International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 02, February 2016
www.ijarse.com
IJARSE
ISSN 2319 - 8354

MEASURING PERFORMANCE OF DELAY BASED CONGESTION CONTROL ALGORITHMS (LOW PRIORITY, WESTWOOD AND VENO)

Deepak Mehta[1], Sanjay Dahiya[2]

[1]Research Scholar, Dept. of CSE, JJT University, Rajasthan, (India)

[2]Dept. of CSE, Ch. Devi Lal State Institute of Engineering & Technology, Panniwala - Mota Sirsa, Haryana, (India)

ABSTRACT

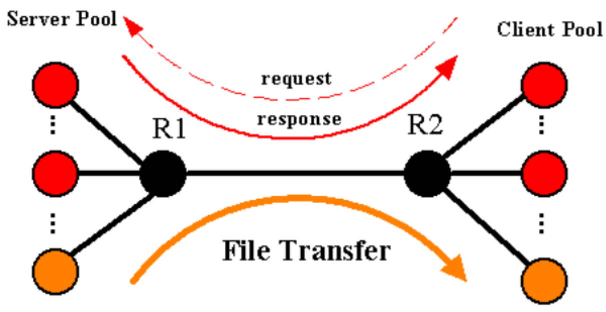
Transmission Control Protocol congestion control is backbone of the Internet stability. TCP Westwood, Veno routing agents are sender-side modification of the congestion window algorithm that improves upon the performance of Reno in wired as well as wireless networks. Both continuously measure the bandwidth at the TCP sender side via monitoring the rate of returning ACKs. This estimate is then used to compute congestion window and slow start threshold when congestion occurs. In contrast with TCP Reno which "blindly" halves the congestion window after three duplicate ACKs received. TCP LP implement the mechanism which provide "better than best effort service" by classifying the existing traffic as best-effort class and the other low-priority class. LP flows are able to successfully utilize excess network bandwidth; moreover, multiple TCP-LP flows share excess bandwidth fairly; substantial amounts of excess bandwidth are available to the low-priority class, even in the presence of "greedy" TCP flows.

Keywords: AODV, Best effort class,DSDV, DSR, Low Priority class, Reno,Slow Start

I. INTRODUCTION

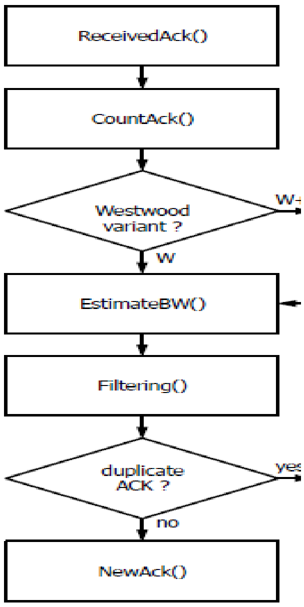
TCP congestion control mechanism was introduced by Van Jacobson in late 1980's. The internet was suffering from congestion collapse because sender sends their packets into internet as fast as advertised window allow and congestion occur at router cause packet drop. So, sender would time out and retransmit packet, this gives more congestion in internet. TCP uses acknowledgment for transmission of new packet. The available bandwidth changes over time so windows size must be changed over time. The algorithms used by TCP and problems. Basic algorithms are slow start algorithm, congestion avoidance, fast retransmit and fast recovery [6].

TCP-LPis a distributed algorithm that is realized as a sender-side modification of the TCP protocol. One class of applications of TCP-LP is low-priority file transfer over the Internet. For network clients on low-speed access links, TCP-LP provides a mechanism to retain faster response times for interactive applications using TCP, while simultaneously making progress on background file transfers using TCP-LP. Similarly, in enterprise networks, TCP-LP enables large file backups to proceed without impeding interactive applications, a functionality that would otherwise require a multi-priority or separate network. In contrast, TCP-LP allows low priority applications to use all excess capacity while also remaining transparent to TCP flows [7].



