ISSN:0975-9646

Ashish Kumar et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (2) , 2012,3816 - 3820

Comparison and Analysis of Drop Tail and RED Queuing Methodology in PIM-DM Multicasting Network

Ashish Kumar , Ajay K Sharma , Arun Singh
Dr. B R Ambedkar
National Institute of Technology, Jalandhar
India

***Abstract*—The paper describes a Multicasting network using PIM-DM (Protocol Independent Multicast- Dense Mode) with two queuing algorithms Drop Tail and Random Early Detection (RED). A simulation environment is created in NS2 to analyse and contrast Drop Tail and RED for queue management on basis of drop out data packets in network. The experiment indicates better performance of RED by 13.7375% on the basis of reducing drop out data packets. The topology is created using TCL to simulate multicast network and graphs are generated in Tracegraph, to contrast the difference.**

***Keywords*—** PIM-DM, Drop Tail, RED, Data Multicasting, NS2

I. INTRODUCTION

Multicasting is a widely used service in today's computer networking system; it is mostly used in Streaming media, Internet television, video conferencing and net meeting etc. Routers involved in multicasting packets need a better management over stacking system of packets to be multicast. Quality of service (QOS) is dependent on the queuing algorithm used in the multicasting system.

A PIM Domain is a contiguous set of routers that all implement PIM and are configured to operate within a common boundary defined by PIM Multicast Border Routers (PMBRs) [1]. The queuing algorithms used in simulation are Drop Tail and RED. Drop Tail object, which implements First in First out (FIFO) scheduling and drop-on-overflow buffer management typical of most present day Internet routers [2]. The basic idea of RED is that one should not wait till the buffer is full in order detect detection (drop packets), but start detecting congestion before the buffer overflows [3].RED has been supported in Linux since the 2.2.* kernel. [4].RED has been recommended by the Internet Engineering task force (IETF) as the default active queue management scheme for the next generation networks [5, 6]. The data packet drop depends upon queuing algorithm and became the basis for this paper.

II. SYSTEM DESCRIPTION

A. TOPOLOGY

A network of six nodes is created and UDP protocol is used to send constant bit rate (CBR) packets. Bandwidth is 0.5Mbps between node (2 – 4), node (4 – 5), node (4 – 6) and node (5 – 6) , and all other connections have a bandwidth of 0.3Mbps, delay of 10ms; node 1 and node 2 is the data source and multicast protocol will be put into effect at 0.4s and 2s respectively in the two node; receiver nodes 3, 4, 5 and 6 will be effective at 0.6s, 1.3s, 1.6s, and 2.3s respectively; node 4 and node 3 will leave the group at 1.9s and 3.5s.

The node 1 and node 2 is the source node which refers to node 0 and node 1 in the topology and can be seen in the topology as in fig 1.Other nodes are marked as receivers, the topology is coded in ns2 TCL as,

```
# Topology Layout
$ns duplex-link $n(1) $n(2) 0.3Mb 10ms DropTail
$ns duplex-link $n(2) $n(3) 0.3Mb 10ms DropTail
$ns duplex-link $n(2) $n(4) 0.5Mb 10ms DropTail
$ns duplex-link $n(2) $n(5) 0.3Mb 10ms DropTail
$ns duplex-link $n(3) $n(4) 0.3Mb 10ms DropTail
$ns duplex-link $n(4) $n(5) 0.5Mb 10ms DropTail
$ns duplex-link $n(4) $n(6) 0.5Mb 10ms DropTail
$ns duplex-link $n(5) $n(6) 0.5Mb 10ms DropTail
#Group Activity
$ns at 0.6 "$n(3) join-group $rcvr $group"
$ns at 1.3 "$n(4) join-group $rcvr $group"
$ns at 1.6 "$n(5) join-group $rcvr $group"
$ns at 1.9 "$n(4) leave-group $rcvr $group"
$ns at 2.3 "$n(6) join-group $rcvr $group"
$ns at 3.5 "$n(3) leave-group $rcvr $group"
```

