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Performance Comparison of Transport Layer Protocols

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Abstract— Transport layer is responsible for delivering data to the appropriate application process on the host computers. The two most popular transport layer protocols are Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP is considered one of the most important protocols in the Internet. UDP is a minimal message-oriented Transport Layer protocol. In this paper we have compared the performance of TCP and UDP on the wired network. Network Simulator (NS2) has been used for performance Comparison since it is preferred by the networking research community. Constant bit rate (CBR) traffic used for both TCP and UDP protocols.

Keywords—TCP, UDP, CBR, NS-2, AWK, GUNPLOT.

I. INTRODUCTION

A network is called wired networks which are connected through physical wires with each other. It is also called an Ethernet network which is the part LAN (Local Area Network) technology. Wired network is just a collection of two or more devices, these devices could be a combination of computers, printers, and any other devices linked together by Ethernet cables An Ethernet cable is required if anyone want to connect a computer to the network and computer must also have an Ethernet adapter also called NIC (Network Interface Card). NIC can be installed internal or external both. Internal means that installed in a computer, some computer include built-in NIC which eliminates the need of extra Ethernet Adapter [1].

TCP was designed to run over any packet-switching wired networks. TCP provides reliable service without overloading the network. In addition to many services such as flow control, congestion management and reliability, TCP attempts to provide both an efficient utilization and a fair share of network resources.[2]

User datagram protocol (UDP) is a fast transmission protocol used by most of the real-time applications as it is suitable for delay sensitive applications like video and audio transmission. UDP does not provide flow control or error recovery and does not require connection management [3].

NS-2 is the acronym of network simulator-2.NS2 source code is copyrighted but freely distributed and discrete event simulator which works on packet scenario of networking projects for both wired and wireless network.NS-2 has many built in libraries and functions which support many routing protocols, network topologies like bus, ring, hybrid, star topologies to design both wired and wireless network with the help of simulation scripts. Main advantage of NS-2 is that we can easily calculate total throughput, error rate, end to end delay, total number of packet send and received by destination with custom scripts AWK, Perl [4].

Ns-2 support both transport layer protocols TCP and UDP to transmit data in the form of packets from source to destination [5]. Ns2 support mainly four type of traffic generators to generate data in the form of packets and send packets over transport layer protocols. CBR (Constant Bit Rate), exponential traffic (poison traffic), Pareto traffic (poo traffic) and FTP are traffic generators [6].

II. RELATED WORK

In paper [7] practical implementation by analysis packet flow and average rate of both transport layer protocols and compare them on the wired network of NS-2 with the help of TCL simulation script, GNUPLOT and Perl script. Transport layer protocols TCP and UDP for transmitting data from source node to destination node in the form of packets.

In paper [1] appreciate the key terminologies of UDP and TCP, to recognize the key difference between them. This work use to simulation for designing and studying wired network by using NS2 simulator. In the wired scenario, first analysed packet transmission into the UDP and TCP, second calculate bandwidth in UDP and TCP transport layer protocol and finally compare UDP and TCP performance based on their bandwidth. The reason of using wired network because it is easy to understand for all new users. The simulator used for implementation in Network Simulator-2 (NS2).

III. NETWORK MODEL

The simulation model consist of 4 nodes, node no.1 and node no.2 acts as a source node, node no.3 assume as a router which forward the packet coming from node 0 and 1 to the node no.4 which assume the destination node. A TCP agent is attached to node 1 and connection is established to node 4 which is a destination node by attaching "sink" agent to it. Same as a UDP agent is attached to node 2 and "null" agent attached to node 4 for connection establishment.

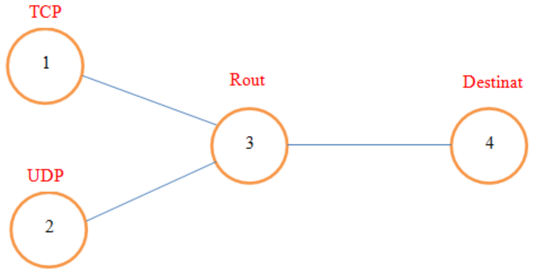


Figure 3.1: Simulation model

IV. NETWORK MODEL

We use network simulator NS-2.35 to simulate model, a duplex links is established between node1 and node 3, node 2 and node 3, node3 and node 4 with band width 1MB and time delay is 20ms. Constant Bit Rate (CBR) traffic is generated on both the TCP and UDP agent.

