)} {incr i} {
  $ns initial_node_pos $node_($i) 30
 }
# Generation of movements
 $ns at 0 "$node_(1) setdest $val(R) $val(R) 3.0"
$ns at 0 "$node_(2) setdest $val(R) $val(R) 3.0"
$ns at 0 "$node_(3) setdest $val(R) $val(R) 3.0"
$ns at 0 "$node_(4) setdest $val(R) $val(R) 3.0"
# Set a TCP connection between node_(0)
and node_(1) set tcp [new
Agent/TCP/Newreno]
#$tcp set class_ 2
set tcp [new Agent/UDP]
$tcp set class_ 2
set sink [new Agent/Null]
$ns attach-agent $node_(1) $tcp
$ns attach-agent $node_(0) $sink
$ns connect $tcp $sink
set ftp [new Application/Traffic/CBR]
$ftp attach-agent $tcp
$ns at 0.0 "$ftp start"
# ###############################################
# For coloring but doesnot work
# ###############################################
$tcp set fid_ 1
$ns color 1 blue
#////////////////////////////////
/////////////// set tcp [new
Agent/UDP]
$tcp set class_ 2
set sink [new Agent/Null]
$ns attach-agent $node_(2) $tcp
$ns attach-agent $node_(0) $sink
$ns connect $tcp $sink
```

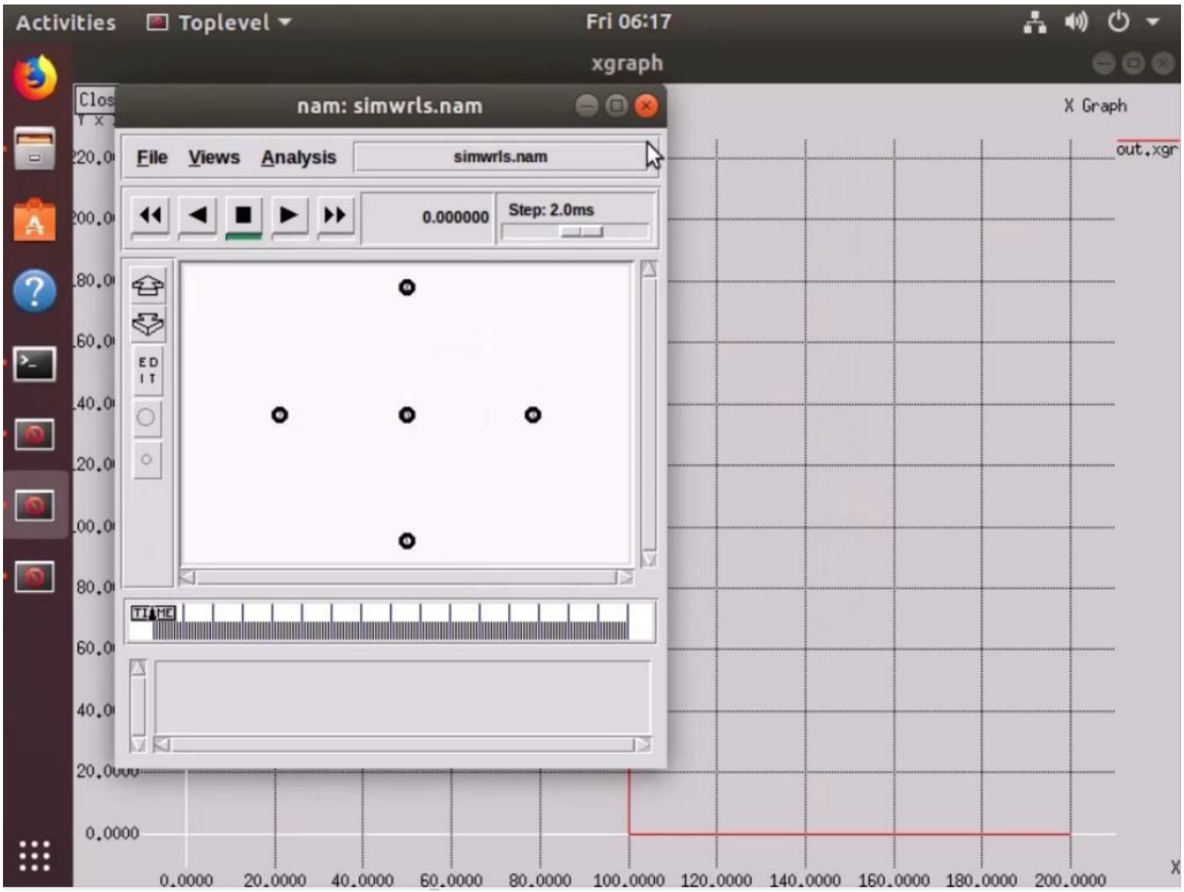
```
set ftp [new Application/Traffic/CBR]
$ftp attach-agent $tcp
$ns at 0.0 "$ftp start"
set tcp [new Agent/UDP]

$tcp set class_ 2
set sink [new Agent/Null]
$ns attach-agent $node_(3) $tcp
$ns attach-agent $node_(0) $sink
$ns connect $tcp $sink
set ftp [new Application/Traffic/CBR]
$ftp attach-agent $tcp
$ns at 0.0 "$ftp start"
set tcp [new Agent/UDP]
$tcp set class_ 2
set sink [new Agent/Null]
$ns attach-agent $node_(4) $tcp
$ns attach-agent $node_(0) $sink
$ns connect $tcp $sink
set ftp [new Application/Traffic/CBR]
$ftp attach-agent $tcp
$ns at 0.0 "$ftp start"