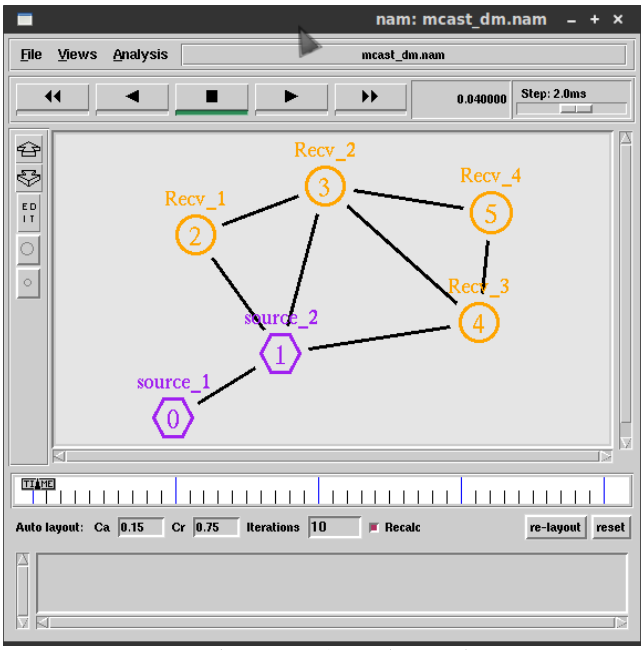

Fig. 1 Network Topology Design

B. *Multicasting [7]*

The basic principle of multicast routing is that routers must interact with each other to exchange information about neighbouring routers. In order to distribute the multicast data, the designated routers need to establish distribution trees and connect all of the members of a multicast group. The distribution trees specify the forwarding path from the source to each of the members of the multicast group. There are a number of different distribution trees, but the two most basic types are source specific trees and shared or centre specific trees.

Source specific trees find the shortest path from the source to the receivers. Source specific trees build multiple delivery trees, which emanate from the sub networks that are directly connected to the source.

Shared or centre specific trees use distribution centres and build a single tree that is shared by all members of a group. In the shared tree approach, multicast traffic is sent and received over the same path regardless of the sources of the data.

Multicast routing protocols

Multicast routing protocols facilitate the exchange of information between routers and are responsible for constructing distribution trees and forwarding multicast packets. There are a number of different routing protocols, but they generally follow one of two basic approaches—dense mode or sparse mode.

Dense mode protocols

Dense mode protocols are based on the assumption that there are a number of multicast group members densely distributed across a network. Because of this, these protocols periodically flood the network with multicast traffic to establish and maintain the distribution tree. Dense mode protocols are best suited to environments where there are a number of hosts that want to or must receive the multicast data and the bandwidth to cope with the flooding of the network.

C. *PIM-DM*

PIM-DM is a multicast routing protocol. It uses unicast routing information base to flood multicast datagrams to all multicast routers connected in the network. It uses prune messages to prevent future messages from propagating to routers without group membership information.

It assumes that when a source starts sending, members in the network want to receive multicast datagrams. At the beginning multicast datagrams are flooded to whole network. PIM-DM uses RPF (Reverse path forwarding) to prevent looping of multicast datagrams while flooding and if some areas of the network do not have group members, PIM-DM will prune off the forwarding branch by instantiating prune state [8] as done in NS2 TCL as,

```
#Selecting Multicast protocol
set mproto DM
#Allocate Group Address
set group [Node allocaddr]
#All Nodes will contain multicast protocol agents
set mrthandle [$ns mrtproto $mproto]
```

The prune message has a life time set with it. Once the lifetime expires, multicast datagram will be forwarded again to the previously removed/pruned branches.

Graft messages are used when a new member for a group appears in a pruned area. The router sends a graft message toward the source for the group to turn the pruned branch back into a forwarding branch for multicast messages.

D. *Queuing Method*

1) Drop Tail

Drop Tail is a Passive Queue Management (PQM) algorithm which only sets a maximum length for each queue at router [9]. Routers decide when to drop packets. It uses first in first out algorithm. In Drop Tail, the traffic is not differentiated. Each packet is has the same priority. When the queue buffer is filled to its maximum capacity, the packets arrived afterward are dropped till the queue is full. That is , Drop Tail will keep discarding/dropping the packet until the queue has enough room for new packets.

