

# CS5331: Mobile Data Management and Privacy Spring 2023

## Project #2: Heartbeat

### Instructions how to run the program:

Download and install GlobalProtect from the raiderlink to access the ttu vpn.

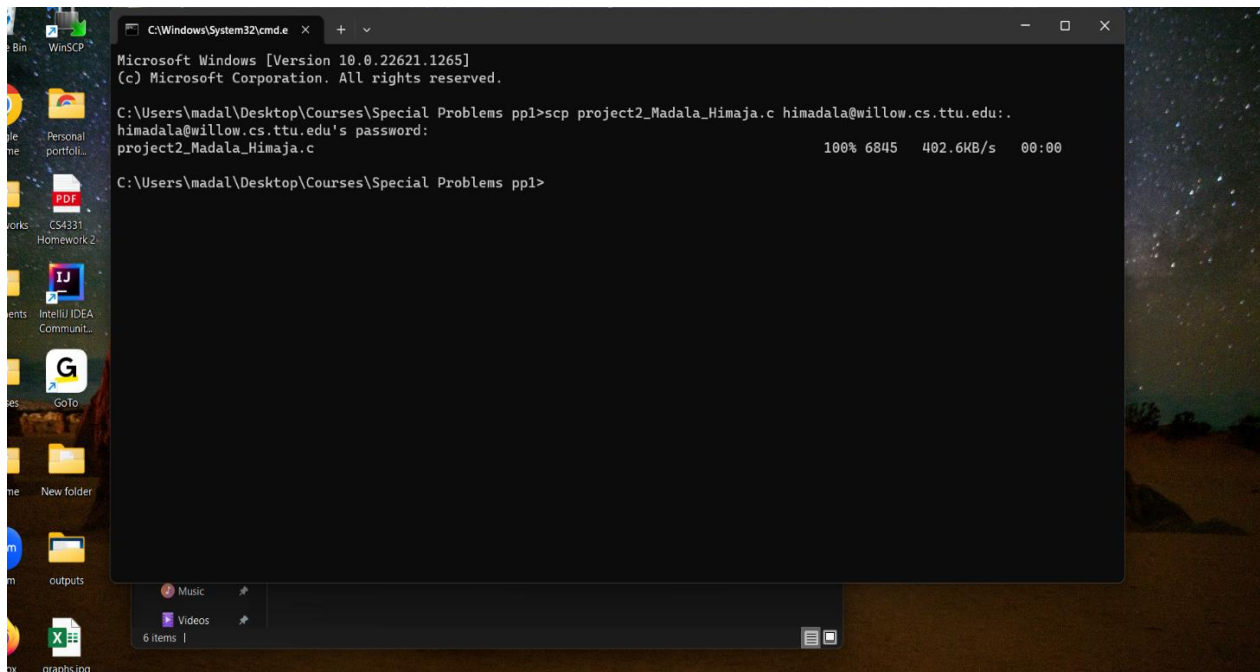
Download and install Winscp to access willow server. Also, download Xming to use PuTTY.

Now create a folder and save the project code with .c extension on desktop.

Open cmd in the path of the folder created on desktop.

Run the following command in cmd:

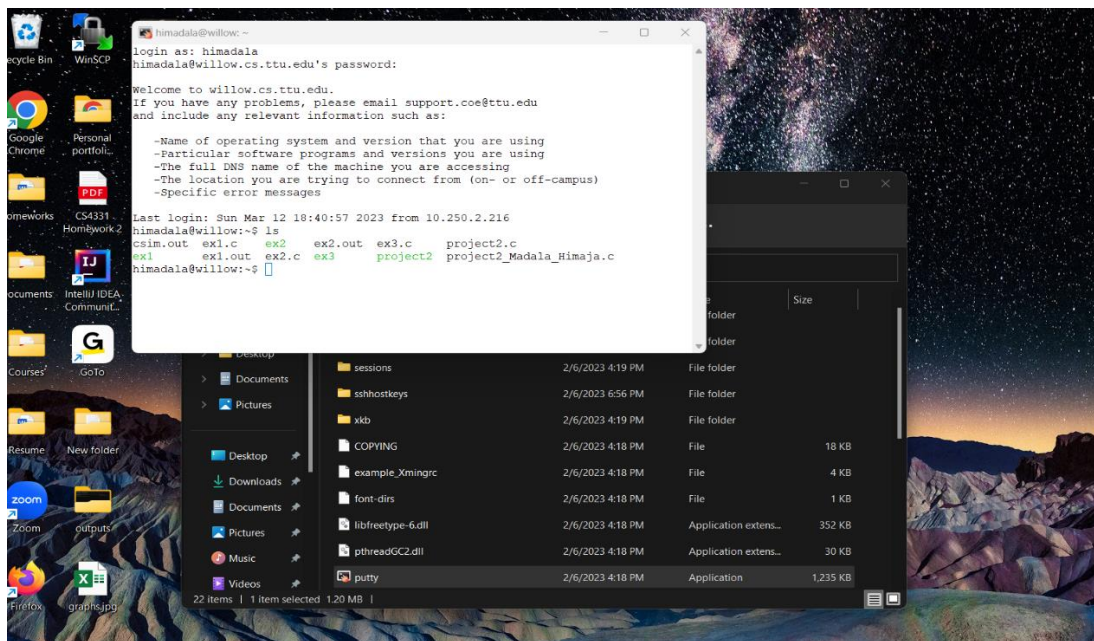
**scp project2\_Madala\_Himaja.c [himadala@willow.cs.ttu.edu](mailto:himadala@willow.cs.ttu.edu):**



Now, open Xming and run PuTTY.

Login to PuTTY using your credentials.

Enter the command 'ls' to see all the saved files and verify whether you can see the project code folder.



After verifying, enter the following command to compile the code:

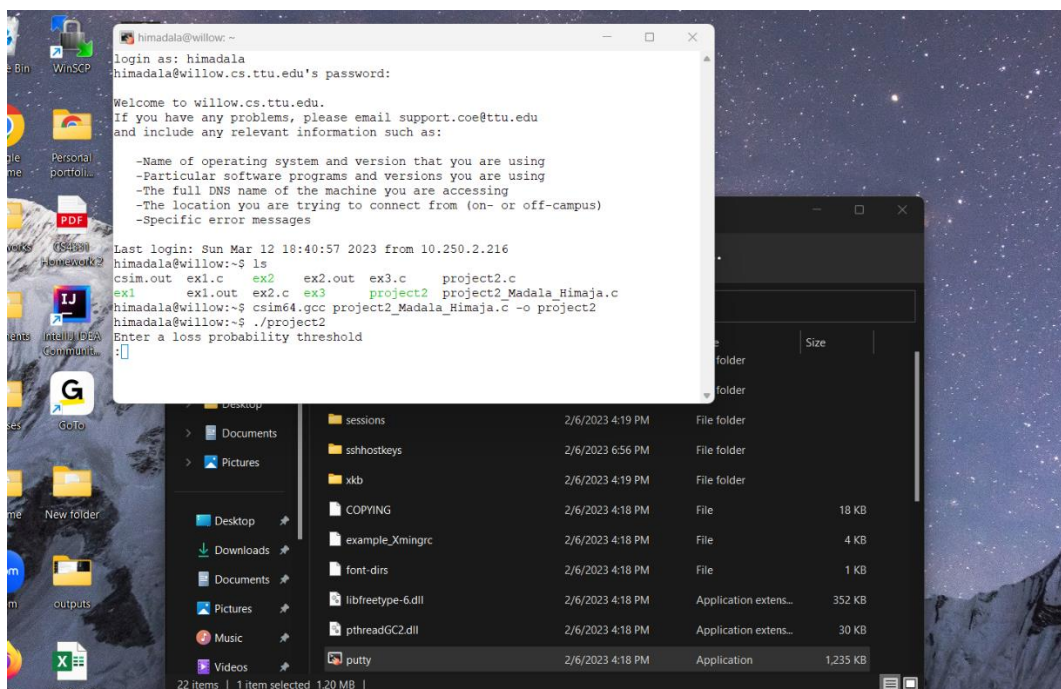
**"csim64.gcc project2\_Madala\_Himaja.c -o project2"**

The above command also saves the output in 'project2'

Now, in order to check the output, enter the following command:

**"./project2"**

It will then ask us to enter the threshold probability

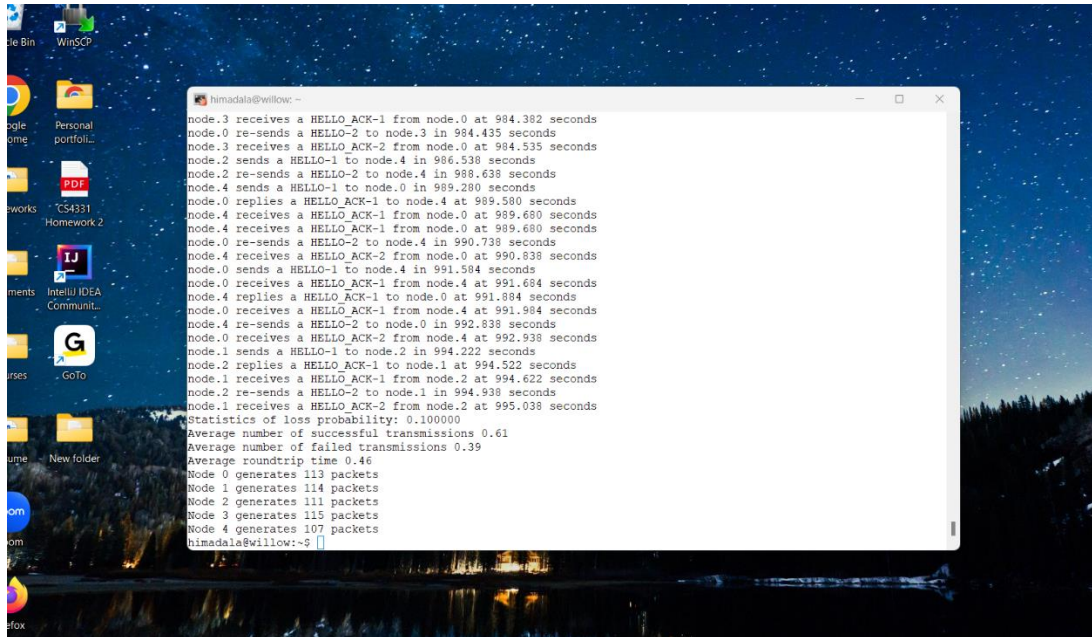


According to the project, we considered the packet loss probabilities 0.1, 0.2, 0.3, 0.4 and 0.5

So, we should execute the command “./project2” and enter the above probabilities to get average number of successful transmissions and average number of failed transmissions.

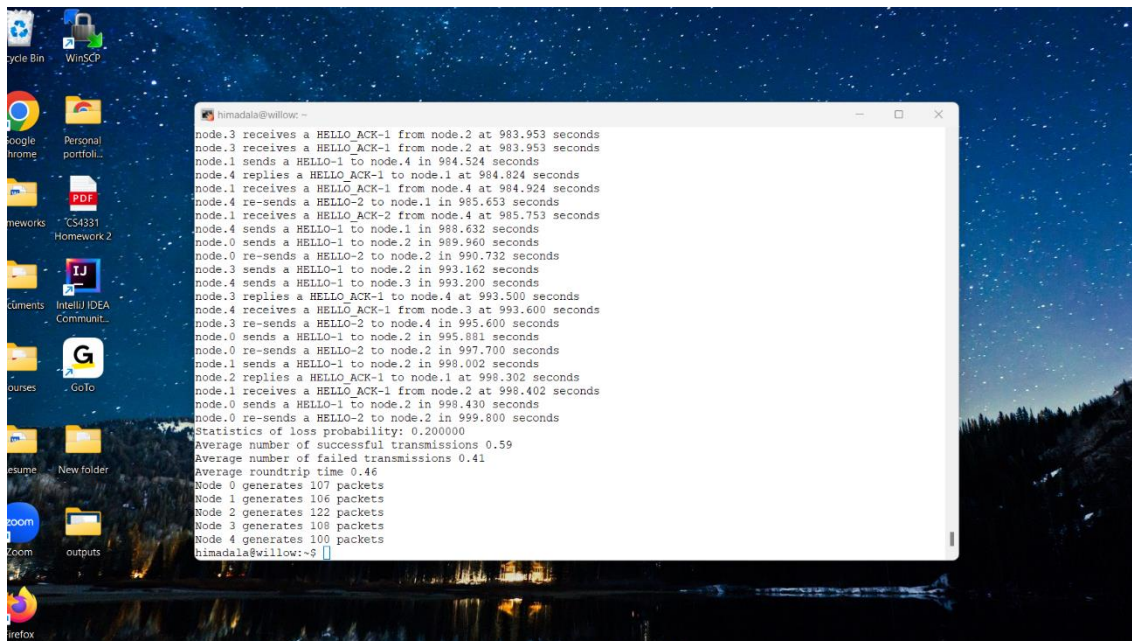
The following are the outputs for the above packet loss probability.