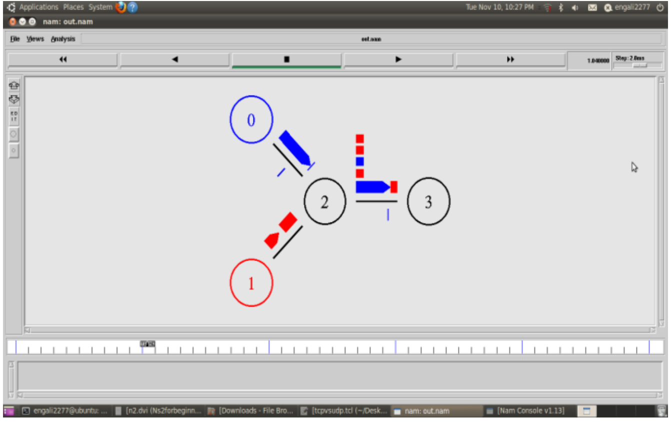


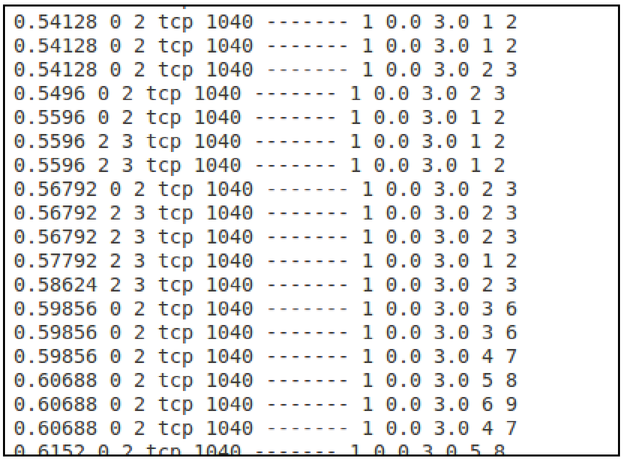
Figure 4.1: Flow of TCP and UDP Packets

In this simulation we used many parameters which are shown in the following table:

Table 4.1: Simulation Parameter

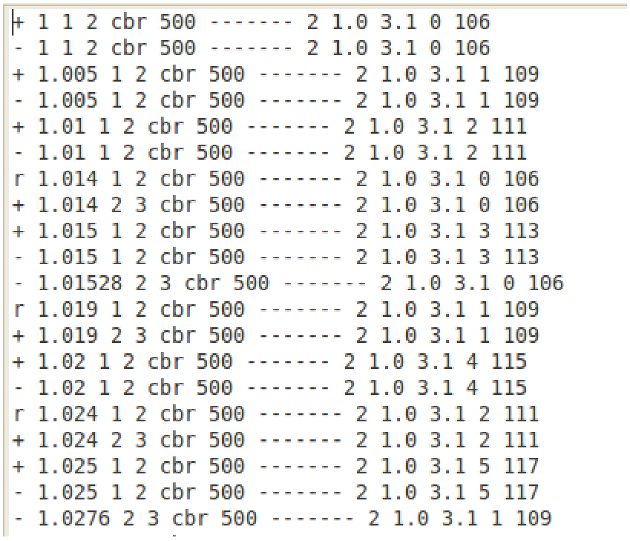
Simulator	NS-2.35
Network Interface	Wired
Number of Nodes	Four
Queue	Drop Tail
Band Width	1MB
Traffic generator	CBR
Packet size	512 bytes
Packet rate	90 kbps
Simulation Time	10 sec

