

NAME:- DUBEY KARAN SANJEEV  
CLASS:-B.E – 4  
ROLL NO:- 04  
BATCH:- A

## Experiment 9

### Implementation of hidden terminal problem (NS-2)

Code:

```
Hidden-Terminal.tcl Mac/Simple set bandwidth_
1Mb set MESSAGE_PORT 42 set
BROADCAST_ADDR -1
set val(prop) Propagation/TwoRayGround ;# radiopropagation model set val(netif)
Phy/WirelessPhy
                                ;# network interface type
set val(mac)                    Mac/Simple
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)
32768;# max packet in ifq set val(rp) DumbAgent set ns [new
Simulator] set f [open shttemp.tr w] $ns traceall $f $ns eventtrace-all
set nf [open shttemp.nam w]
$ns namtrace-all-wireless
$nf 700 200 set topo
                                [new Topography]
$topo load_flatgrid 700 200
$ns color 3 green;
$ns color 8 red;
$ns color 1 black; $ns color 7 purple; create-god 3 set mac0
[new Mac/Simple] $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 Channel/WirelessChannel \
            -topoInstance $topo \
            -agentTrace OFF \
            -routerTrace OFF \
            -macTrace ON \
            -movementTrace OFF
for {set i 0} {$i < 3}
{incr i} { set node_($i) [$ns node] $node_($i) randommotion
0 }
$node_(0)      color
black $node_(1) color
black
$node_(2) color black
$node_(0) set X_ 200.0
$node_(0) set Y_ 30.0
$node_(0) set Z_ 0.0
```

\$node\_(1) set X\_ 330.0

\$node\_(1) set Y\_ 150.0

\$node\_(1) set Z\_ 0.0

\$node\_(2) set X\_ 60.0

\$node\_(2) set Y\_ 30.0

\$node\_(2) set Z\_ 0.0

\$ns at 0.25 "\$node\_(2) setdest 500.0 30.0 10000.0"

Class Agent/MessagePassing/Flooding -superclass

Agent/MessagePassing

Agent/MessagePassing/Flooding instproc recv

{ source sport size data } {

    \$self instvar messages\_seen node\_

        global ns BROADCAST\_ADDR

    set message\_id [lindex [split \$data ":"] 0] puts "\nNode [\$node\_

node-addr] got message

    \$message\_id\n" if {[lsearch \$messages\_seen

    \$message\_id] == -1} { lappend messages\_seen

        \$message\_id

                \$ns trace-annotate "[node\_ node-addr] received {\$data} from \$source"

                \$ns trace-annotate "[node\_ node-addr] sending message \$message\_id" \$self

    sendto \$size \$data \$BROADCAST\_ADDR \$sport

    } else {

        \$ns trace-annotate "[node\_ node-addr] received redundant message \$message\_id

        from \$source"

    } }

Agent/MessagePassing/Flooding instproc send\_message { size message\_id data port } {

    \$self instvar messages\_seen node\_ global ns

    MESSAGE\_PORT BROADCAST\_ADDR

    lappend messages\_seen \$message\_id

    \$ns trace-annotate "[node\_ node-addr] sending message \$message\_id"

    \$self sendto \$size "\$message\_id:\$data" \$BROADCAST\_ADDR \$port

} for {set i 0} {\$i < 3} {incr i} { set a(\$i) [new Agent/MessagePassing/Flooding]

    \$node\_(\$i) attach \$a(\$i) \$MESSAGE\_PORT

    \$a(\$i) set messages\_seen { }

}

\$ns at 0.1 "\$a(0) send\_message 500 1 {first\_message} \$MESSAGE\_PORT"

\$ns at 0.101 "\$a(2) send\_message 500 2 {second\_message}

\$MESSAGE\_PORT"

\$ns at 0.2 "\$a(0) send\_message 500 11 {eleventh\_message}

\$MESSAGE\_PORT"

\$ns at 0.2 "\$a(2) send\_message 500 12 {twelfth\_message}

\$MESSAGE\_PORT"