2) RED[3][10][11]

In this Method, dropping is based on the threshold values; minimum threshold T(min) and maximum threshold T(max). RED monitors the average queue size avg, and checks whether it lies between some minimum threshold and maximum threshold. If it does, then arriving packet is dropped or marked with probability p=p(avg) which is an increasing function of the average queue size [3]. If avg exceed T(max) , all the packet arrived will be dropped/discarded. Average is calculated as:

$$\text{Avg} = \begin{cases} (1-wq)avg+wq*q, & \text{if } q<0 \\ (1-wq)^m * avg, & \text{otherwise} \end{cases}$$

Where q is the current queue size , wq is the value given to the current queue [5].

Dropping probability; if count is the number of packets which are arriving consecutively and not discarded since the last discard packet. It has been sure that if count increases, then dropping probability will increase. Let P_x be the temporary probability which is varies from 0 to $P_{max.}$

$$P_x = \begin{cases} 0, & \text{if } avg= T_{thr}(min) \\ P_{max}, & \text{if } avg=T_{thr}(max) \end{cases}$$

We can map average queue size avg into the corresponding probability, $P_x(avg)$ as follows:

$$P_x(avg)=P_{max}*(avg-T_{thr}(min)/(T_{thr}(max)-T_{thr}(min))$$

Now, dropping (discard) probability can be calculated with the help of above two equations.

Expected number of packets which is discarded can be calculated as

$$N(d)= P_a N_1(d) + N_2(d)$$

Where $N_1(d)$ is the expected number of packets of the situation in which average queue size is lying between $[T_{thr}(min), T_{thr}(max)]$. $N_2(d)$ is the total number of packets discarded when average queue size is larger than maximum threshold $T_{thr}(max)$.

III. SIMULATION RESULT

A. Simulating Drop Tail in PIM-DM Multicasting Network represented in 2D

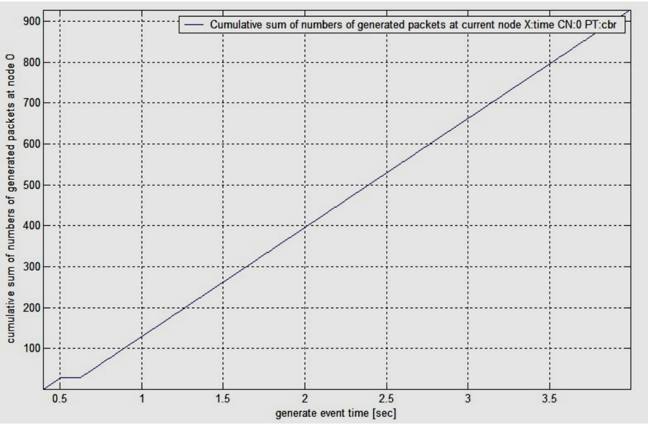

Fig.2 CBR packet generated at source 1

Fig.2 depicts, source 1 starts generating CBR packets after 0.4s of the start of simulation. Since the packet size is 210bytes and it is the beginning of the generation process, hence queue is empty and the graph shows the constant generation of packets in the range of 950 packets.

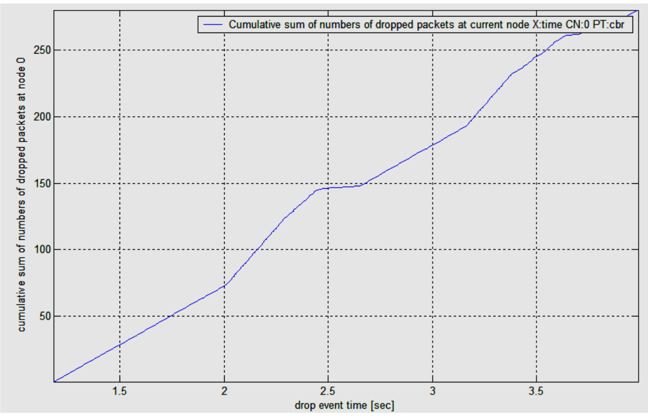

Fig.3 CBR packets dropped at source 1

Fig.3 shows, dropping of packets starts when the receiver nodes leave one multicasting group and join other. During this process prune and graft packets are generated by intermediate and leaf routers of the network. The queue starts getting full and the dropping increases. The graph shows the increase in dropping of packets at 2.4s due to the increase in traffic since source 2 also starts sending and nodes start joining this group while leaving other.

