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# An Approach for Enhanced Performance of Packet Transmission over Packet Switched Network

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**ABSTRACT**
*With the increased use of real time applications, there is a need for improved network traffic and bandwidth management. Switches are being used by computer networks for enabling connection between those hosts which are not connected by a direct link. When two or more than two host attempt to transmit packet at the same time, collision in data packets occurred. In this paper an optimized performance of local area network in terms of collision count and some other parameter have been investigated using simulation model. Simulation results have been obtained in different network scenarios by varying the number of devices in the network.*
**Keywords:** *LAN, Switches, Hubs, CSMA/CD, collision count, Multimedia, Latency*.

## I. Introduction

A collision avoidance approach is a mechanism used by LAN (Local Area Network) to control access and allocate shared bandwidth among stations that want to transmit at the same time in a shared medium. There must be some mechanisms by which stations can come to know about that they want to transmit at the same time. Such mechanisms are known as collision detection methods [3]. Ethernet uses CSMA/CD (Carrier Sense Multiple Access/Collision Detection) for collision detection. The use of switch in Ethernet makes it possible to reduce the collision. Certain rules are being followed by the communication process. For example, when a peripheral device wishes to communicate, it sends the request for communication that reaches the switch. If another peripheral device communicates already, two messages are found at the same time on the network. The message from the first host is taken at the beginning of a queue, and the second host waits for trying again to communicate a few milliseconds later [7]. Now a day's Local Area Network (LAN) technology has made a significant impact on almost every industry. Operations of these industries solely depend on computers and their networking. The data is stored on computers than on paper, and the dependence on networking is so high that banks, airlines, insurance companies and many government organizations would stop functioning if there were a network failure. Since, the dependency on networks is so high and the network traffic is increasing, we have to address some of the bandwidth problems this has caused and find solutions to tackle them [3-4].
The key problem that a switch must deal with is the finite bandwidth of its outputs [1]. If packets destined for a certain output arrive at a switch and their arrival rate exceeds the capacity of that output, then we have a problem of connection. In this case, the switch will queue (or buffer) packets until the contention subsides. If it lasts too long, however, the switch will run out of buffer space and be forced to discard the packets. When packets are discarded too frequently, the switch is said to be congested [8].
In this work we implemented a platform for performance assessment of Ethernet for different scenarios by varying the number of network devices and studied some network parameters like throughput, delay and collision count. The rest of the paper is organized as follows. In the next section, we have described switched LAN (Local Area Network). Thereafter, we have presented our simulation model. After that, we have compared the obtained results from simulation. Finally, conclusion is presented.

## II. Switched LAN

Recently the Ethernet has become the most widespread LAN. With gigabit technology it started a new stage of popularity. And this is not the limit yet. Hubs are dumb passive equipment aimed only at the connection of devices as wires. The base element of the Local Area Network (LAN) Ethernet (IEEE 802.x) is a switch of frames. Logically a switch is constituted of a set of ports [6]. LAN segment (for example, made up via hub) or terminal equipment such as workstation or server may be attached to each port. The task of a switch is the forwarding of incoming frame to the port that the target device is connected to. The usage of a switch allows for a decrease in quantity of collisions so each frame is transmitted only to the target port and results in an increased bandwidth [8]. Moreover the quality of information protection rises with a reduction of ability to overhear traffic.

There is a limit on the number of hosts that can be attached to a single network and on the size of a geographic area that a single network can serve [6]. Computer networks use switches to enable the communication between one host and another, even when no direct connection exists between those hosts [5]. The key problem that a switch must deal with is the finite bandwidth of its outputs [7]. If packets destined for a certain output arrive at a switch and their arrival rate exceeds the capacity of that output, then we have a problem of connection. In this case, the switch will queue (or buffer) packets until the contention subsides. If it lasts too long, however, the switch will run out of buffer space and be forced to discard the packets. When packets are discarded too frequently, the switch is said to be congested [1]. Local Area Networks in many organizations have to deal with increased bandwidth demands. More and more users are being added to the existing LANs. If this was the only problem, it could be solved by upgrading the backbone that connects various LANs. Bridges and routers can be used to keep the number of users per LAN at an optimal number. However with increase in the speed of workstation the bandwidth requirement of each machine has grown more that five times in the last few years. Coupled with bandwidth hungry multimedia applications and unmanaged and bursty traffic this problem is further aggravated. With the increasing use of client-server architecture in which most of the software is stored in the server, the traffic from workstations to server has increased. Further, the use of a large number of GUI applications means more pictures and graphics files need to be transferred to the workstations. This is another cause of increased traffic per workstation [7].
LAN switching is a fast growing market, with virtually every network vendor marketing its products. Besides LAN switches, switching routers, switching hubs are also sold. Different vendors add new features to their products to keep them competitive. At present, one can get switches that link same as well as different LAN topologies [5].