\$ns at 0.35 "\$a(0) send\_message 500 3 {third\_message}

\$MESSAGE\_PORT"

\$ns at 0.351 "\$a(2) send\_message 500 4 {fourth\_message}

\$MESSAGE\_PORT"

\$ns at 0.45 "\$a(0) send\_message 500 13 {thirteenth\_message}

\$MESSAGE\_PORT"

```
$ns at 0.45 "$a(2) send_message 500 14
```

```
{fourteenth_message} $MESSAGE_PORT" for {set i 0}
```

```
{ $i < 3 } {incr i} {
```

```
    $ns initial_node_pos $node_($i) 30
```

```
    $ns at 4.0 "$node_($i) reset";
```

```
}
```

```
$ns at 4.0 "finish"
```

```
$ns at 4.1 "puts \"NS EXITING...\"; $ns halt"
```

```
proc finish {} { global ns f nf val
```

```
    $ns flushtrace close
    $f close $nf }
puts "Starting
Simulation..." $ns
run
```

```
rts-cts.tcl:
```

```
Mac/Simple set bandwidth_ 1Mb set
MESSAGE_PORT 42 set BROADCAST_ADDR -1 set val(prop)
Propagation/TwoRayGround ;# radiopropagation 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) 32768 ;# max packet in ifq set val(rp)
DumbAgent set ns [new Simulator] set f
[open rts-cts-data-ack.tr w] $ns trace-all $f
$ns eventtrace-all set nf [open rtscsdata-
ack-temp.nam w] $ns namtraceall-
wireless
$nf 700 200 set topo
                [new Topography]
$topo load_flatgrid 700 200
$ns color 3 green;
$ns color 8 red; $ns
color 1 black; $ns
color 7 purple; $ns
color 6 tan; $ns color 2
orange; createnode 3
$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 Channel/WirelessChannel \
    -topoInstance $topo \
    -agentTrace ON \
    -routerTrace OFF \
    -macTrace ON \
    -movementTrace OFF
    set node_($i) [$ns node] $node_($i) random-motion
    0
}
$node_(0) color black
```

```

$node_(1) color black $node_(2)
color black $node_(0) set X_
200.0
$node_(0) set Y_ 30.0
$node_(0) set Z_ 0.0
$node_(1) set X_ 330.0
$node_(1) set Y_ 150.0
$node_(1) set Z_ 0.0
$node_(2) set X_ 60.0
$node_(2) set Y_ 30.0
$node_(2) set Z_ 0.0
$ns at 0.6 "$node_(2) setdest 330.0 30.010000.0"
$ns at 1.1 "$node_(2) setdest 500.0 30.010000.0"
Class Agent/MessagePassing/Flooding -superclass
Agent/MessagePassing
Agent/MessagePassing/Flooding instproc recv
{source sport size data} {
    $self instvar messages_seen node_ global ns 1 set message_id [lindex
    [split $data ":"] 0] puts "\nNode [$node_ node-addr] got message
    $message_id\n" if {[lsearch $messages_seen
    $message_id] == -1} { lappend messages_seen
    $message_id
    $ns trace-annotate "[$node_ node-addr] received {$data} from $source"
    $ns trace-annotate "[$node_ node-addr] sending message $message_id"
    $self sendto $size $data 1 $sport
    } else {
    $ns trace-annotate "[$node_ node-addr] received redundant message
    $message_id from $source"
    } }
Agent/MessagePassing/Flooding instproc send_message {size message_id data port} {
    $self instvar messages_seen node_
    global ns MESSAGE_PORT
    1
    lappend messages_seen $message_id
    $ns trace-annotate "[$node_ node-addr] sending message $message_id"
    $self sendto $size "$message_id:$data" 1 $port
} for {set i 0} {$i < 3} {incr i} { set a($i) [new Agent/MessagePassing/Flooding]
    $node_($i) attach $a($i) $MESSAGE_PORT
    $a($i) set messages_seen {}
}
$ns at 0.1 "$a(0) send_message 500 1 {first_message} $MESSAGE_PORT"
$ns at 0.1 "$a(2) send_message 500 2 {second_message}
$MESSAGE_PORT"
$ns at 0.8 "$a(0) send_message 500 5 {fifth_message} $MESSAGE_PORT"
$ns at 0.8 "$a(2) send_message 500 6 {sixth_message} $MESSAGE_PORT"
$ns at 1.3 "$a(2) send_message 500 15 {fifteenth_message}
$MESSAGE_PORT"
$ns at 1.3 "$a(0) send_message 500 16 {sixteenth_message}
$MESSAGE_PORT"
    $ns initial_node_pos $node_($i) 30
    $ns at 20.0 "$node_($i) reset";

}
$ns at 20.0 "finish"
$ns at 20.1 "puts \"NS EXITING...\"; $ns halt"
proc finish {} { global ns f nf val