For loss probability threshold being 0.1,



```
himadala@willow: ~$ ./project2
node.3 receives a HELLO ACK-1 from node.0 at 984.382 seconds
node.0 re-sends a HELLO-2 to node.3 in 984.435 seconds
node.3 receives a HELLO ACK-2 from node.0 at 984.535 seconds
node.2 sends a HELLO-1 to node.4 in 986.538 seconds
node.2 re-sends a HELLO-2 to node.4 in 988.638 seconds
node.4 sends a HELLO-1 to node.0 in 989.280 seconds
node.0 replies a HELLO ACK-1 to node.4 at 989.580 seconds
node.4 receives a HELLO ACK-1 from node.0 at 989.680 seconds
node.4 receives a HELLO ACK-1 from node.0 at 989.680 seconds
node.0 re-sends a HELLO-2 to node.4 in 990.738 seconds
node.4 receives a HELLO ACK-2 from node.0 at 990.938 seconds
node.0 sends a HELLO-1 to node.4 in 991.584 seconds
node.0 receives a HELLO ACK-1 from node.4 at 991.684 seconds
node.4 replies a HELLO ACK-1 to node.0 at 991.884 seconds
node.0 receives a HELLO ACK-1 from node.4 at 991.984 seconds
node.4 re-sends a HELLO-2 to node.0 in 992.838 seconds
node.0 receives a HELLO ACK-2 from node.4 at 992.938 seconds
node.1 sends a HELLO-1 to node.2 in 994.222 seconds
node.2 replies a HELLO ACK-1 to node.1 at 994.522 seconds
node.1 receives a HELLO ACK-1 from node.2 at 994.622 seconds
node.2 re-sends a HELLO-2 to node.1 in 994.938 seconds
node.1 receives a HELLO ACK-2 from node.2 at 995.038 seconds
Statistics of loss probability: 0.100000
Average number of successful transmissions 0.61
Average number of failed transmissions 0.39
Average roundtrip time 0.46
Node 0 generates 113 packets
Node 1 generates 114 packets
Node 2 generates 111 packets
Node 3 generates 115 packets
Node 4 generates 107 packets
himadala@willow:~$
```

