Performance Analysis of TCP LBA and TCP TAHOE Approaches in 802.11g Standard

Savreet KaurBrar[1], Sandeep Singh Kang[2]

[1] *(MTechCSE Student, Chandigarh Engineering College Landran,India)*

[2] *(Associate Professor and Head CSE, Chandigarh Engineering College Landran (Mohali)*

ABSTRACT:

In this paper we analyzed the performances of the two approaches i.e. TCP Tahoe and TCP LBA in wireless networks. We study the affect of mobility in the transmission range of 2.4 GHz. We first investigate the performance of TCP Tahoe protocol with this transmission range and then compares with TCP LBA approach in 52 mobile nodes. These mobile nodes moves in random Walk model by employing these approaches. The proposed algorithm used in TCP LBA approach that solves the congestion and acknowledgment related problems. Simulation results show that the proposed algorithm outperforms over TCP Tahoe in terms of Average delay and congestion.

Keywords: *TCP, TCP LBA, TCP Tahoe,congestion, delay.*

1. Introduction

TCP is a Transmission control protocol that works on the transport layer and relates to its error free connection oriented protocol. This connection oriented protocol establishes the connection between the source machine and destination machine. If an error occurred in between the data transmission then TCP checksum is detected and receiver request to the source machine for retransmission of the packet [6]. For the transmission of relatively large quantities of data or important information, it makes sense to use this transport layer protocol. The connection oriented feature of the protocol means that it will require a period of time for the source and destination to exchange handshake information [6].

The TCP Protocol guaranteed the delivery of packets in the wired networks but comparing with the wireless networks that would causes more packet losses. These packets losses not causes due to congestion but also due to high error rates, wireless link errors, host mobility, longer delay and lower bandwidth [2]. The number of TCP enhanced schemes should be proposed to improve the performance of TCP protocol before it is applied to the wireless networks to solve the problems [2]. This section explained the two approaches i.e. TCP Tahoe and TCP Lost Based Acknowledgment (TCP LBA).

1.1 TCP Tahoe [1]

TCP Tahoe had been performed multi-faceted congestion control mechanism. This type of protocol mostly works on the wireless networks; when there is a congestion and retransmission problems. To tackle these problems the TCP Tahoe performed slow start mechanism and set the

congestion window is 1 that means when the connection was restart or connection open then it starts transmission of the packets and increases the congestion window every time with the successful transmission of the packets. If any congestion occurs on the media then it reduces the congestion window and then again the packets were restart. This protocol periodically checks the timeouts if the packets losses are there.

For congestion avoidance Tahoe uses Additive Increase Multiplicative Decrease. A packet loss is taken as a sign of congestion and Tahoe saves the half of the current window as a threshold value. It then set CWD to one and starts slow start until it reaches the threshold value. After that it increments linearly until it encounters a packet loss. Thus it increase it window slowly as it approaches the bandwidth capacity.

1.2TCP-LBA [2]

TCP Lost Based Acknowledgment is the new acknowledgment technique that reduces the acknowledgment number and optimized the acknowledgments in TCP protocols. This type of acknowledgment mechanism is used by TCP sender and TCP receiver. This type of mechanism wait for the TCP packets send by the TCP sender; if the TCP sender sends all the packets to the TCP destination machine then this destination machine counts the packets; also marks the packet loss and then inform to the sending machine. The destination machine doesn't acknowledged each packet that means it only reply when all the packets is received.

Fig. 1.1: TCP-LBA Header Format [2]

Source Port (16 bit)									Destination port (16 bit)
Number of Total Piece(32 bit)									
Number of current Piece (32 bit)									
Data offset (4 bit)	Piece type (2 bit)	Reserved(4 bit)	URG	ACK	PSH	RST	SYN	FIN	Window (16 bit)
Checksum (16 bit)									Urgent pointer (16 bit)
Options									Padding
Data (if any)									

The TCP-LBA Header format explained as:

(1) The Source and Destination machines are those machines which are able to communicating with each other and these communicating machines transfer request/reply from the assigned port numbers.

(2) The total piece defines the number of total pieces received from the destination machine and number of current piece specifies the TCP sender machine sending the data. To count the loss packets from the TCP sender and receiver machines both have been subtracted and resultant the number of loss packets i.e. mark by the TCP Receiver machine.

(3) These fields similar from the TCP Header format.

(4) The checksum field only detects the error in the packet and look for TCP Checksum fields whereas the urgent pointer points the urgent data only.

(5) Options, padding and data are the same fields i.e. used in TCP header format.

2. Related Work

The number of TCP approaches had been discussed by the authors earlier and these approaches are experimenting but none of the approach provides an accurate result. We are using a link layer schemes and summarized the authors work given below:

Gergo Buchholcz et.al.(2003) explained Packet losses are indicated either by a timeout or by three duplicate acknowledgements triggering fast retransmit, fast recovery. Because a timeout is a very strong indication for network congestion, the proposed mechanism was invoked. Whenever an acknowledgement arrives, the source checks whether it is acknowledging new segments or segments that have been previously acknowledged. For congestion avoidance on the TCP networks it increments the window size. The TCP-ELN protocol managed the duplicate acknowledgments at the receiver end and checks by the sender side. The sender checks whether packet corruption on the radio channel and comparing the values of the corruption field received in the acknowledgment.