```

```

$ns flushtrace close
    $f close $nf
} puts "Starting Simulation..." $ns run

```

### Output :

```

Sending Messages: Sht-temp.nam n -t * -s 0 -x 200
-y 30 -Z 0 -z 30 v circle -c black n -t
* -s 1 -x 330 -y 150 -Z 0 -z 30 -v
    circle -c black n -t
* -s 2 -x 60 -y 30 -Z 0 -z 30 v
    circle -c black V -t * -v
1.0a5 -a 0 W
-t * -x 700 -y
200
A -t * -n 1 -p 0 -o 0x7fffffff -c 30 -a 1 A -t * -h 1 -m
1073741823 -s 0 c -t * -i 8 -n red c -t * -i 1 -n black c
-t * i 7 -n purple c -t * i 3 -n green v -t 0.1 -e sim_annotation 0.1 1 0 sending message 1 v -t
0.101 -e sim_annotation 0.101 2 2 sending message 2 + -t 0.103625000 -s 0 -d -1 -p message
-e 500 -c 2 -a 0 -i 0 -k MAC - -t 0.103625000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 0 -k
MAC h -t 0.103625000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 0 -kMAC + -t 0.103725000 -s 2
-d -1 -p message -e 500 -c 2 -a 0 -i 1 -k MAC
- -t 0.103725000 -s 2 -d -1 -p message -e 500 -c 2 -a 0 -i 1 -k MAC h -t 0.103725000 -s 2 -d -1 -p message -e
500 -c 2 -a 0 -i 1 -kMAC d -t 0.107725467 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 1 -kMAC d -t 0.107725985
-s
1 -d -1 -p message -e 500 -c 2 -a 0 -i 1 -kMAC v -t 0.2 -e
sim_annotation 0.2 3 0 sending message11 v -t 0.2 -e sim_annotation
0.2 4 2 sending message12
+ -t 0.203525000 -s 2 -d -1 -p message -e 500 -c 2 -a 0 -i 3 -k MAC - -t 0.203525000 -s 2 -d -1 -p message -e
500 -c 2 -a 0 -i 3 -k MAC h -t 0.203525000 -s 2 -d -1 -p message -e 500 -c 2 -a 0 -i 3 -kMAC + -t
0.203625000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 2 -k MAC - -t 0.203625000 -s 0 -d -1 -p message -e
500 -c 2 -a 0 -i 2 k MAC h -t 0.203625000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 2 -kMAC d -t
0.207625467 -s 2 -d -1 -p message -e 500 -c 2 -a 0 -i 2 -kMAC d -t 0.207625590 -s 1 -d -1 -p message -e
500 -c 2 -a 0 -i 2 -kMAC n -t
0.250000 -s 2 -x 60.000000 -y 30.000000 -U 10000.000000 -V 0.000000 T 0.044000
v -t 0.35 -e sim_annotation 0.35 5 0 sending message 3

v -t 0.351 -e sim_annotation 0.351 6 2 sending message 4 + -t 0.352325000 -s 0 -d -1 -p
message -e 500 -c 2 -a 0 -i 4 -k MAC - -t 0.352325000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 4 -
k MAC h -t 0.352325000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 4 -k MAC + -t 0.353825000 s
2 -d -1 -p message -e 500 -c 2 -a 0 -i 5 -k MAC - -t 0.353825000 -s 2 -d -1 -p message -e 500 -c
2 -a 0 -i 5 -k MAC h -t 0.353825000 -s 2 -d -1 -p message -e 500 -c 2 -a 0 -i 5 -k MAC d -t
0.357825694 -s 1 -d -1 -p message -e 500 -c 2 -a 0 -i 5 -k MAC d -t 0.357826000 -s 0 -d -1 -p
message -e 500 -c 2 -a 0 -i 5 -k MAC v -t 0.45 -e sim_annotation 0.45 7 0 sending message 13
v -t 0.45 -e sim_annotation 0.45 8 2 sending message 14 + -t 0.450725000 -s 0 -d -1 -p message
-e 500 -c 2 -a 0 -i 6 -k MAC - -t 0.450725000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i
6 -k MAC h -t 0.450725000 -s 0 -d -1 -p message -e 500 -c 2 -a 0 -i 6 -k MAC + -t
0.450925000 -s
2 -d -1 -p message -e 500 -c 2 -a 0 -i 7 -k MAC - -t 0.450925000 -s 2 -d -1 -p message -e 500 -c
2 -a 0 -i 7 -k MAC h -t 0.450925000 -s 2 -d -1 -p message -e 500 -c 2 -a 0 -i 7 -k MAC d -t
0.454925694 -s 1 -d -1 -p message -e 500 -c 2 -a 0 -i 7 -k MAC d -t 0.454926000 -s 0 -d -1 -p
message -e 500 -c 2 -a 0 -i 7 -k MAC Different Cases executed for Hidden Terminal Problem
sht.nam : n -t * -s 0 -x 200 -y 30 -Z 0 -z 30 -v circle -c black n -t * -s 1 -x 330 -y 150 -Z 0 z
30 -v circle -c black n -t * -s 2 -x 60 -y 30 -Z 0 -z 30 -v circle
-c