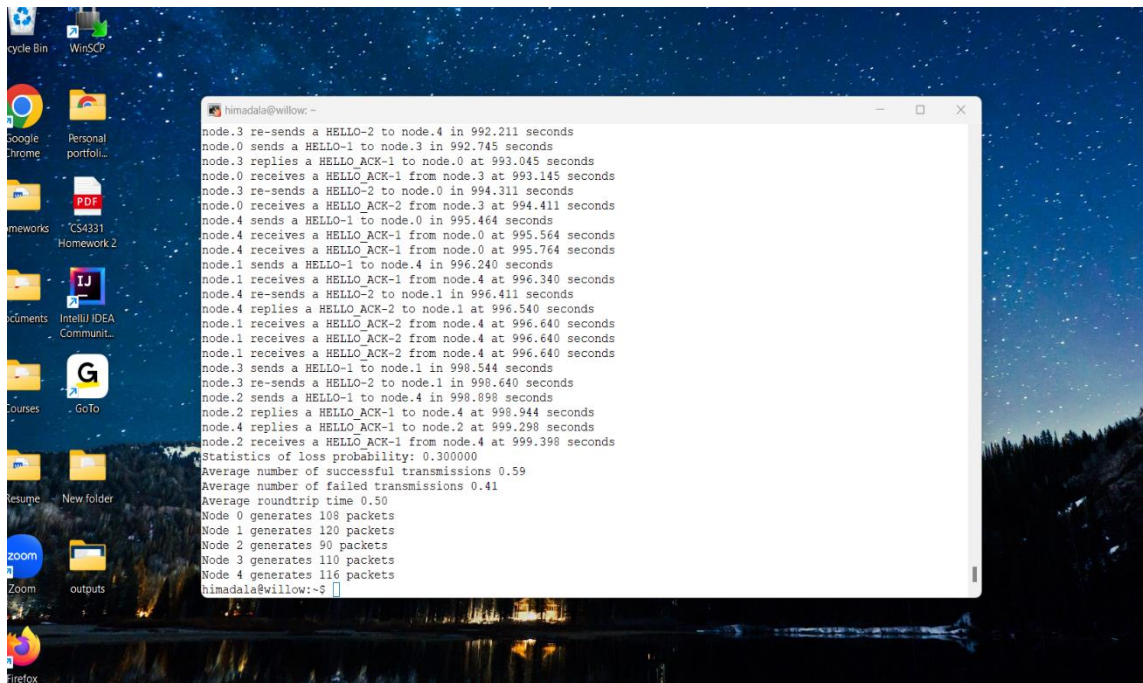
For loss probability threshold being 0.2,



```
himadala@willow: ~$ ./project2
node.3 receives a HELLO ACK-1 from node.2 at 983.953 seconds
node.3 receives a HELLO ACK-1 from node.2 at 983.953 seconds
node.1 sends a HELLO-1 to node.4 in 984.524 seconds
node.4 replies a HELLO ACK-1 to node.1 at 984.824 seconds
node.1 receives a HELLO ACK-1 from node.4 at 984.924 seconds
node.4 re-sends a HELLO-2 to node.1 in 985.653 seconds
node.1 receives a HELLO ACK-2 from node.4 at 985.753 seconds
node.4 sends a HELLO-1 to node.1 in 988.632 seconds
node.0 sends a HELLO-1 to node.2 in 989.960 seconds
node.0 re-sends a HELLO-2 to node.2 in 990.732 seconds
node.3 sends a HELLO-1 to node.2 in 993.162 seconds
node.4 sends a HELLO-1 to node.3 in 993.200 seconds
node.3 replies a HELLO ACK-1 to node.4 at 993.500 seconds
node.4 receives a HELLO ACK-1 from node.3 at 993.600 seconds
node.3 re-sends a HELLO-2 to node.4 in 995.600 seconds
node.0 sends a HELLO-1 to node.2 in 995.881 seconds
node.0 re-sends a HELLO-2 to node.2 in 997.700 seconds
node.1 sends a HELLO-1 to node.2 in 998.002 seconds
node.2 replies a HELLO ACK-1 to node.1 at 998.302 seconds
node.1 receives a HELLO ACK-1 from node.2 at 998.402 seconds
node.0 sends a HELLO-1 to node.2 in 998.490 seconds
node.0 re-sends a HELLO-2 to node.2 in 999.800 seconds
Statistics of loss probability: 0.200000
Average number of successful transmissions 0.59
Average number of failed transmissions 0.41
Average roundtrip time 0.46
Node 0 generates 107 packets
Node 1 generates 106 packets
Node 2 generates 122 packets
Node 3 generates 108 packets
Node 4 generates 100 packets
himadala@willow:~$
```