# Telling nodes when the
simulation ends #for {set i 0}
{$i < $val(nn) } { incr i } {
#   $ns at $val(stop)
"$node_($i) reset"; #}

# ending nam and the simulation
$ns at $val(stop) "$ns nam-end-wireless $val(stop)"
$ns at $val(stop) "stop"
$ns at $val(stop) "puts \"end
simulation\" ; $ns halt" proc stop {} {
 exec awk -f fil.awk
out.tr > out.xgr exec
xgraph out.xgr &


    global ns tracefd namtrace
    $ns
   flush
   -
   trace
   clos
   e
   $trac
   efd
   clos
   e
   $na
   mtra
   ce
    exec nam simwrls.nam &
}


$ns run
```

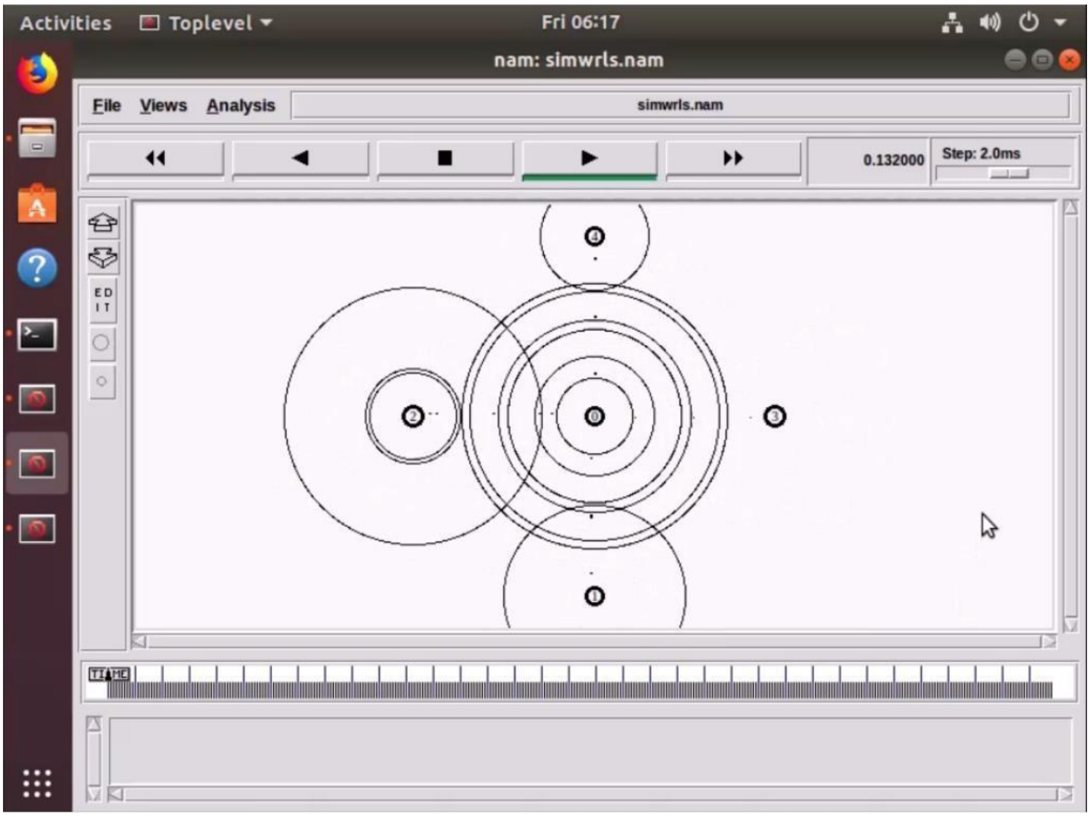
Output:

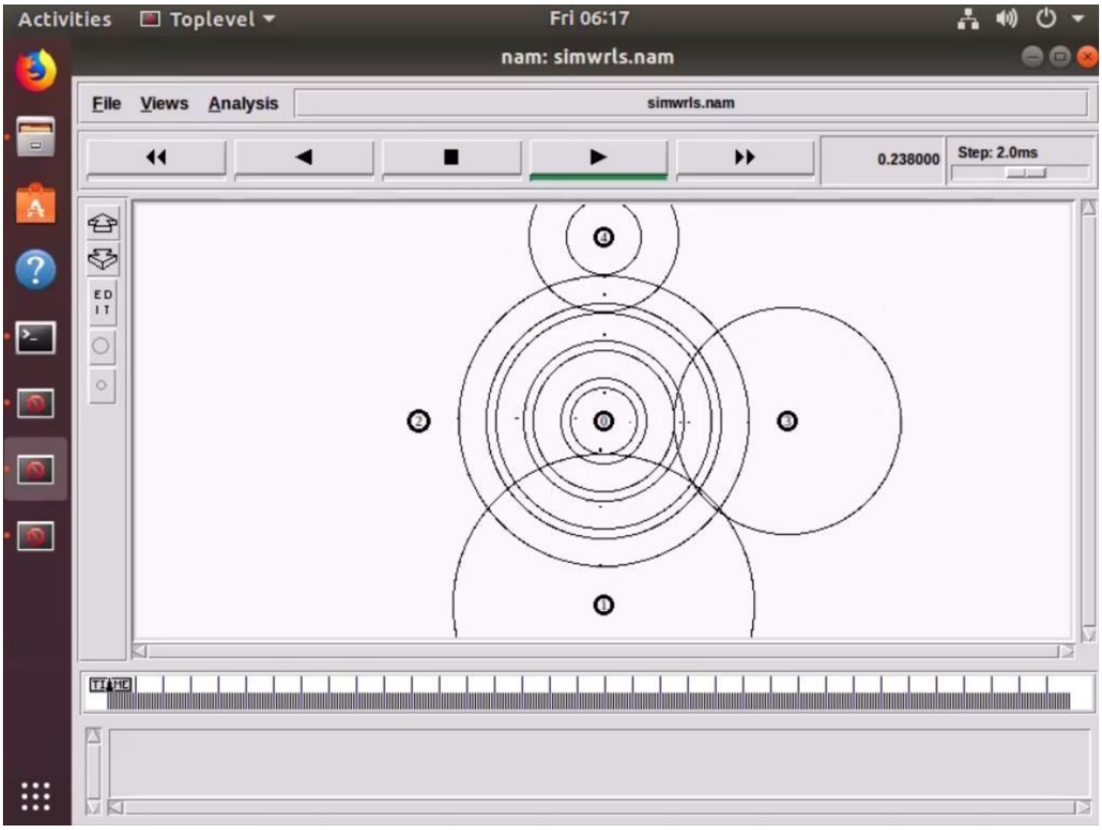
1. The node 0 and 2 want to send data to node 1 the range of node 0 and 2 is limited to 1 they do not know that other node is also sending data to 1 and therefore collision occurs.