Bulk FTP flow using TCP-LP vs. TCP

TCP Westwoodcongestion control algorithm use a bandwidth estimation, it executed at sender side of a TCP connection. The congestion window dynamics during slow start and congestion avoidance are unchanged. The general idea is to use the bandwidth estimate BWE to set the congestion window (cwin) and the slow start threshold (ssthresh) after a congestion episode. In TCP Westwood the sender continuously computes the connection BWE which is defined as the share bottleneck used by the connection. Thus, BWE is equal to the rate at which data is delivered to the TCP receiver. The estimate is based on the rate at which ACKs are received and on their payload. After a packet loss, the sender resets the congestion window and the slow start. Threshold based on BWE. The packet loss is suspected with a reception of three duplicates ACKs or timeout expiration. Another important element of this procedure is the RTT estimation. That is because the congestion window is set precisely to BWE * RTT after indication of packet loss.



II. ALGORITHM AFTER THREE DUPLICATE ACK

The pseudo code of the TCP Westwood algorithm after three duplicate acknowledgements is:

After 3 DUPACKS

If receiving 3 DUPACKS

Set ssthresh=(BWE*RTTmin) /seg_size;

and if cwnd >ssthresh then set cwnd = ssthresh ;

enter congestion.

In the pseudo-code, seg_size indicates the length of TCP segments in bits. During the congestion avoidance phase the sender is trying for extra available bandwidth. If three duplicate ACKs are received, the network capacity might have been reached or that in case of wireless links, one or more segments have were dropped due to sporadic losses.

Veno makes use of a mechanism similar to that in Vegas to estimate the state of the connection, nonetheless, such a scheme is used to deduce what kind of packet loss–congestion loss or random loss—is most likely to have occurred, rather than to pursue preventing packet loss as in Vega. If packet loss is detected while the connection is in the congestive state, Veno assumes the loss is due to congestion; otherwise, it assumes the loss is random. Veno makes use of a mechanism similar to that in Vegas to estimate the state of the connection, nonetheless, such a scheme is used to deduce what kind of packet lossy congestion loss or random loss -- is most likely to have occurred, rather than to pursue preventing packet loss as in Vegas.

III. RELATED WORK

Jch described about TCP-LP in [1] that people prefer to Bit Torrent traffic to other network traffic. They always want to make BitTorrent traffic always stay "in the background", access to web and other traffic as much speed whenever needed. Since normal network traffic can be considered as "best-effort traffic", other traffic like BitTorrent traffic "less than best-effort". Author gave solution by taking example prevalent downloading application-µTorrent µTP which will always give priority or service to best effort clients to access the web and use network traffic when not in use or extra free traffic to download and. It can be implemented in operating system which consists in building in less than best-effort capabilities in a compatible manner, and so that all applications can use it. In Linux implemented as "low priority" variant of TCP called TCP-LP.

E. Fathima et.al coined the term Service prioritization in [2]. Author try to implement the mechanism which provide “better than best effort service” by classifying the existing traffic as best-effort class as the low-priority class. Author devised an approach which can also be called as distributed algorithm TCP Low Priority (TCP-LP). Its core characteristic isutilize only the excess network bandwidth as compared to the “fair share” of bandwidth as targeted by TCP. For early congestion indication, it use one-way packet delays and also use TCP-transparentcongestion avoidance policy. Author concluded that the LP flows are able to successfully utilize excess network bandwidth; moreover, multiple TCP-LP flows share excess bandwidth fairly; substantial amounts of excess bandwidth are available to the low-priority class, even in the presence of “greedy” TCP flows; The response times of web connections in the best-effort class decrease by up to 90% when long-lived bulk data transfers use TCP-LP rather than TCP; despite their low-priority nature, TCP-LP flows are able to utilize significant amounts ofavailablebandwidth in a wide-area network environment.