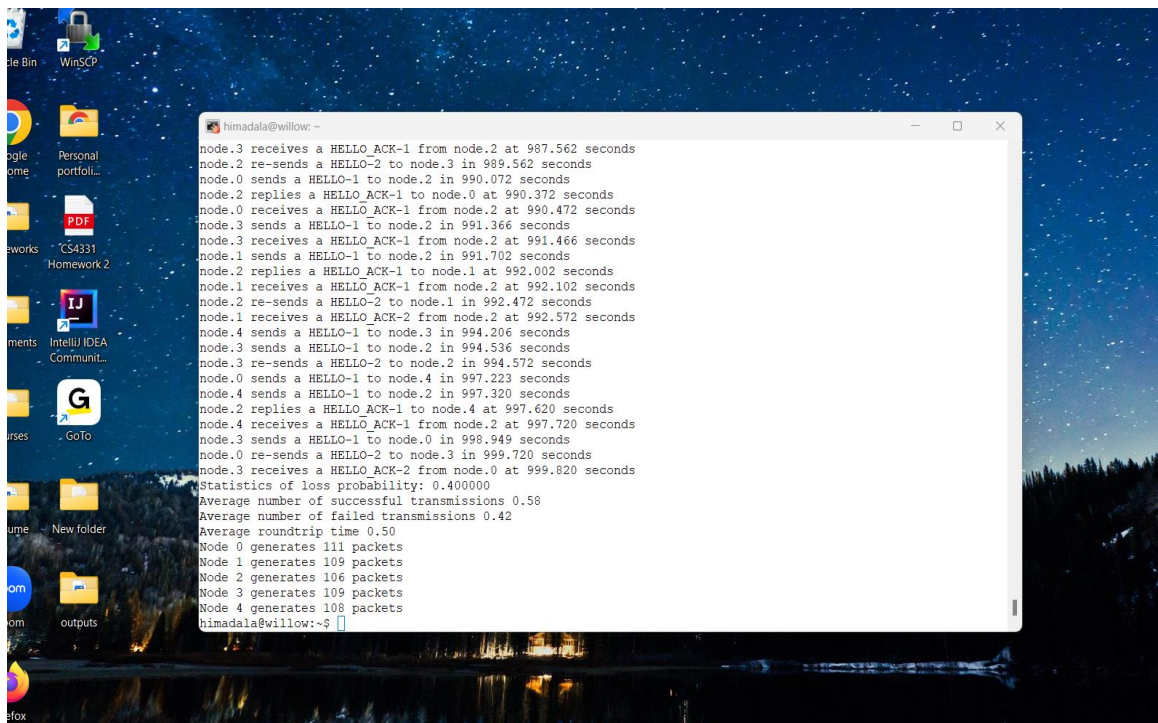


For loss probability threshold being 0.3,



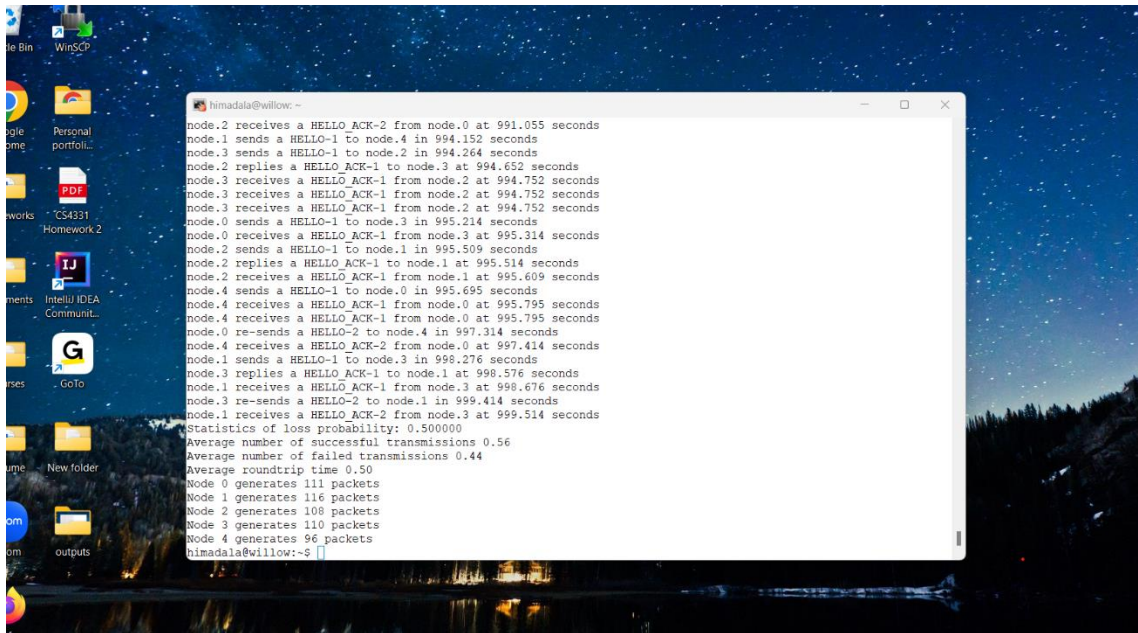
```
himadala@willow:~$
node.3 re-sends a HELLO-2 to node.4 in 992.211 seconds
node.0 sends a HELLO-1 to node.3 in 992.745 seconds
node.3 replies a HELLO_ACK-1 to node.0 at 993.045 seconds
node.0 receives a HELLO_ACK-1 from node.3 at 993.145 seconds
node.3 re-sends a HELLO-2 to node.0 in 994.311 seconds
node.0 receives a HELLO_ACK-2 from node.3 at 994.411 seconds
node.4 sends a HELLO-1 to node.0 in 995.464 seconds
node.4 receives a HELLO_ACK-1 from node.0 at 995.564 seconds
node.4 receives a HELLO_ACK-1 from node.0 at 995.764 seconds
node.1 sends a HELLO-1 to node.4 in 996.240 seconds
node.1 receives a HELLO_ACK-1 from node.4 at 996.340 seconds
node.4 re-sends a HELLO-2 to node.1 in 996.411 seconds
node.4 replies a HELLO_ACK-2 to node.1 at 996.540 seconds
node.1 receives a HELLO_ACK-2 from node.4 at 996.640 seconds
node.1 receives a HELLO_ACK-2 from node.4 at 996.640 seconds
node.1 receives a HELLO_ACK-2 from node.4 at 996.640 seconds
node.3 sends a HELLO-1 to node.1 in 998.544 seconds
node.3 re-sends a HELLO-2 to node.1 in 998.640 seconds
node.2 sends a HELLO-1 to node.4 in 998.898 seconds
node.2 replies a HELLO_ACK-1 to node.4 at 998.944 seconds
node.4 replies a HELLO_ACK-1 to node.2 at 999.298 seconds
node.2 receives a HELLO_ACK-1 from node.4 at 999.398 seconds
Statistics of loss probability: 0.300000
Average number of successful transmissions 0.59
Average number of failed transmissions 0.41
Average roundtrip time 0.50
Node 0 generates 108 packets
Node 1 generates 120 packets
Node 2 generates 90 packets
Node 3 generates 110 packets