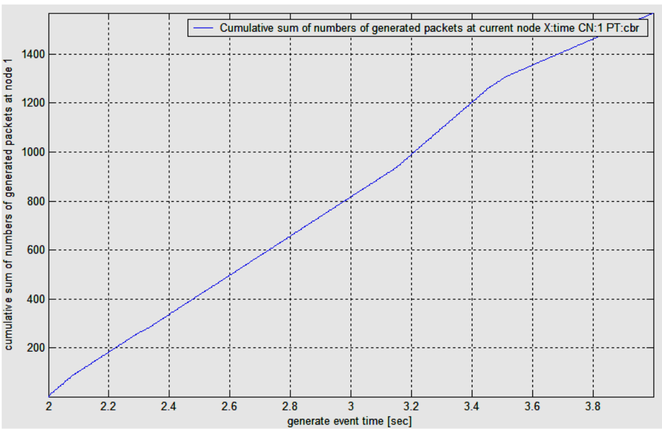

Fig.4 CBR packets generated at source 2

Fig.4 shows, source 2 starts generating CBR packets after 2s of the start of simulation. Number of packets generated is in the range of 1500 by the end of the simulation.

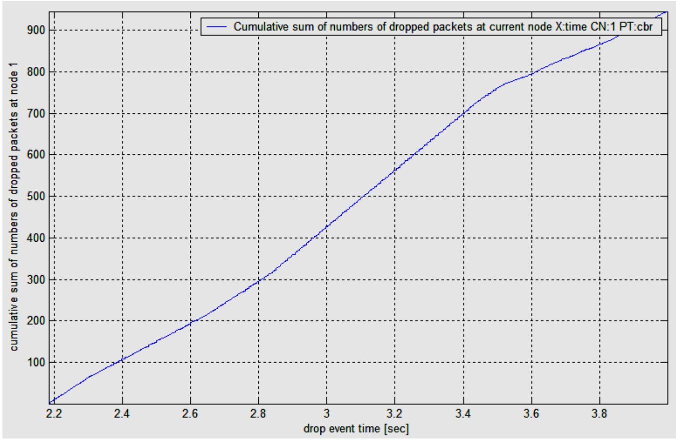

Fig.5 CBR packet dropped at source 2

Fig.5 shows, drop of CBR packets at source 2. Drop of packets starts at 2.2s of simulation. Source 2 is the gateway of source 1, so the queue of source 2 gets full early and starts dropping of packets after 0.2s of its packet generation which is in the range of 950.

B. Simulating Drop Tail in PIM-DM Multicasting Network represented in 3D.

Fig.6 shows total packets generated at each node in PIM-DM network including data packets by node 1 & 2 and prune & graft packets by other nodes.