Vasudev I Kanani discussed about a sender-side modification congestion window algorithm named Westwood in [3]which is slighter improvement of Reno algorithm. Westwood continuously take bandwidth measures at the sender side via monitoring the rate of returning ACKs. This estimation is then used to calculate the congestion window and slow start threshold when congestion exhibit, after three duplicate acknowledgments or after a timeout. Since TCP Reno which "blindly" halves the congestion window after three duplicate ACKs, the working of Westwood is particularly effective over wireless links where sporadic losses due to radiochannel problems are often misinterpreted as a symptom of congestion by Current TCP schemes and thus lead to an unnecessary window reduction which was misinterpreted by Reno.

CLAUDIO CASETTI et.al characterized TCP Westwood (TCPW) a better approach for congestion control in wireless network [4]. TCP Westwood introduces a "faster" recovery mechanism to avoid over-shrinking CWnd after three duplicate ACKs. It does so by taking into account the end-to-end estimation of the bandwidth available to TCP but it performs poorly when random packet loss rate exceeds a few percent.

In the recent communication world amajority of people are accessing the network by wireless media. Wireless access networks in the form of wireless local area networks, home networks, and cellular networks are becoming an integral part of the Internet. Cheng Peng Fu proposed [5] a novel end-to-end congestion control mechanism called TCP Veno that is very effective for dealing with random packet loss. Basically Veno make minor changes only the sender-side protocol of Reno without changing the receiver-side protocol stackAmajor part of this technology is it monitors the network congestion level and uses that information to decide whether packet losses are likely to be due to congestion or random bit errors.Actually it refines the multiplicative decreasealgorithm of TCP Reno, by adjusting the slow-start threshold according to the perceived network congestion level rather than a fixed dropfactor and it refines the linear increase algorithm so that the connection can stay longer in an operating region inwhich the network bandwidth is fully utilized.

IV. QOS BASED PERFORMANCE METRICS

The performance metrics includes the QoS parameters such as Packet Delivery Ratio (PDR), average Throughput, average Delay, Routing Overhead and average Jitter.

Packet Delivery Ratio (PDR):PDR also known as the ratio of the data packets delivered to the destinations to those generated by the CBR sources. This metric characterizes both the completeness and correctness of the routing protocol.

$$PDR=\sum\frac{ReceivedPackets}{SentPackets}$$

Average End to End Delay: Average End to End delay is the average time taken by a data packet to reach from source node to destination node. It is ratio of total delay to the number of packets received.

$$\text{Average E2E Delay} = \frac{\sum(RecivedPacketsTime-SentPacketsTime)}{\sum ReceievedPackets}$$

Throughput: Throughput is the ratio of total number of delivered or received data packets to the total duration of simulation time.

$$\text{Throughput} = =\frac{\sum ReceivedPackets}{TotalSimulationTime}$$

V. SIMULATION RESULT & DISCUSSION

The performance of AODV, DSDV and DSR has been analyzed on Delay based TCP Variants varying number of nodes. The parameters used for simulation are summarized in Table 1.The performance metrics comprises of QoS parameters such as packet delivery ratio, average throughput, average delay

Simulation Environment in NS2 Simulator

Parameters	**Values**
Number of Nodes	10,30
Simulation Time	100
Environment Size	500X400
Traffic	FTP
Queue Length	50
Source Node	Node 0
Destination Node	All nodes except Zero node
Source Type	Veno, Westwood, LP
Routing Protocol	AODV, DSDV, DSR
Mobility Model	Random Way Point
Antenna Type	Omni Directional
Simulator	NS 2.35
Operating System	Cent OS 6

VI. RESULTS AND FINDINGS

Table 1

AODV(10 nodes)						
Metrics / Routing Agents	E2E Transmission Delay (ms)	Total Sent (bytes)	Total Received (bytes)	Packet Delivery Ratio	Throughput (KBPS)	packet loss
AODV_LP	0.6696807	5900	5530	93.73%	2.765	370
AODV_Westwood	0.73246466	5522	5153	93.32%	2.5765	369
AODV_Veno	0.67340289	6027	5747	95.35%	2.8735	280