After we run TCL script then it generates two type of file: first is trace analysis file with tr extension and 2 nd is NAM file with nam extension. Trace file contain all the information of TCL script like source node, destination node, type of protocol used, topology used, packet number, type of traffic which we are using in our script. In this paper we generated two Trace files to evaluate the performance to transport layer protocols. First trace file for TCP, 2 nd trace file for UDP.As shown below:



```
0.54128 0 2 tcp 1040 ------- 1 0.0 3.0 1 2
0.54128 0 2 tcp 1040 ------- 1 0.0 3.0 1 2
0.54128 0 2 tcp 1040 ------- 1 0.0 3.0 2 3
0.5496 0 2 tcp 1040 ------- 1 0.0 3.0 2 3
0.5596 0 2 tcp 1040 ------- 1 0.0 3.0 1 2
0.5596 2 3 tcp 1040 ------- 1 0.0 3.0 1 2
0.5596 2 3 tcp 1040 ------- 1 0.0 3.0 1 2
0.56792 0 2 tcp 1040 ------- 1 0.0 3.0 2 3
0.56792 2 3 tcp 1040 ------- 1 0.0 3.0 2 3
0.56792 2 3 tcp 1040 ------- 1 0.0 3.0 2 3
0.57792 2 3 tcp 1040 ------- 1 0.0 3.0 1 2
0.58624 2 3 tcp 1040 ------- 1 0.0 3.0 2 3
0.59856 0 2 tcp 1040 ------- 1 0.0 3.0 3 6
0.59856 0 2 tcp 1040 ------- 1 0.0 3.0 3 6
0.59856 0 2 tcp 1040 ------- 1 0.0 3.0 4 7
0.60688 0 2 tcp 1040 ------- 1 0.0 3.0 5 8
0.60688 0 2 tcp 1040 ------- 1 0.0 3.0 6 9
0.60688 0 2 tcp 1040 ------- 1 0.0 3.0 4 7
0.6152 0 2 tcp 1040 ------- 1 0.0 3.0 5 8
```

Figure 4.2: TCP Trace File.



```
+ 1 1 2 cbr 500 ------- 2 1.0 3.1 0 106
- 1 1 2 cbr 500 ------- 2 1.0 3.1 0 106
+ 1.005 1 2 cbr 500 ------- 2 1.0 3.1 1 109
- 1.005 1 2 cbr 500 ------- 2 1.0 3.1 1 109
+ 1.01 1 2 cbr 500 ------- 2 1.0 3.1 2 111
- 1.01 1 2 cbr 500 ------- 2 1.0 3.1 2 111
r 1.014 1 2 cbr 500 ------- 2 1.0 3.1 0 106
+ 1.014 2 3 cbr 500 ------- 2 1.0 3.1 0 106
+ 1.015 1 2 cbr 500 ------- 2 1.0 3.1 3 113
- 1.015 1 2 cbr 500 ------- 2 1.0 3.1 3 113
- 1.01528 2 3 cbr 500 ------- 2 1.0 3.1 0 106
r 1.019 1 2 cbr 500 ------- 2 1.0 3.1 1 109
+ 1.019 2 3 cbr 500 ------- 2 1.0 3.1 1 109
+ 1.02 1 2 cbr 500 ------- 2 1.0 3.1 4 115
- 1.02 1 2 cbr 500 ------- 2 1.0 3.1 4 115
r 1.024 1 2 cbr 500 ------- 2 1.0 3.1 2 111
+ 1.024 2 3 cbr 500 ------- 2 1.0 3.1 2 111
+ 1.025 1 2 cbr 500 ------- 2 1.0 3.1 5 117
- 1.025 1 2 cbr 500 ------- 2 1.0 3.1 5 117
- 1.0276 2 3 cbr 500 ------- 2 1.0 3.1 1 109
```

Figure 4.3: UDP Trace File.

We evaluate the performance of protocol according to the following criteria, Throughput, End-to-end delay, packet delivery ratio. Throughput is the number of successfully received packets in a unit time and it is represented in bps. Here we use AWK language to calculate the average throughput of both TCP and UDP trace file .TCP throughput comes 739.449 kbps and UDP throughput comes 586.5925 kbps, AS showed in Figure 4.4. Packet flow comparison for TCP flow and UDP flow is showed in Figure 4.5.

