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A Project Report on

Network Transmission of Ping Messages using Network Simulator 2

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CERTIFICATE

This is to certify that ***Harsh Satish Patkar (4NM19EC059), Harshith B Shetty (4NM19EC061), Hasini (4NM19EC062)*** *are bonafide students of N.M.A.M. Institute of Technology, Nitte have submitted the report for the project entitled* ***"NETWORK TRANSMISSION OF PING MESSAGES USING NETWORK SIMULATOR 2"*** *towards* ***Computer Networks Lab (19EC702)*** *in partial fulfilment of the requirements for the award of Bachelor of Engineering Degree in Electronics and Communication Engineering during the year 2022-2023.*

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ABSTRACT

"Implementation of transmission of ping messages/traceroute over a network topology consisting of n nodes and to find the number of packets dropped due to congestion" are the problem statement. Ping calculates the round-trip time for messages sent from the source to a destination computer and then echoed back to the source. The name is derived from active sonar terminology, which sends a pulse of waves and listens for the echo to detect objects underwater. In practice, networks are not congestion-free, i.e., there will be some traffic present, and some of the packets sent will be dropped as a result of this traffic. The implemented code will send ping requests or trace routes over a network topology while also calculating the number of packets that were dropped due to traffic or congestion using the Network Simulator tool.

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Chapter 1

INTRODUCTION

The Internet Control Message Protocol (ICMP) echo request and ICMP echo reply messages are commonly referred to as ping messages in networking. A ping is a troubleshooting tool used by system administrators to manually evaluate network device connectivity as well as network delay and packet loss. The ping command makes an ICMP echo request to a network device, which promptly answers with an ICMP echo reply. When the device receives the response, it suggests that the two devices are linked. Ping can also be used to test for network delay and packet loss. It also reports errors, packet loss, and a statistical summary of the results, which typically includes the minimum, maximum, mean round-trip times, and standard deviation of the mean. In computer networks, packet loss occurs when one or more data packets attempt to reach their destination but are unsuccessful. Network congestion or data transmission problems, which commonly occur over wireless networks, are the two main causes of packet loss. Network congestion is a cause of packet loss that can affect all types of networks. There is no other choice but to delete packets when data continuously arrives at a router or network segment at a pace that is higher than what can be sent through. A bottleneck is defined as a router or connection that limits the capacity of the whole trip path or of network transit in general.

1.1 Literature Review

This section deals with the literature review of the proposed Network Transmission of Ping Messages using ns2.

Francisco H.M.B et.al. [1] In this paper, an ICMP protocol version with header suppression was developed to enable Ping to work in underwater environments with acoustic communication. ICMP messages sent from any computer on the Internet now may achieve underwater destinations, which can generate responses and send them back. The presented solution may be used, for example, in monitoring lakes or oil pipelines. By using an intermediate device, a gateway, the ICMP protocol messages sent from any place on the Internet are suppressed and transmitted to the underwater

devices, whose communication is limited by their low computational power and the particular characteristics of underwater communication, like high latency, low transmission rate, high packet loss rate, and others, which compose obstacles for the creation of Internet of Underwater Things.

Mitko Bogdanoski et.al. [2] In this, the effects of the ICMP Ping Flood Attack on the wireless network were explored. More specifically, the behavior of the wireless networks under the attack of different numbers of attackers and different ping packets size is examined. With the in-depth simulation, found that the wireless networks Quality of Service (QoS) parameters can be dramatically reduced under this type of flooding attack. Also, an increased number of attackers and packet size has different effect on different WLAN QoS Parameters.

1.2 Objectives

1. To send ping messages across a network, four nodes are assigned as ping agents and they transmit data.

2. To calculate the round-trip time: After receiving the response, the round-trip time should be calculated.

3. To count the number of packets dropped due to congestion.

Chapter 2

METHODOLOGY

The program is divided into 2 sub-programs, namely the AWK file and the TCL file. We have considered 6 nodes in the program out of which 4 nodes (n0, n4, n5, n6) are assigned as ping agents and 1 node (n2) is a router. Duplex links between the nodes are created and the queue limit between the nodes is set to 5 (n0 - n2 and n2 - n5), 2(n2 - n6), 3(n2-n4). Next, we attach the nodes to their respective agents, i.e., ping agents. Later a rec is defined, which calculates the round-trip time for the reply received using the built-in function ‘Round Trip Time (RTT)’ and the same is displayed on the screen. Finally, the events have to be scheduled to what event should be triggered at what time. In the AWK file first, we initialize the count to 0. If there is a drop in the packet, then the count must be incremented. Once all the packet transmission is done, the total number of packets dropped is printed on the screen.