We have studied two cases: 1) Ethernet with the hub only, and 2) Ethernet with the hub and switch. The results demonstrate that, although the traffic send is almost the same in both cases, the traffic received has improved in the Hub-and-Switch case. The second configuration makes network perform better in terms of throughput and delay characteristics. With a switched network any user can be connected to each port directly [3]. Therefore, the bandwidth is shared only among a number of users in the workgroup (connected to the ports). Since this is the reduced media, the sharing of other portions of the bandwidth is available. Switches can also maintain multiple connections at one point [4]. Switches normally have higher port counts than bridges and divide network into several dedicated channels independent ("parallel") from each other. These multiple independent data paths increase the throughput capacity of a switch. There is no contention to gain access, and LAN switch architecture becomes scalable. Another advantage of switches is that most of them are self-configuring. This property allows to minimizing the network downtime, although ways for manual configuration are also available [2].

## III. Simulation Model

We considered a hypothetical network topology as illustrated in our simulations, in order to demonstrate the performance of different LANs using only hub and switch. The simulation is carried out with riverbed modeller academic edition 17.5. 10BaseT link is used to connect the two hubs with the switch and all other links are also taken 10BaseT. Clients working with multimedia or any other bandwidth hungry application will consume lot of bandwidth, so the workgroup should be appropriately segmented to keep the traffic low in that particular LAN segment. Replacing concentrators, repeaters, or hubs in a workgroup with LAN switches can substantially increase the effective transmit bandwidth to each user. Full duplex operation would further enhance the bandwidth availability. Workgroup switches should be provided with high speed ports for connecting to servers [3].

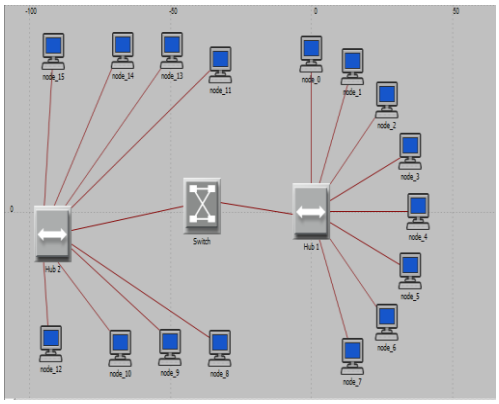


Fig. 1 The Topology for which the simulation was carried out

The effect of random-early drop over drop-tail policy is also tested. While enabling random-early drop, the minimum threshold is kept 200 and maximum threshold is kept 400. Mark probability denominator, that is, the fraction of packets dropped when the average queue size is at maximum threshold, is considered 12. The value of the exponential weight factor, which is used to calculate the average queue size based on the previous average and current queue size, is kept 9.

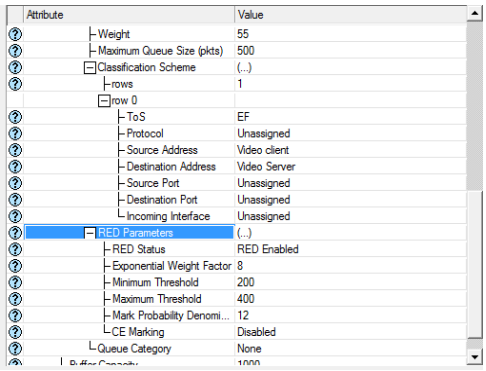


Fig. 2 IP RED definition

Sizes of the packets are kept constant value 1500 bytes with exponential inter-arrival time 0.02 seconds. ON state and OFF state time are kept exponential. After all the consecutive simulation runs, simulation results were collected for each data traffic, based on the chosen global statistics, for the different scenarios. The comparison of the simulation results are discussed in the next section [3].

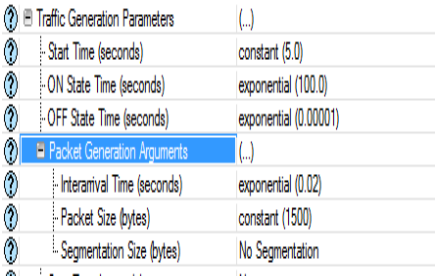


Fig. 3 Packet definition

## IV. Result Analysis

For multimedia applications or any other bandwidth hungry application will consume lot of bandwidth, so the workgroup should be appropriately segmented to keep the traffic low in that particular LAN segment. Replacing concentrators, repeaters, or hubs in a workgroup with LAN switches can substantially increase the effective transmit bandwidth to each user. Full duplex operation would further enhance the bandwidth availability. Workgroup switches should be provided with high speed ports for connecting to servers. The following study demonstrates why the adding of a switch makes a network perform better in terms of throughput and delay characteristics.

### *4.1 Traffic received for Interactive Multimedia*

We have studied two cases: 1) Ethernet with the hub only, and 2) Ethernet with the hub and switch. The results shown in Figures 4 and 5 demonstrate that, although the traffic send is almost the same in both cases, the traffic received has improved in the Hub-and-Switch case. The second configuration makes network perform better in terms of throughput and delay characteristics.