Table 2

AODV(30 nodes)						
Metrics / Routing Agents	E2E Transmission Delay (ms)	Total Sent (bytes)	Total Received (bytes)	Packet Delivery Ratio	Throughput (KBPS)	packet loss
AODV_LP	0.738094369	6448	5462	84.71%	2.731	986
AODV_Westwood	0.738094369	6448	5462	84.71%	2.731	986
AODV_Veno	0.691729593	6887	5846	84.88%	2.923	1041

Table 3

DSDV (10 nodes)						
Metrics / Routing Agents	E2E Transmission Delay (ms)	Total Sent (bytes)	Total Received (bytes)	Packet Delivery Ratio	Throughput (KBPS)	packet loss
DSDV_LP	0.54496624	7282	7008	96.24%	3.504	274
DSDV_Westwood	0.58626886	6855	6523	95.16%	3.2615	332
DSDV_Veno	0.55396938	7065	6856	97.04%	3.428	209

Table 4

Table 4DSDV(30 nodes)						
Metrics / Routing Agents	E2E Transmission Delay (ms)	Total Sent (bytes)	Total Received (bytes)	Packet Delivery Ratio	Throughput (KBPS)	packet loss
DSDV_LP	0.590474748	6681	5745	85.99%	3.1025	936
DSDV_Westwood	0.590474748	7201	6205	86.17%	3.1025	996
DSDV_Veno	0.57794391	7081	6131	86.58%	3.0655	950

Table 5

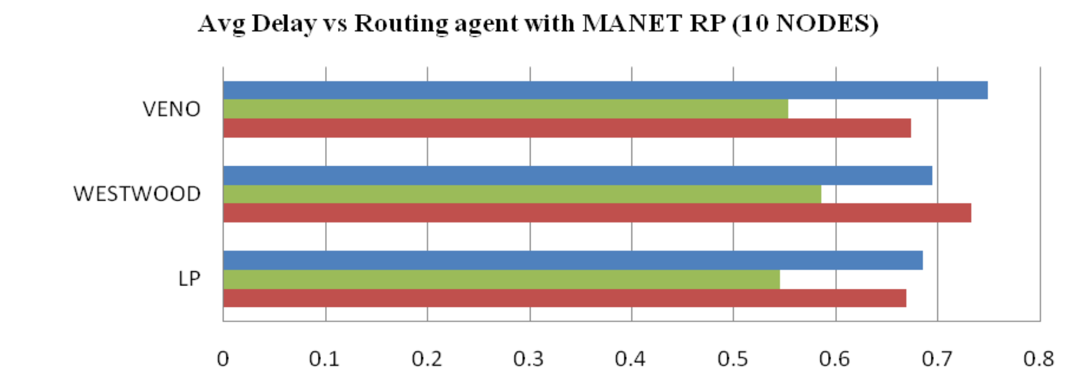
DSR(10 nodes)						
Metrics / Routing Agents	E2E Transmission Delay (ms)	Total Sent (bytes)	Total Received (bytes)	Packet Delivery Ratio	Throughput (KBPS)	packet loss
DSR_LP	0.68567734	6184	5863	94.81%	2.9315	321
DSR_Westwood	0.69408085	6104	5764	94.43%	2.882	340
DSRVeno	0.74882196	5986	5658	94.52%	2.829	328

Table 6

DSR(30 nodes)						
Metrics / Routing Agents	E2E Transmission Delay (ms)	Total Sent (bytes)	Total Received (bytes)	Packet Delivery Ratio	Throughput (KBPS)	packet loss
DSR_LP	0.690075019	7201	6205	84.71%	2.8725	996
DSR_Westwood	0.690075019	6681	5745	85.99%	2.8725	936
DSRVeno	0.712571351	6412	5577	86.98%	2.7885	835