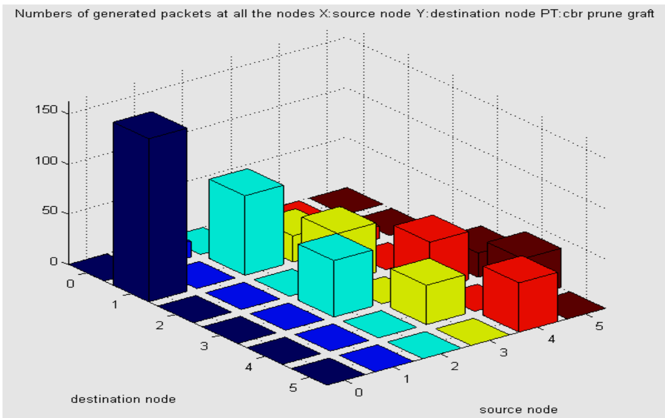

Fig.6 Packet generated at all the nodes

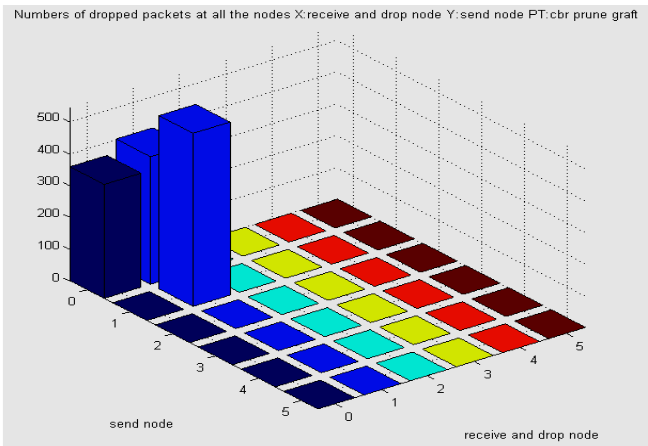

Fig.7 Packet dropped at all the nodes

Fig.7 shows, dropping of packets at source nodes. Number of packets dropped at source node 2 is in the range of 900 whereas number of packets dropped at source 1 is in the range of 350.

C. Simulating RED in PIM-DM Multicasting Network represented in 2D

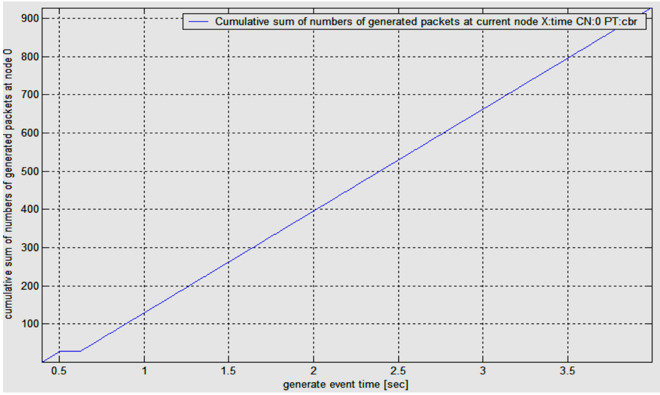

Fig.8 CBR packets generated at source 1

Fig.8 depicts, source 1 starts generating CBR packets after 0.4s of the start of simulation. Since the packet size is 210bytes and it is the beginning of the generation process, hence queue is empty and the graph shows the constant generation of packets in the range of 950 packets.

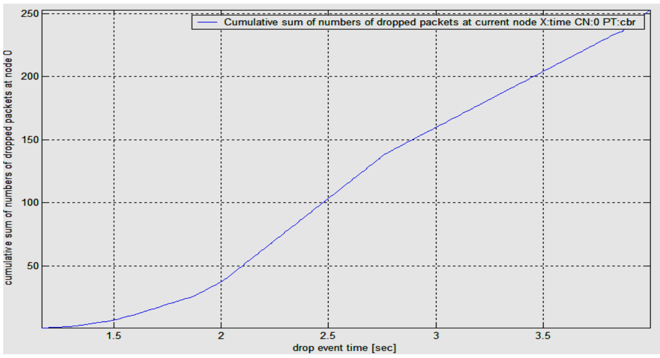

Fig.9 CBR packet dropped at source 1

Fig.9 shows, drop of packets starts when the receiver nodes leave one multicasting group and join other. During this process prune and graft packets are generated by intermediate and leaf routers of the network. The queue starts getting full and the dropping increases. The graph shows that increase in drop of packets is below 50 before 2.05s whereas drop of packets increases 50 at 1.75s in Drop Tail queuing implementation. Total number of dropped packets is in the range of 250.