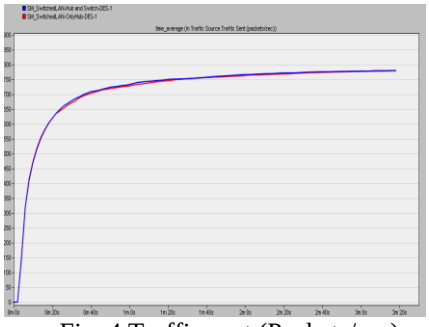

Fig. 4 Traffic sent (Packets/sec)

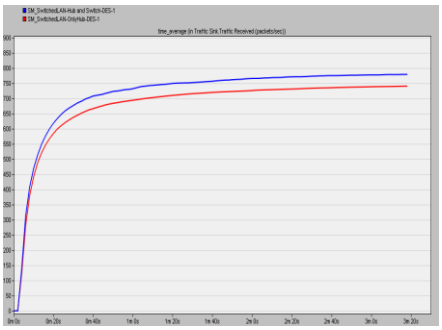

Fig. 5 Traffic received (Packets/sec)

***4.2 Latency***

Figure 6 shows the time average traffic end-to-end delay (sec) graph for the two scenarios. It is also clear from the graph that network with switch provide less latency and the delay is almost constant for traffic.

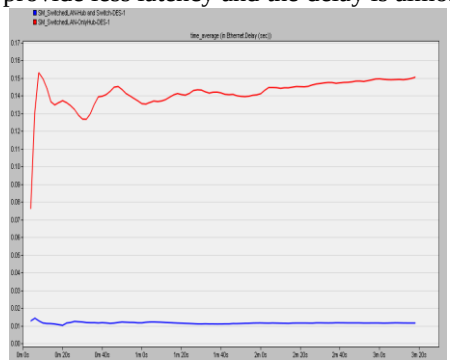

Fig. 6 Ethernet delay (sec)

***4.3 Collision count in the switched LAN***

The use of the switch makes it possible to reduce the collisions on the network. The result can be observed from Figure 7. The communication procedures follow the certain rules. For example, when a peripheral device wishes to communicate, it sends the request for communication that reaches the switch. If another peripheral device communicates already, two messages are found at the same time on the network. The message from the first host is taken at the beginning of a queue, and the second host waits for trying again to communicate a few milliseconds later. Switches upon finding that the destination port is overloaded will send the jam message to the sender. Since the decoding of the MAC address is fast and the switch can, in very little time, respond with a jam message, collision or packet loss can be avoided [3, 7].

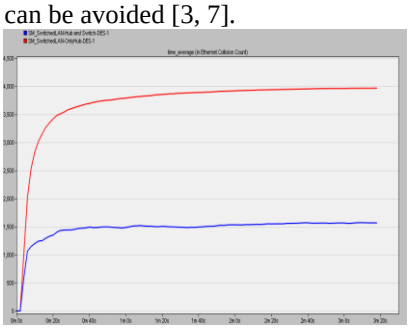

Fig. 7 Ethernet Collision count

## V. Conclusion

In the present work the technology of switched local area networks' models development was studied. The usage of switch in LAN tremendously enhanced the performance of the network. The model reflects the major features of a real-life network. CSMA procedures, full-duplex mode and switching tables were modelled. a special measuring model of workstation was suggested and implemented to estimate the network performance. The model developed is of enterprise class, so it allows easy and convenient adequate representation of LAN with an arbitrary given topology. The technique described is aimed at real-time applications, requiring the precise estimation of timed delays before implementation.

## References


[1] Sabyasachi Mukherjee, O.S.Khanna, "Fairness Evaluation of a DSCP based scheduling algorithm for Real-time traffic in Differentiated service Networks", International Journal of Information and Electronics Engineering (IJIEE), Vol. 3, No. 4, July 2013, pp. 423-427.

[2] Opnet Training Course Modeler Notes, www.opnet.com Training documents, 2006.

[3] Sabyasachi Mukherjee, Anupam Kumar Yadav, "Collision Avoidance Approach for Performance Optimization in Packet Switched Network", International Journal of Innovative Research in Advanced Engineering (IJIRAE), Vol. 2, Issue 3, March 2015, pp. 64-68.

[4] A. Shawish, X. Jiang and S. Horiguchi, "Voice Capacity Analysis and Enhancement in Wireless LAN" WCNC 2008 pp. 2153-2157, 2008.

[5] Sabyasachi Mukherjee, Sandeep Singh, Paramita Mukherjee, "Fair and Latency Aware Scheduler for Voice over IP network with video conferencing traffic" International journal of Electronics & Communication Technology (IJECT), Vol. 3, Issue 4, Oct-Dec 2012, pp. 108-111.

[6] Minagawa,T.; Ikegami,T., "Controlling User Flows with RIO and WFQ", 2010 International Symposium on Communications and Information Technologies (ISCIT), 10.1109/ISCIT.2010.5664907, 2010, pp. 87-92.

[7] D. Bertsekas, R. Gallager, "Data Networks," Prentice Hall, 2nd, 195-210p.

[8] Sabyasachi Mukherjee, O.S.Khanna, "Improved Quality of service for video conferencing traffic with combination of weighted fair queuing scheduling discipline and DSCP", Proceedings of the International Conference on Control, Communication, Computer and Mechanical Engineering (ICCCCME-2012),Delhi, November 4, 2012, pp. 1-3.