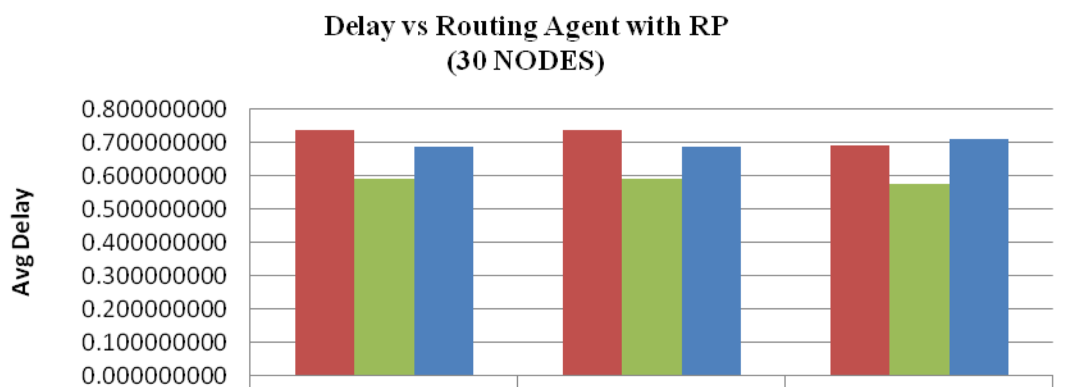
VII. AVERAGE DELAY

Fig 1, 2 display average delays versus routing agents for different MANET routing protocols (AODV, DSDV and DSR) for ten numbers of nodes under three delay based TCP variants aka delay based routing agents named LP, Westwood and Veno. It is observed that TCP LP having minimum average delay with DSDV routing protocol among three routing protocols.Same scenario also reflects in Westwood and Veno with DSDV routing protocol.Number of nodes increased even then DSDV with each routing agent exhibiting same low delay among three MANETrouting protocol.



	LP	WESTWOOD	VENO
DSR AVG Delay	0.685677338	0.694080846	0.748821957
DSDV AVG Delay	0.544966244	0.586268864	0.553969384
AODV Avg Delay	0.669680696	0.73246466	0.673402894

Figure 1



	LP	Westwood	Veno
AODV E2E Delay	0.738094369	0.738094369	0.691729593
DSDV Delay	0.590474748	0.590474748	0.57794391
DSR E2E Delay	0.690075019	0.690075019	0.712571351

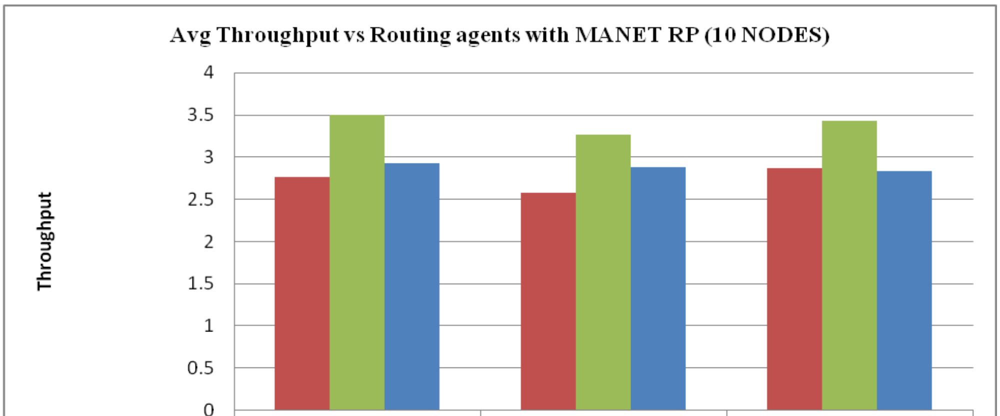
Figure 2

VIII. AVERAGE THROUGHPUT

Fig 3, 4 shows average throughput versus routing agents with different MANET routing protocols (AODV, DSDV and DSR)with ten numbers of nodes under three delay based TCP variants named LP,Westwood andVeno. It is observed that TCP LP have maximum average throughput with AODV routing protocol among three routing protocolsfollowed by DSR with Veno and DSDV with Westwood have high throughput but in AODV with Westwood have worst performance. On increasing the number of nodes 10 to 30 scenario changed DSDV came out exceptional growth in throughput with given routing agents. Same phenomena appeared in