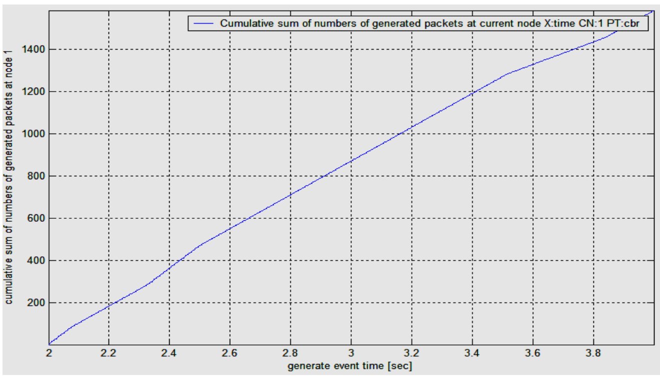

Fig.10 CBR packet generated at source 2

Fig.10 shows, source 2 starts generating CBR packets after 2s of the start of simulation. Number of packets generated is in the range of 1500 by the end of the simulation.

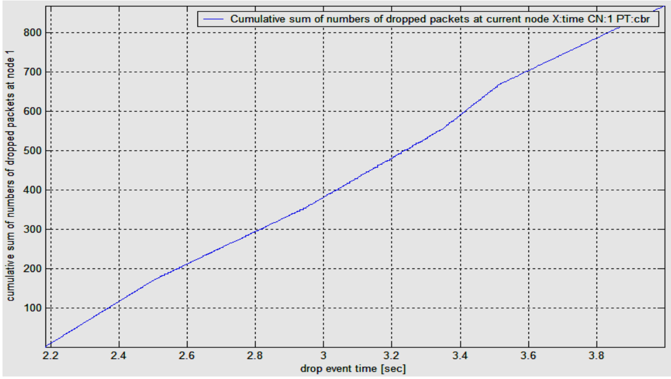

Fig.11 CBR packet dropped at source 2

Fig.11 shows, drop of CBR packets at source 2. Drop of packet starts at 2.2s after simulation starts. Source 2 is the gateway of source 1, so the queue of source 2 gets full early and starts dropping of packets after 0.2s of its packet generation which is in the range of 800.

D. Simulating RED in PIM-DM Multicasting Network represented in 3D

Fig.12 shows total packets generated at each node in PIM-DM network including data packets by node 1 & 2 and prune & graft packets by other nodes.

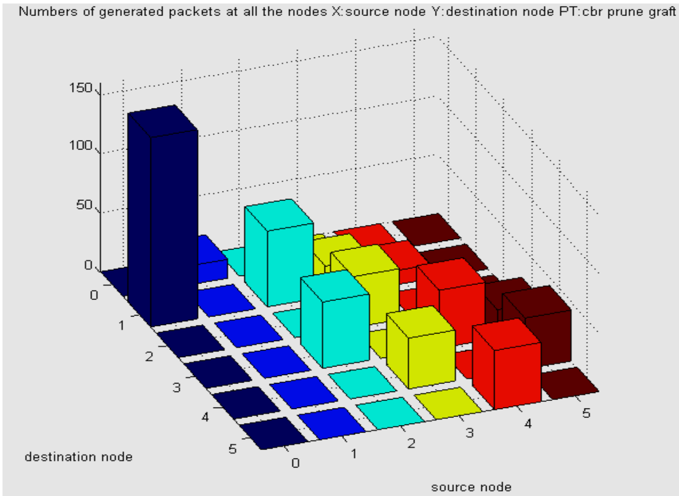

Fig.12 Packets generated at all the nodes

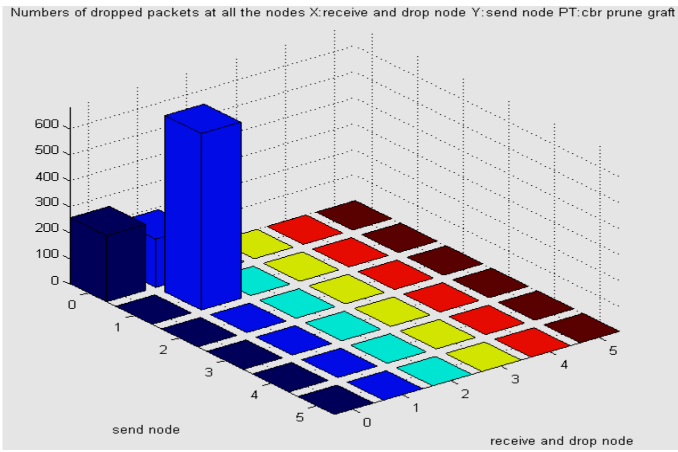

Fig.13 Packets dropped at all the nodes

Fig.13 shows, drop of packets at source nodes. Number of packets dropped at source node 2 is in the range of 750 whereas number of packets drop at source 1 is in the range of 250.