Node 4 generates 116 packets
himadala@willow:~$
```

For loss probability threshold being 0.4,



```
himadala@willow:~$
node.3 receives a HELLO_ACK-1 from node.2 at 997.562 seconds
node.2 re-sends a HELLO-2 to node.3 in 999.562 seconds
node.0 sends a HELLO-1 to node.2 in 990.072 seconds
node.2 replies a HELLO_ACK-1 to node.0 at 990.372 seconds
node.0 receives a HELLO_ACK-1 from node.2 at 990.472 seconds
node.3 sends a HELLO-1 to node.2 in 991.366 seconds
node.3 receives a HELLO_ACK-1 from node.2 at 991.466 seconds
node.1 sends a HELLO-1 to node.2 in 991.702 seconds
node.2 replies a HELLO_ACK-1 to node.1 at 992.002 seconds
node.1 receives a HELLO_ACK-1 from node.2 at 992.102 seconds
node.2 re-sends a HELLO-2 to node.1 in 992.472 seconds
node.1 receives a HELLO_ACK-2 from node.2 at 992.572 seconds
node.4 sends a HELLO-1 to node.3 in 994.206 seconds
node.3 sends a HELLO-1 to node.2 in 994.536 seconds
node.3 re-sends a HELLO-2 to node.2 in 994.572 seconds
node.0 sends a HELLO-1 to node.4 in 997.223 seconds
node.4 sends a HELLO-1 to node.2 in 997.320 seconds
node.2 replies a HELLO_ACK-1 to node.4 at 997.620 seconds
node.4 receives a HELLO_ACK-1 from node.2 at 997.720 seconds
node.3 sends a HELLO-1 to node.0 in 998.949 seconds
node.0 re-sends a HELLO-2 to node.3 in 999.720 seconds
node.3 receives a HELLO_ACK-2 from node.0 at 999.820 seconds
Statistics of loss probability: 0.400000
Average number of successful transmissions 0.58
Average number of failed transmissions 0.42
Average roundtrip time 0.50
Node 0 generates 111 packets
Node 1 generates 109 packets
Node 2 generates 106 packets
Node 3 generates 109 packets
Node 4 generates 108 packets
himadala@willow:~$
```