2.1 Code

Lab2.awk

```
BEGIN {
count=0;
}
{
        if($1=="d") count++;
}
END {
        printf("The Total no of Packets Drop is :%d\n\n", count);
}
```

Lab2.tcl

```
#-------Event scheduler object creation--------#
set ns [new Simulator]
#-------Open the trace file--------#
set tf [open lab2.tr w]
$ns trace-all $tf
#----------Creating nam objects---------------#
set nf [open lab2.nam w]
$ns namtrace-all $nf
#------Creating nodes------#
set n0 [$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]
#-------- Node colors----------------------#
$n0 color red
$n5 color green
$n4 color red
$n6 color green
#------------Labelling----------------#
$n0 label "Ping0"
$n4 label "Ping4"
$n5 label "Ping5"
$n6 label "Ping6"
$n2 label "Router"
#-------- Data flow color------------#
$ns color 1 "red"
```

```
$ns color 2 "green"
$n2 shape square
#---creating duplex link---------#
$ns duplex-link $n0 $n2 100Mb 300ms DropTail
$ns duplex-link $n1 $n2 1Mb 300ms DropTail
$ns duplex-link $n3 $n2 1Mb 300ms DropTail
$ns duplex-link $n5 $n2 100Mb 300ms DropTail
$ns duplex-link $n2 $n4 1Mb 300ms DropTail
$ns duplex-link $n2 $n6 1Mb 300ms DropTail
# setting queue size of the link
$ns queue-limit $n0 $n2 5
$ns queue-limit $n2 $n4 3
$ns queue-limit $n2 $n6 2
$ns queue-limit $n5 $n2 5
# connect between the ping agents to the node n0, n4, n5 and n6.
set ping0 [new Agent/Ping]
$ns attach-agent $n0 $ping0
$ping0 set packetSize_ 50000
$ping0 set interval_ 0.0001
set ping4 [new Agent/Ping]
$ns attach-agent $n4 $ping4
set ping5 [new Agent/Ping]
$ns attach-agent $n5 $ping5
$ping5 set packetSize_ 60000
$ping5 set interval_ 0.00001
set ping6 [new Agent/Ping]
$ns attach-agent $n6 $ping6
$ping0 set class_ 1
$ping5 set class_ 2
$ns connect $ping0 $ping4
```

```
$ns connect $ping5 $ping6
#Define a 'recv' function for the class 'Agent/Ping'
#The below function is executed when the ping agent receives a reply from the destination
Agent/Ping instproc recv {from rtt} {
$self instvar node_
puts " The node [$node_ id] received an reply from $from with
round trip time of $rtt"
}
#---------finish procedure--------#
proc finish {} {
        global ns nf tf
        exec nam lab2.nam &
        $ns flush-trace
        close $tf
        close $nf
        exit 0
}
# scheduling events
$ns at 0.1 "$ping0 send"
$ns at 0.2 "$ping0 send"
$ns at 0.3 "$ping0 send"
$ns at 0.4 "$ping0 send"
$ns at 0.5 "$ping0 send"
$ns at 0.6 "$ping0 send"
$ns at 0.7 "$ping0 send"
$ns at 0.8 "$ping0 send"
$ns at 0.9 "$ping0 send"
$ns at 1.0 "$ping0 send"
$ns at 1.1 "$ping0 send"
$ns at 1.2 "$ping0 send"
```

```
$ns at 1.3 "$ping0 send"
$ns at 1.4 "$ping0 send"
$ns at 1.5 "$ping0 send"
$ns at 1.6 "$ping0 send"
$ns at 1.7 "$ping0 send"
$ns at 1.8 "$ping0 send"
$ns at 0.1 "$ping5 send"
$ns at 0.2 "$ping5 send"
$ns at 0.3 "$ping5 send"
$ns at 0.4 "$ping5 send"
$ns at 0.5 "$ping5 send"
$ns at 0.6 "$ping5 send"
$ns at 0.7 "$ping5 send"
$ns at 0.8 "$ping5 send"
$ns at 0.9 "$ping5 send"
$ns at 1.0 "$ping5 send"
$ns at 1.1 "$ping5 send"
$ns at 1.2 "$ping5 send"
$ns at 1.3 "$ping5 send"
$ns at 1.4 "$ping5 send"
$ns at 1.5 "$ping5 send"
$ns at 1.6 "$ping5 send"
$ns at 1.7 "$ping5 send"
$ns at 1.8 "$ping5 send"
$ns at 5.0 "finish"
$ns run
```

Chapter 3

RESULTS

Fig 3.1 shows how the nodes are connected. There are 6 nodes in the program out of which 4 nodes (n0, n4, n5, n6) are assigned as ping agents and 1 node (n2) is a router.