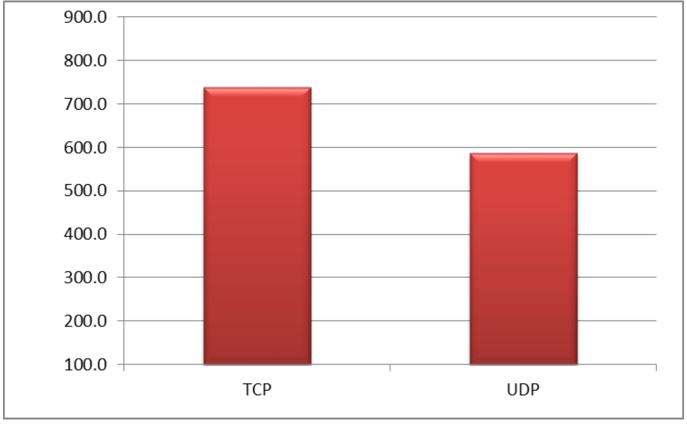


Figure 4.4 : Throughput Comparison of TCP and UDP

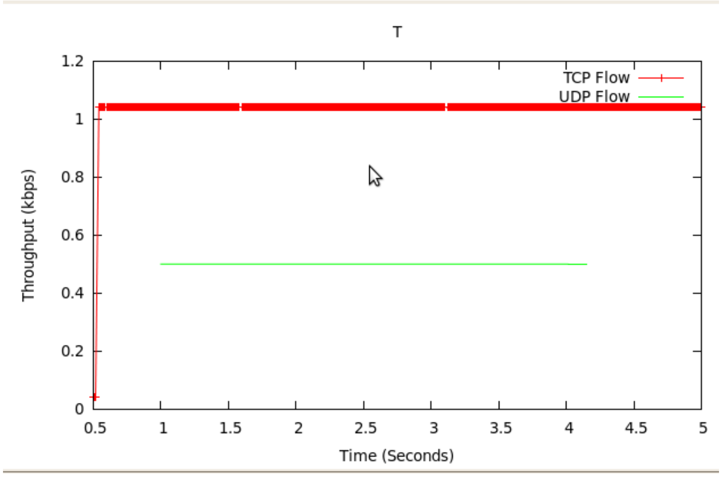


Figure 4.5 : Packet Flow Comparison of TCP and UD

End-to-end Delay: the average time taken by a data packet to arrive in the destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations that counted. We have calculated UDP Average end-to-end transmission delay is 0.0513315 seconds, and TCP Average end-to-end transmission delay is 0.0593662 seconds. The lower value of end to end delay means the better performance of the protocol.so that UDP Shows less delay. Figure4.6 show the end-to-end delay comparison of TCP and UDP.

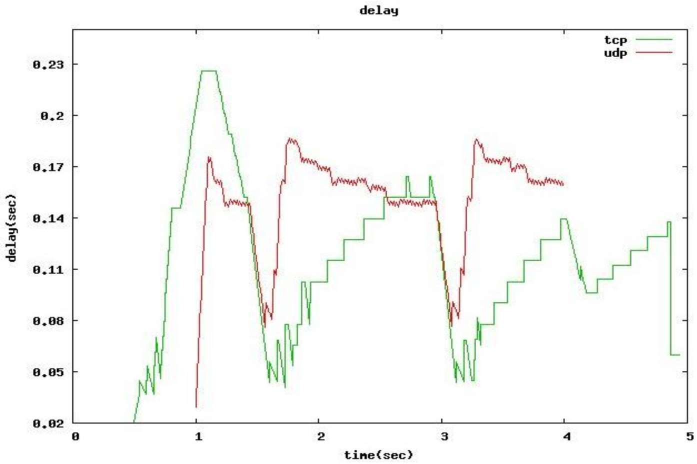


Figure 4.6: End-to-End Delay Comparison of TCP and UDP

Packet delivery ratio: the ratio of the number of delivered data packet to the destination. This illustrates the level of delivered data to the destination. After calculation the packet delivery ratio for both TCP and UDP, we find that TCP packet delivery ratio is 96.9211%, and UDP packet delivery ratio is 74.12646% as shown in Figure 4.7. The greater value of packet delivery ratio means the better performance of the protocol. Simulation result show that TCP is more reliable than UDP.