```

black

V -t \* -v 1.0a5 -a 0 W

-t \* -x 700 -y 200

A -t \* -n 1 -p 0 -o 0xffffffff -c 31 -a 1 A -t \* -h 1 -m 2147483647 -s 0 c -t \* -i 8 -n red c -t \* -i 1 -n black c

-t \* -i 7 -n purple c -t \* -i 3 -n green v -t 0.000 -e sim\_annotation 0.0 1

COLOR LEGEND : v -t 0.001 -e sim\_annotation 0.001 2 Nodes turn green when they are sensing carrier v  
-t

0.002 -e sim\_annotation 0.002 3 Nodes turn purple when they backoff v -t 0.003 -e sim\_annotation 0.003 4

Nodes turn red when there is a collision v -t 0.10000000 -e set\_rate\_ext 0.200ms 1 n -t 0.101025 -s 2 -S

COLOR -c green -o black -I black n -t 0.101025 -s 2 -S DLABEL -l "Carrier sense" -L "" v -t 0.101025 -e  
sim\_annotation 0.101025 5 CASE 1 : NO CONTENTION v -t 0.101075 -e sim\_annotation 0.101075 6 Only  
Node 2 is sending data packets and therefore no contention n -t 0.111025 -s 2 -S COLOR -c black -o green i  
black -I green n -t 0.111025 -s 2 -S DLABEL -l "" -L

"" + -t 0.111025 -s 2 -d 1 -p message -e 2500 -a 1 - -t 0.111025 -s 2 -d 1 -p message -e 2500 -a 1 h

-t 0.111025 -s 2 -d 1 -p message -e 2500 -a 1 r -t 0.111025 -s 2 -d 1 -p message -e 2500 -a 1 n -t 0.121025 -s