For loss probability threshold being 0.5,



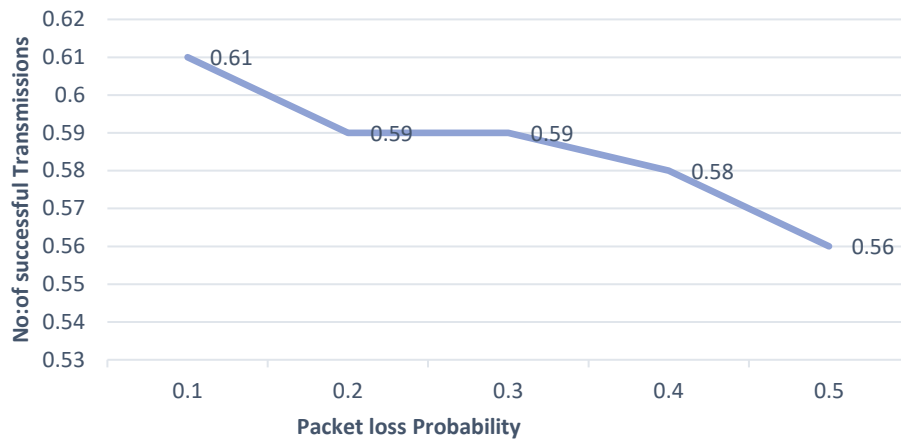
```
himadala@willow: ~$
node.2 receives a HELLO ACK-2 from node.0 at 991.055 seconds
node.1 sends a HELLO-1 to node.4 in 994.152 seconds
node.3 sends a HELLO-1 to node.2 in 994.264 seconds
node.2 replies a HELLO ACK-1 to node.3 at 994.652 seconds
node.3 receives a HELLO ACK-1 from node.2 at 994.752 seconds
node.3 receives a HELLO ACK-1 from node.2 at 994.752 seconds
node.0 sends a HELLO-1 to node.3 in 995.214 seconds
node.0 receives a HELLO ACK-1 from node.3 at 995.314 seconds
node.2 sends a HELLO-1 to node.1 in 995.509 seconds
node.2 replies a HELLO ACK-1 to node.1 at 995.514 seconds
node.2 receives a HELLO ACK-1 from node.1 at 995.609 seconds
node.4 sends a HELLO-1 to node.0 in 995.695 seconds
node.4 receives a HELLO ACK-1 from node.0 at 995.795 seconds
node.4 receives a HELLO ACK-1 from node.0 at 995.795 seconds
node.0 re-sends a HELLO-2 to node.4 in 997.314 seconds
node.4 receives a HELLO ACK-2 from node.0 at 997.414 seconds
node.1 sends a HELLO-1 to node.3 in 998.276 seconds
node.3 replies a HELLO ACK-1 to node.1 at 998.576 seconds
node.1 receives a HELLO ACK-1 from node.3 at 998.676 seconds
node.3 re-sends a HELLO-2 to node.1 in 999.414 seconds
node.1 receives a HELLO ACK-2 from node.3 at 999.514 seconds
Statistics of loss probability: 0.500000
Average number of successful transmissions 0.56
Average number of failed transmissions 0.44
Average roundtrip time 0.50
Node 0 generates 111 packets
Node 1 generates 116 packets
Node 2 generates 108 packets
Node 3 generates 110 packets
Node 4 generates 96 packets
himadala@willow:~$
```

The following are the average number of successful and failed transmissions:

Packet loss Probability	No:of successful transmissions	No:of failed transmissions
0.1	0.61	0.39
0.2	0.59	0.41
0.3	0.59	0.41
0.3	0.58	0.42
0.4	0.56	0.44

The graphs for the above successful and failed transmissions are below:

### Average Successful Transmissions



### Average Failed Transmissions