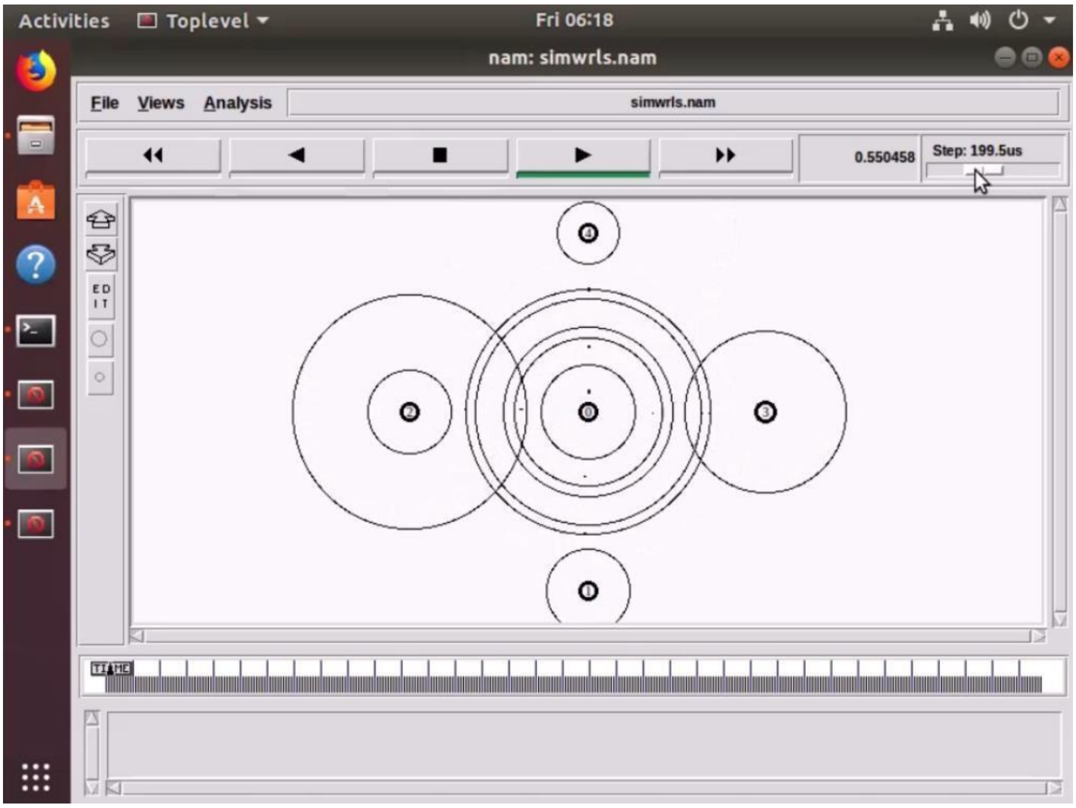


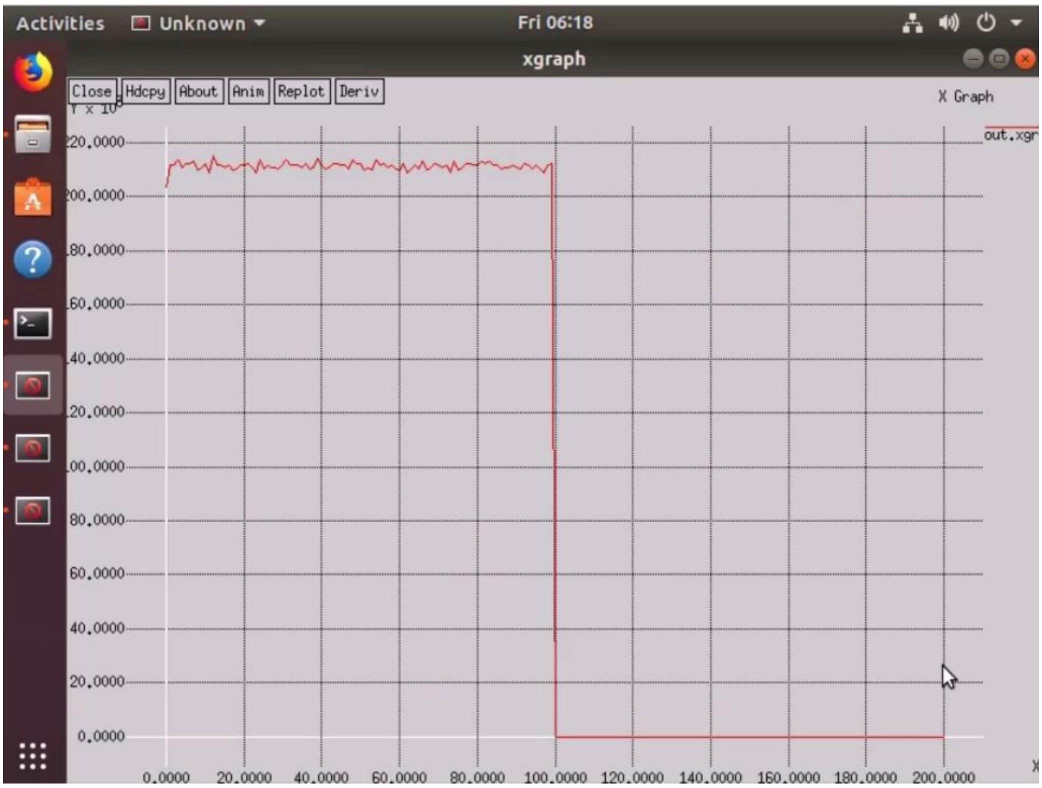

Activities
Terminal
Fri 06:17
vyd@vyd-VirtualBox: ~/Downloads
File Edit View Search Terminal Help
98.543203: d: 6.180665, Pr: 5.033381e-06
98.543203: d: 6.180665, Pr: 5.033381e-06
98.543203: d: 8.740780, Pr: 2.516691e-06
98.543565: d: 4.369304, Pr: 1.007177e-05
98.543565: d: 4.369304, Pr: 1.007177e-05
98.543565: d: 4.369304, Pr: 1.007177e-05
98.543565: d: 4.369304, Pr: 1.007177e-05
98.543879: d: 4.368362, Pr: 1.007611e-05
98.543879: d: 6.177797, Pr: 5.038056e-06
98.543879: d: 6.177797, Pr: 5.038056e-06
98.543879: d: 8.736724, Pr: 2.519028e-06
98.545841: d: 4.362476, Pr: 1.010332e-05
98.545841: d: 4.362476, Pr: 1.010332e-05
98.545841: d: 4.362476, Pr: 1.010332e-05
98.545841: d: 4.362476, Pr: 1.010332e-05
98.546275: d: 4.361174, Pr: 1.010935e-05
98.546275: d: 6.167631, Pr: 5.054677e-06
98.546275: d: 6.167631, Pr: 5.054677e-06
98.546275: d: 8.722347, Pr: 2.527338e-06