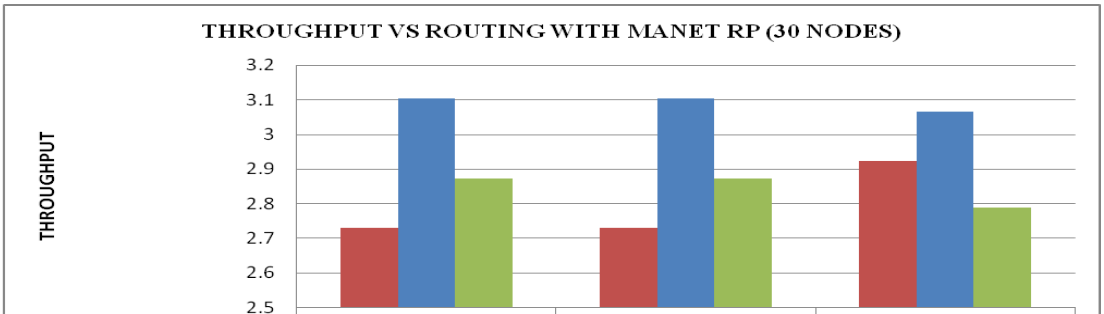
International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 02, February 2016
www.ijarse.com
IJARSE
ISSN 2319 - 8354

Westwood and LP on increasing the numbers of nodes so clear that when the number of nodes are becoming higher LP and Westwood showing same growth.



	LP	WESTWOOD	VENO
AODV Throughput	2.765	2.5765	2.8735
DSDV Throughput	3.504	3.2615	3.428
DSR Throughput	2.9315	2.882	2.829

Figure 3

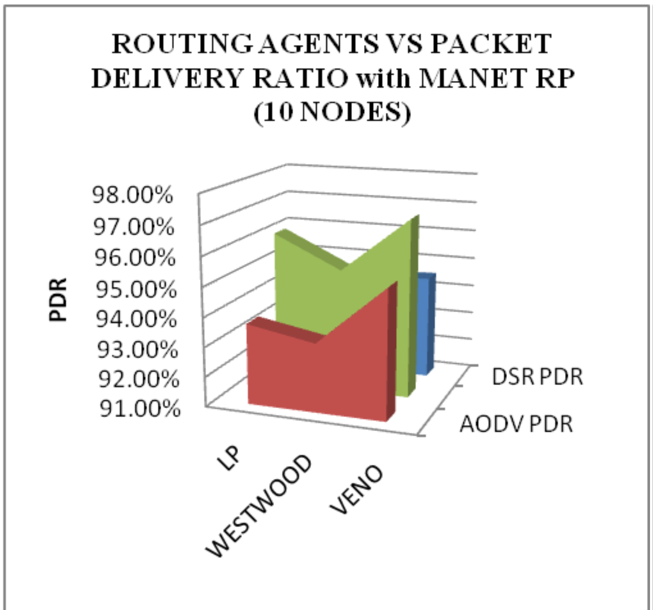


	LP	Westwood	Veno
AODV THROUGHPUT	2.731	2.731	2.923
DSDV THROUGHPUT	3.1025	3.1025	3.0655
DSR THROUGHPUT	2.8725	2.8725	2.7885