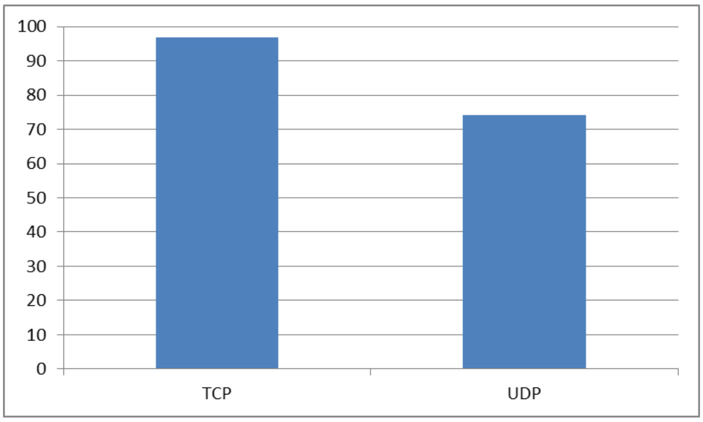


Figure 4.7: Packet Delivery Ratio of TCP and UDP

Also we calculate the number of packet drop for both TCP and UDP, we find that TCP packet dropped is 8, and UDP packet dropped is 311. Figure 4.8 shows the comparison of both TCP and UDP packet drop.

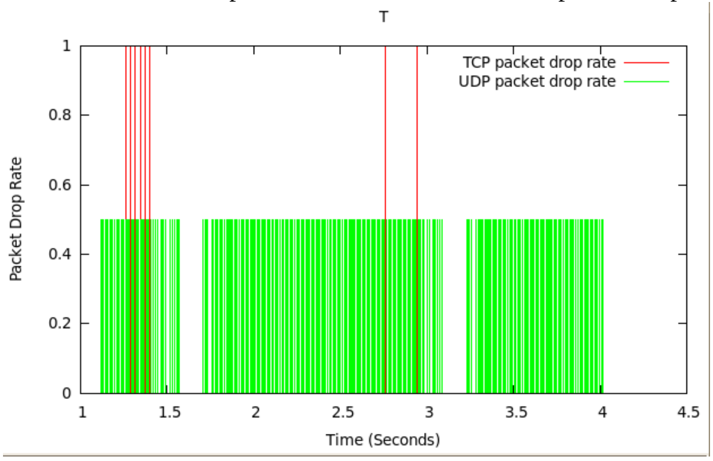


Figure 4.8: Packet Drop Comparison for TCP and UDP.

V. CONCLUSION

This paper compare performance of both two transport layer protocols TCP and UDP and its Simulations generated with the help of NS-2 software. NS-2 used to design and implement both wired and wireless network before building it in the real world which will help us to obtain better output and less drop rate of packets. In this simulation script two source nodes are taken, source node1 is attached to TCP agent and source node 2 is attached to UDP agent. Performance evaluated according to the following criteria Throughput, end-to-end delay, and packet delivery ratio. Simulation results calculated with help of AWK script and with graphs through GNUPLOT.

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REFERENCES

[1] Preeti, Mtech CSE, Renu Singla, "Simulation Based Performance Analysis of TCP Transport Layer Protocol Based on Wired Network Using NS-2" International Journal of Advanced Research In Computer Science and Software Engineering" page 272-278, Volume 5, Issue 4,2015.

[2] Maninder Kaur, and Parminder Singh,“ENHANCEMENT OF TCP PERFORMANCE WITH THE HELP OF SNOOP PROTOCOL IN WIRED CUM WIRELESS NETWORK ”, International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.6, November 2012.

[3] S. M. Koli, R. G. Purandare, S. P. Kshirsagar, V. V. Gohokar "Enhanced Network Throughput of Wireless Network for Digital Video Transmission " International Journal of Wireless & Mobile Networks (IJWMN) Vol. 5, No. 1, February 2013 .

[4] Ajay Singh, Dr. Pankaj Dashore,” Packet Flow Analysis in Wireless Scenario”, International Journal of Advanced Research in Computer Science and Software Engineering, ISSN: 2277 128X”.

[5] Ajay singh, Dr. Pankaj Dashore, “A Comparative Study of UDP and TCP by Using NS2”, International Journal of Computer Science and Information Security (IJCSIS) Volume (1): Issue (1), June 2013.

[6] Assist Prof. Dr. Saad Talib Hasson, Ahmed Jawad Kadhim, Zainab Saad Talib,” Enhancing the NS-2 Traffic Generator for the MANETs”, IOSR Journal of Computer Engineering (IOSRJCE) ISSN: 2278-0661 Volume 4, Issue 2 , PP 12-16 ,Sep.-Oct. 2012.

[7] Sharat Kaushik, Poonam, Anita Tomar. “A Comparative Analysis of Transport Layer Protocols”, International Journal of Information & Computation Technology, Volume 4, Number 14, pp. 1403-1410, (2014).