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CLASS:-B.E – 4

ROLL NO:- 04

BATCH:- A

Code:

Experiment 9 Implementation of hidden terminal problem (NS-2)

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 rtsctsdata- 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; creategod 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