Figure 4

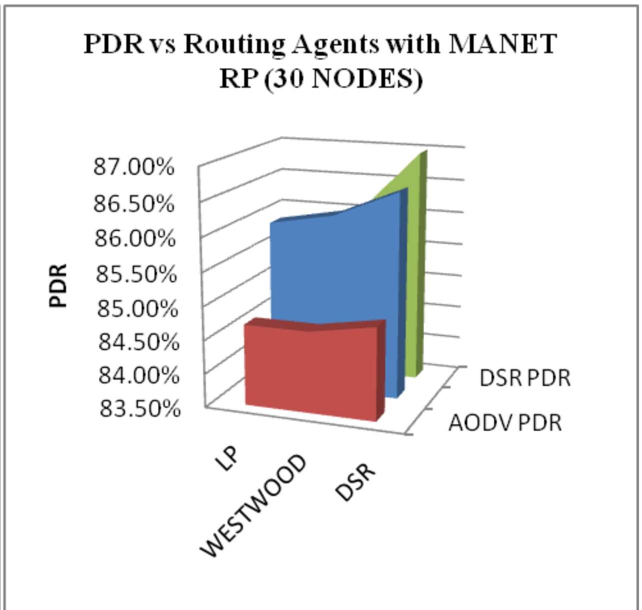
IX. PACKET DELIVERY RATIO

Figure 5, 6 shows Packet Delivery Ratio versus Routing Agents with different routing protocols with ten numbers of nodes with three TCP variants named LP, Westwood and Veno. It is observed that DSDVwith LP, Westwood and Veno have high packet delivery ratio but AODV with different routing agent displaying worst performances especially with Westwood but on increasing the number of nodes 10 to 30 packet delivery ratio increased in DSR MANET routing protocol.



	LP	WESTWOOD	VENO
AODV PDR	93.73%	93.32%	95.35%
DSDV PDR	96.24%	95.16%	97.04%
DSR PDR	94.81%	94.43%	94.52%

Figure 5



	LP	WESTWOOD	DSR
AODV PDR	84.71%	84.71%	84.88%
DSDV PDR	85.99%	86.17%	86.58%
DSR PDR	84.71%	85.99%	86.98%

Figure 6

X. CONCLUSION

Above scenarios reflect that DSDV with any routing agents (LP, Westwood, and Veno) exhibiting better result among three MANET Routing protocols with high scalability.

Same scenarios can be tested with different active queue management techniques.

REFERENCES

[1] Jch ,(2010,April)-“ Better than µTP? TCP-LP in Transmission” January 30,2016 from https://forum.transmissionbt.com/viewtopic.php?t=9945

[2] E. Fathima and K.P. Kaliyamoorthie 2014. An Innovative of Low-Priority Service via End-Point Congestion Control for TCP-LP, Middle-East Journal of Scientific Research 20 (1): 100-107, 2014 ISSN 1990-9233

[3] Vasudev I Kanani, Mr.Krunal J Panchal 2014. Performance Analyses of TCP Westwood, IJEDR, Volume 2, Issue 2, ISSN: 2321-9939

[4] CLAUDIO CASETTI, MARIO GERLA, SAVERIO MASCOLO, M.Y. SANADIDI and REN WANG-TCPWestwood: End-to-End Congestion Control for Wired/Wireless Networks, 2002 Kluwer Academic Publishers Manufactured in The Netherlands Wireless Networks 8,pg- 467–479, 2002, *and ISSN*: 1022-0038.

[5] Cheng Peng Fu, Soung C. Liew- TCP Veno: TCP Enhancement for Transmission Over Wireless Access Networks, IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 21, NO. 2, FEBRUARY 2003, ISSN: 0733-8716, Feb 2003.

[6] ShimaaHagag and Ayman El-Sayed "Enhanced TCP Westwood Congestion Avoidance Mechanism (TCP WestwoodNew)" International Journal of Computer Applications (0975 – 8887) Volume 45– No.5, May 2012

[7] KeranaHanirex, D. and K.P. Kaliyamurthie, 2013 Multi-classification approach fordetecting thyroid attacks, International Journal of Pharma and Bio Sciences, 4(3): B1246-B1251.