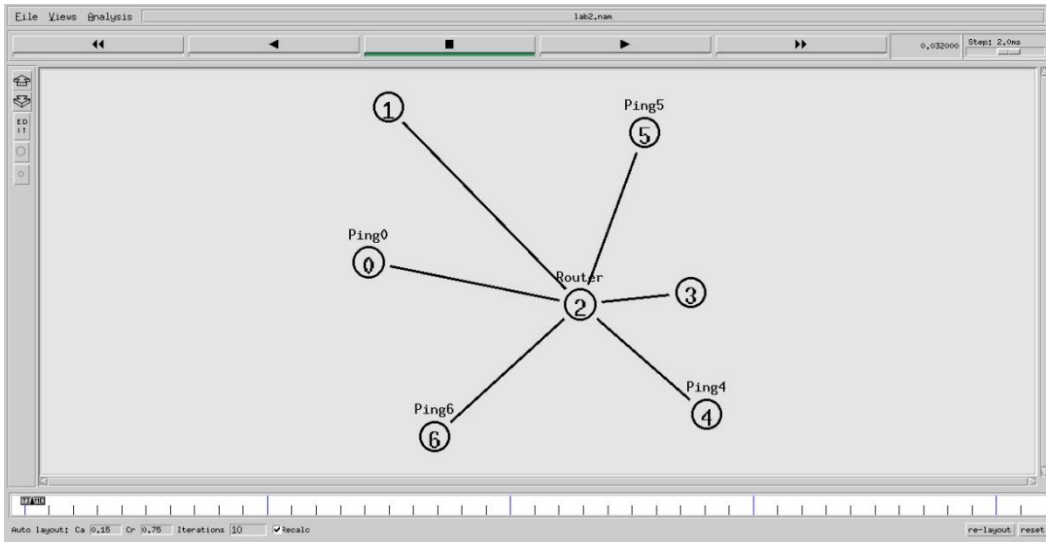

Fig 3.1: Interconnection of nodes

Fig 3.2 depicts the packetgetting dropped due to congestion. As seen from the figure, node 0, node 4, node 5, node 6 are assigned as ping agents and node 2 acts arouter. A packet is getting dropped from router or node 2 due to traffic.

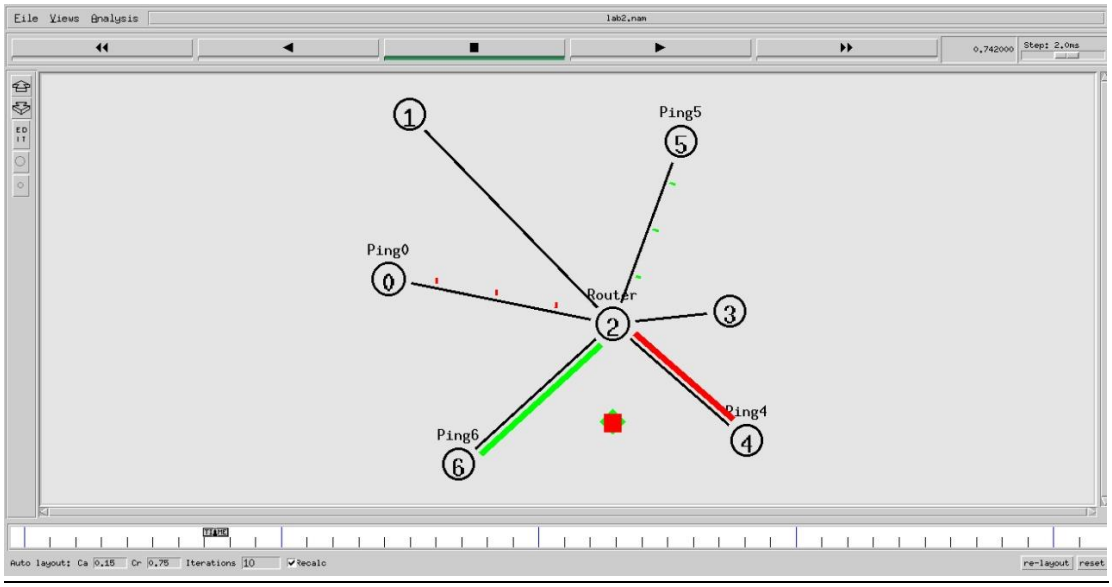

Fig 3.2: Illustration of packet drop

Fig 3.3 shows the command line output. When the node receives the echo reply, the program is supposed to measure the round-trip time andprint it. Finally, the count of packets dropped is printed on the screen.