E. Simulating Results

Fig.14 shows Simulating information in Drop Tail queuing method with number of packets generated, sent, forwarded, dropped and lost.

Fig.15 shows Simulating information in RED queuing method with number of packets generated, sent, forwarded, dropped and lost.

Simulation information:

Simulation length in seconds:	3.5994
Number of nodes:	6
Number of sending nodes:	6
Number of receiving nodes:	6
Number of generated packets:	3095
Number of sent packets:	2096
Number of forwarded packets:	1702
Number of dropped packets:	1303
Number of lost packets:	1575
Minimal packet size:	80
Maximal packet size:	210
Average packet size:	194.1892
Number of sent bytes:	372430
Number of forwarded bytes:	357420
Number of dropped bytes:	263490
Packets dropping nodes:	0 1

Fig.14 Simulation information in Drop Tail

Simulation information:

Simulation length in seconds:	3.5994
Number of nodes:	6
Number of sending nodes:	6
Number of receiving nodes:	6
Number of generated packets:	3097
Number of sent packets:	1995
Number of forwarded packets:	1809
Number of dropped packets:	1124
Number of lost packets:	1435
Minimal packet size:	80
Maximal packet size:	210
Average packet size:	193.9971
Number of sent bytes:	346150
Number of forwarded bytes:	379890
Number of dropped bytes:	235780
Packets dropping nodes:	0 1

Fig.15 Simulation information in RED

IV. CONCLUSIONS

Simulation results noted out to be drop out data packets are 1303 for Drop Tail and 1124 for RED queuing methodology for PIM-DM Multicasting Network. Hence there is 13.735% percent increase in performance and conclude RED to be better queuing algorithm for our networking topology in TCL using default simulation environment of NS2.

REFERENCES

[1] S S Nagamuthu Krishnan, Prof. (Dr).V Saravanan, “Defending Denial of Service: State Overload”, Int. J. Advanced Networking and Applications Volume: 02, Issue: 03, Pages: 719-722 (2010).

[2] The ns Manual (formerly ns Notes and Documentation), The VINT Project A Collaboration between researchers at UC Berkeley, LBL, USC/ISI, and Xerox PARC. Kevin Fall hkfall@ee.lbl.govi, Editor Kannan Varadhan hkannan@catarina.usc.edui, Editor, May 9, 2010, page no 73

[3] NS Simulator for Beginners, Lecture notes, 2003-2004, Univ. de Los Andes, Merida, Venezuela and ESSI, Sophia-Antipolis, France, Eitan Altman and Tania Jimenez December 4, 2003, Page No-75.

[4] http://www.icir.org/floyd/red.html.

[5] D. Que, Z. Chen, B. Chen, “An improvement algorithm based on RED and its performance analysis”, 9th Int. Conf. on Signal Processing, Oct. 2008, pp. 2005- 2008.

[6] B. Zheng, M. Atiquzzaman, “DSRED: A New Queue Management Scheme for the Next Generation Networks” IEICE Trans. On Communications, Vol. E89-B, No. 3, 2006, pp. 764-774.

[7] Multicasting White paper ,Allied Telesis,Can be found at http://www.alliedtelesis.com/media/pdf/multicasting_wp.pdf

[8] RFE-3973, http://www.ietf.org/rfc/rfc3973.txt

[9] Arash Dana and Ahmad Malekloo,“Performance Comparison between Active and Passive Queue Management” ,IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 3, No5, May 2010

[10] Sanjeev Patel, Pankaj Gupta and Ghanshyam Singh, “Performance Measure of Drop Tail and RED Algorithm, 2010 2nd International Conference on Electronic Computer Technology (ICECT 2010).

[11] S.Floyd and V. Jacobson, “Random early detection gateways for congestion avoidance”, IEEE Transactions on Networking, vol. 1, no. 4, pp. 3997-413, August, 1993.