2 -S COLOR -c green -o black -i green -I black n -t 0.121025 -s 2 -S DLABEL -l "Carrier sense" -L "" v

-t 0.121025 -e sim\_annotation 0.121025 7

CASE 2 : BACKOFF

v -t 0.121075 -e sim\_annotation 0.121075 8 Node 0 and Node 2 are in range of each other, they do carrier sense  
at slightly different times v -t 0.121125 -e sim\_annotation 0.121125 9 so Node 0 finds the channel not free, and  
thus backs off n -t

0.131025 -s 0 -S COLOR -c green -o black -i green -I black n -t 0.131025 -s 0 -S DLABEL -l "Carrier Sense" L

"" n -t 0.131025 -s 2 -S COLOR -c black -o green -i black -I green n -t 0.131025 -s 2 -S DLABEL -l "" -L "" +  
-t

0.131025 -s 2 -d 1 -p message -e 2500 -a 1 - -t 0.131025 -s 2 -d 1 -p message -e 2500 -a 1 h -t 0.131025 s

2 -d 1 -p message -e 2500 -a 1 r -t 0.131025 -s 2 -d 1 -p message -e 2500 -a 1 n -t 0.136025 -s 0 -S

COLOR -c purple -o green -i purple -I green n -t 0.136025 -s 0 -S DLABEL -l "Backing off" -L "" n -t

0.141025 -s 0 -S COLOR -c green -o purple -i green -I purple n -t 0.141025 -s 0 -S DLABEL -l "Carrier

sense" -L "" n -t 0.146025 -s 0 -S COLOR -c black -o green -i black -I green n -t 0.146025 -s 0 -S

DLABEL -l "" -L "" + -t 0.146025 -s 0 -d 1 -p message -e 2500 -a 1 - -t 0.146025 -s 0 -d 1 -p message -e

2500 -a 1 h -t 0.146025 -s 0 -d

1 -p message -e 2500 -a 1 r -t 0.146025 -s 0 -d 1 -p message -e 2500 -a 1 n -t 0.200025 -s 0 -S COLOR c

green -o black -i green -I black n -t 0.200025 -s 0 -S DLABEL -l "Carrier sense" -L "" n -t 0.200025 s 2

-S COLOR -c green -o black -i green -I black n -t 0.200025 -s 2 -S DLABEL -l "Carrier Sense" -L "" v -

t 0.200025 -e sim\_annotation 0.200025 10 CASE 3 : COLLISION WHEN NODES SEND AT SAME

TIME v -t 0.200075 -e sim\_annotation 0.200075 11 Sender nodes are in range of each other but they do

carrier sense at the same time, v -t 0.200125 -e sim\_annotation 0.200125 12 thus finding channel to be

free , so they send packets at the

same

time and therefore result in collision at the receiver n -t 0.210025 -s 0 -S COLOR -c black

-o green -i black -I green n -t 0.210025 -s 0 -S DLABEL -l "" -L "" n -t 0.210025 -s 2 -S

COLOR -c black -o green -i black -I green n -t 0.210025 -s 2 -S DLABEL -l "" -L "" + -t

0.210025 -s 0 -d 1 -p message -e 2500 -a 1 - -t 0.210025 -s 0 -d 1 -p message -e 2500 a 1

h -t 0.210025 -s 0 -d 1 -p message -e 2500 -a 1 + -t 0.210025 -s 2 -d 1 -p message e 2500

-a 1 - -t 0.210025 -s 2 -d 1 -p message -e 2500 -a 1 h -t 0.210025 -s 2 -d 1 -p message -e

2500 -a 1 n -t 0.220025 -s 1 -S COLOR -c red -o black -i red -I black n -t

0.220025 -s 1 -S DLABEL -l "Collision " -L "" d -t 0.220025 -s 1 -d 2 -p message e

5000 -a 8 n -t 0.230025 -s 1 -S COLOR -c black -o red -i black -I red n -t

0.230025 -s 1 -S DLABEL -l "" -L "" v -t 0.25000 -e sim\_annotation 0.25000 13 HIDDEN