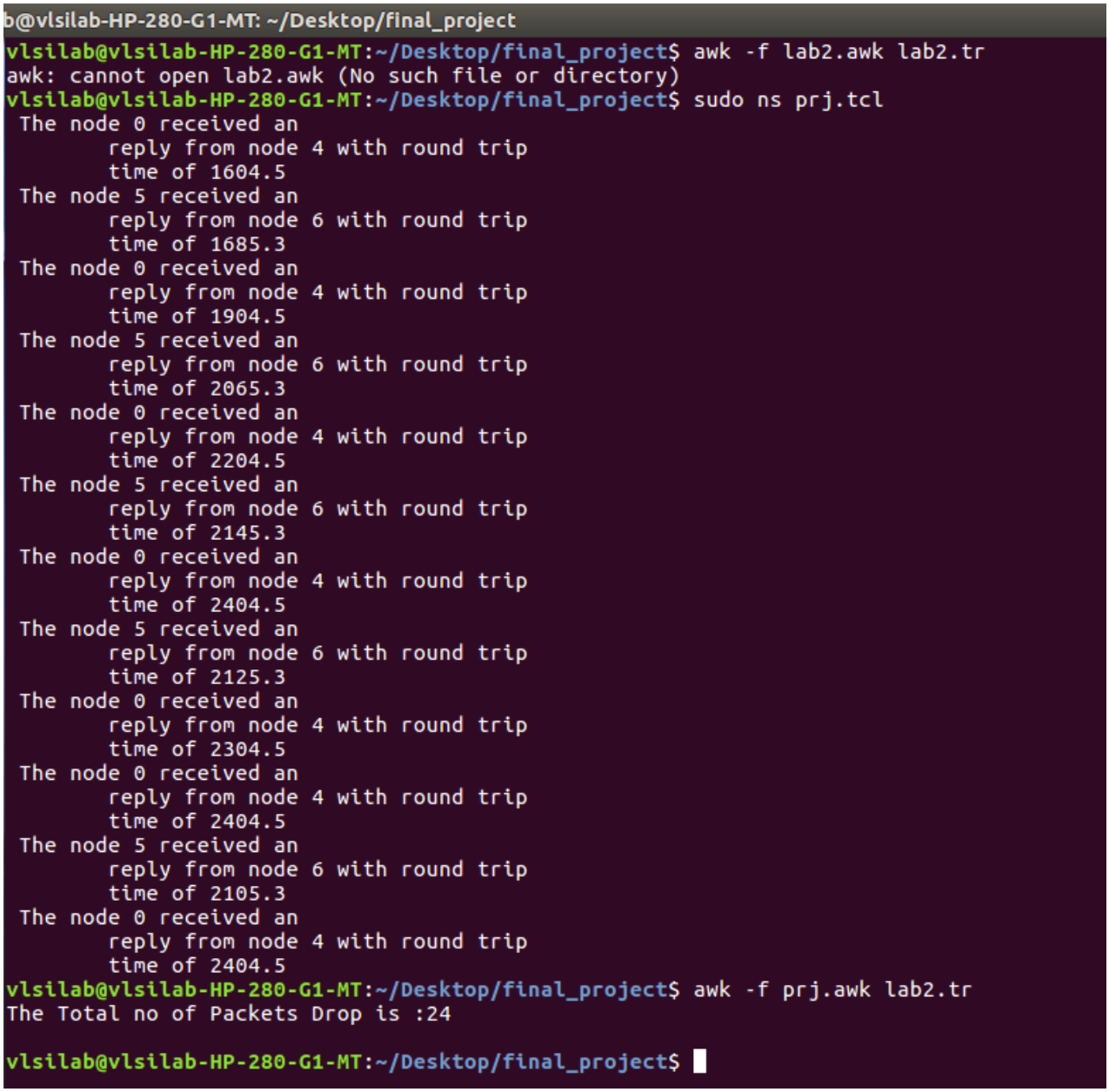

Fig 3.3: Terminal output

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[2] http://eprints.ugd.edu.mk/6462/1/__ugd.edu.mk_private_UserFiles_biljana.kosturanova_Desktop_Mitko%20Bogdanoski%20-%20Trudovi%20za%20UGD%20Repozitorium_Telekomunikacii%20-%20Kompjuterski%20Nauki_8.%2065-254-1-PB.pdf

[3] ICMP - Echo / Echo Reply (Ping) Message (firewall.cx)

[https://www.firewall.cx/networking-topics/protocols/icmp-protocol/152- icmp-echo-ping.html]

[4] https://ieeexplore.ieee.org/abstract/document/1236446