98.546637: d: 4.360088, Pr: 1.011439e-05
98.546637: d: 4.360088, Pr: 1.011439e-05
98.546637: d: 4.360088, Pr: 1.011439e-05
98.546637: d: 4.360088, Pr: 1.011439e-05
98.546951: d: 4.359146, Pr: 1.011876e-05
98.546951: d: 6.164763, Pr: 5.059381e-06
98.546951: d: 6.164763, Pr: 5.059381e-06
98.546951: d: 8.718291, Pr: 2.529691e-06
98.548913: d: 4.353260, Pr: 1.014614e-05


Activities
Toplevel
Fri 06:17
xgraph
nam: simwrls.nam
File Views Analysis
simwrls.nam
0.000000
Step: 2.0ms
X Graph
out.xgr
20.0000
0.0000
0.0000 20.0000 40.0000 60.0000 80.0000 100.0000 120.0000 140.0000 160.0000 180.0000 200.0000
X


Activities
Toplevel
Fri 06:17
nam: simwrls.nam
File Views Analysis
simwrls.nam
0.132000
Step: 2.0ms


Activities
Toplevel
Fri 06:17
nam: simwrls.nam
File Views Analysis
simwrls.nam
0.238000
Step: 2.0ms





Conclusion: Thus, we have performed the experiment of and illustrated the hidden terminal problem using NS2 and properly explained the same which helps to understand better