TERMINAL SCENARIO : Node 2 moves and hence is out of range of node 0 n -t 0.255 -s 2 -x

60.00 -y 30.00 -U 10000.00 -V 0.00 -T 0.044 n -t 0.350025 -s 0 -S COLOR -c green -o black -i green

-I black n -t 0.350025 -s 0 -S DLABEL -l "Carrier sense" -L "" n -t 0.355025 -s 2 -S COLOR -c green -

o black -i green -I black n -t 0.355025 -s 2 -S DLABEL -l "Carrier Sense" -L "" v -t 0.355025 -e

sim\_annotation 0.355025 14 CASE 4 :

SUCCESSFUL

TRANSMISSION WHEN NODES ARE OUT OF RANGE OF EACH OTHER

v -t 0.355075 -e sim\_annotation 0.355075 15 Sender nodes are out of range of each other v -t 0.355125 -  
e sim\_annotation 0.355125 16 but they result in successful transmission since they send packets at  
different times n -t 0.360025 -s 0 -S COLOR -c black -o green -i black -I green n -t 0.360025 -s 0 -S  
DLABEL -l "" -L "" + -t 0.360025 -s 0 -d 1 -p message -e 2500 -a 1  
- -t 0.360025 -s 0 -d 1 -p message -e 2500 -a 1 h -t 0.360025 -s 0 -d 1 -p message -e 2500  
-a 1 n -t 0.365025 -s 2 -S COLOR -c black -o green -i black -I green n -t 0.365025 -s 2 -S  
DLABEL -l "" -L "" + -t 0.365025 -s 2 -d 1 -p message -e 2500 -a 1 - -t 0.365025 -s 2 d  
1 -p message -e 2500 -a 1 h -t 0.365025 -s 2 -d 1 -p message -e 2500 -a 1 n -t 0.450025 s 0  
S COLOR -c green -o black -i green -I black n -t 0.450025 -s 0 -S DLABEL -l "Carrier  
sense"  
-L "" n -t 0.450025 -s 2 -S COLOR -c green -o black -i green -I black n -t 0.450025 -s 2 -S DLABEL -l "Carrier  
Sense" -L "" v -t 0.450025 -e sim\_annotation 0.450025 17 CASE 5 : COLLISION IN A HIDDEN TERMINAL  
SCENARIO v -t 0.450075 -e sim\_annotation 0.450075 18 Sender nodes are out of range of each other v -t  
0.450125 e sim\_annotation 0.450125 19 even though they both do carrier sense, they cannot hear each other  
and thus find the channel free v -t 0.450175 -e sim\_annotation 0.450175 20 and they send packets at the same  
time, thus resulting  
in a collision at the receiver.  
n -t 0.455025 -s 0 -S COLOR -c black -o green -i black -I green n -t 0.455025 -s 0 -S  
DLABEL -l "" -L "" + -t 0.455025 -s 0 -d 1 -p message -e 2500 -a 1 - -t 0.455025 -s 0 d  
1 -p message -e 2500 -a 1 h -t 0.455025 -s 0 -d 1 -p message -e 2500 -a 1 n -t 0.455025  
s 2 S COLOR -c black -o green -i black -I green n -t 0.455025 -s 2 -S  
DLABEL -l "" -L "" + -t  
0.455025 -s 2 -d 1 -p message -e 2500 -a 1 - -t 0.455025 -s 2 -d 1 -p message -e 2500 -a  
1 h -t 0.455025 -s 2 -d 1 -p message -e 2500 -a 1 n -t 0.465025 -s 1 -S COLOR -c red -o  
black -i red -I black n -t 0.465025 -s 1 -S DLABEL -l "Collision " -L "" d -t 0.465025 -s  
1 -d 2  
-p message -e 5000 -a 8 n -t 0.475025 -s 1 -S COLOR -c black -o red -i black -I red n -t

0.475025 -s 1 -S DLABEL -l "" -L