Thierry E. Klein et.al.(2004) worked on spurious Timeouts packet delay variability is buffer overflow, which may lead to further throughput degradations. The Authors propose a new scheduling algorithm that aims at controlling the variability of the interscheduling interval. the scheduling algorithm can induce significant inter-scheduling intervals and highly varying packet transmission times. This algorithm attempts to maximize the total system throughput as measured at the TCP layer. The experimental test-bed designed in his work that uses 2 GHz carrier frequency, set different transmission rates 320 kbps, 480 kbps, 640 kbps, 1.28 Mbps, 1.92 Mbps and 2.56 Mbps, packet length 560 bytes in the opnet simulator. The window size selected by the author is 64 Kbytes. The Author avoids unnecessary

TCP timeouts in his work and consequently achieves greater TCP throughput.

Wang Long et.al. (2010) has been proposed to improve TCP performance in such network. In TCP-LBA, TCP Receiver was reply ACK packet only when TCP Sender had finished sending all pieces within the same TCP Window and there are packets lost during transmission. The TCP-LBA implemented in OPNET simulation tool and the bandwidth of the wireless network is set at 256 kbps, and packet latency is 10ms. This scheme greatly reduces the ACK packet number, eliminates delayed ACK packets bad influence on efficiency of the data transportation and keeps nice transporting efficiency. At last, the simulation results show that the proposed scheme could significantly improve TCP throughput and reduce delay over wireless networks.

Breeson Francis et.al. (2012) had changed the level of congestion; retransmission timeouts for packets lost in transmission is unavoidable. The Authors presented various performance improvements over asymmetric wireless network. The authors proposed a sender based approach where they uses Serialized Timer Approach that controls the congestion and secondly they uses Modifying Fast Retransmission that needs to be modified to detect loss of packets retransmitted and send it again immediately. Although developments in lower layers have substantially increased the reliability of wireless networks, TCP performance in wireless networks is much lower than its wired counterpart. This is mostly due to the control traffic, both at MAC layer and TCP Layer. Reducing control traffic at TCP is one way ahead to increase TCP throughput.

3. Proposed Algorithm

In this Section, the Algorithm had been implemented with the help of TCP-LBA Approach [2] and TCP protocol [3]

Step 1: Sender Establish the connection to the receiver.

Step2: The Receiver sends an Ack of the reply of Sender.

Step3: The connection Establish between Sender and Receiver.

Step4: The Sender sends the data to the receiver.

Step5: If the congestion occurs

Step6: The TCP-LBA Uses

N_{Ack} = Y+1; where y is the number of lost packets during transmitting [2]

Step7: The lost packets successful retransmitted.

Step8: The connection terminates by both ends.

3.1 Flow Chart of Proposed work

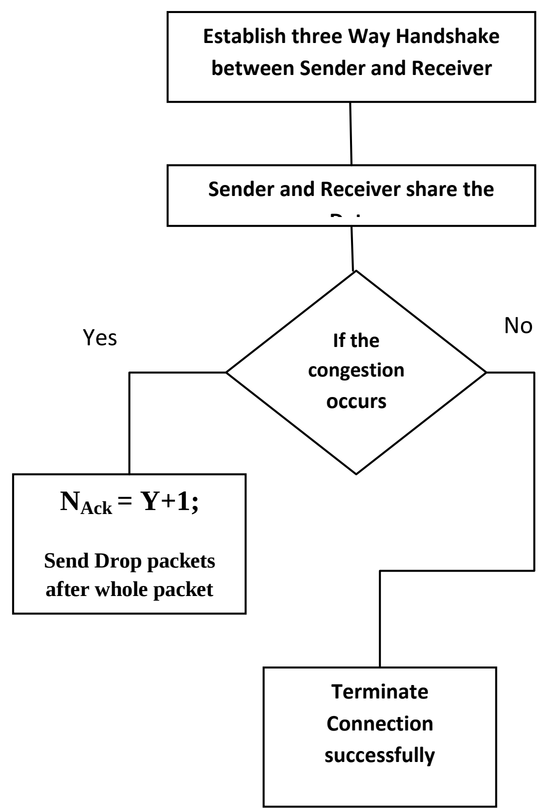

Fig. 1.2: Flowchart of TCP LBA

4. Simulation Results

The Simulation conducted in network simulator (Ns2 allinone 2.34) [9] and implementing the discussed section 3 approach in this simulator. This approach uses IEEE 802.11g standard with the frequency of 2.4 GHz and this standard apply on the 52 nodes also with two base stations acting as an routers. These routers were transmitting the traffic in the nodes and disseminating the packets. The AODV protocol maintained the routing tables and these routing tables provide shortest distance information; if the link had been failure then advertise the messages to each node.

4.1 Average Delay

The delay defines the transmission of time when the source machine sends the packet to receiver machine. The delay is counted in seconds. When the packets doesn't received by the receiver then time is increases and suffers by whole network. This section compares the two approaches of TCP i.e. TCP LBA and TCP Tahoe. This Figure illustrates that the average delay of TCP LBA is less than TCP Tahoe.

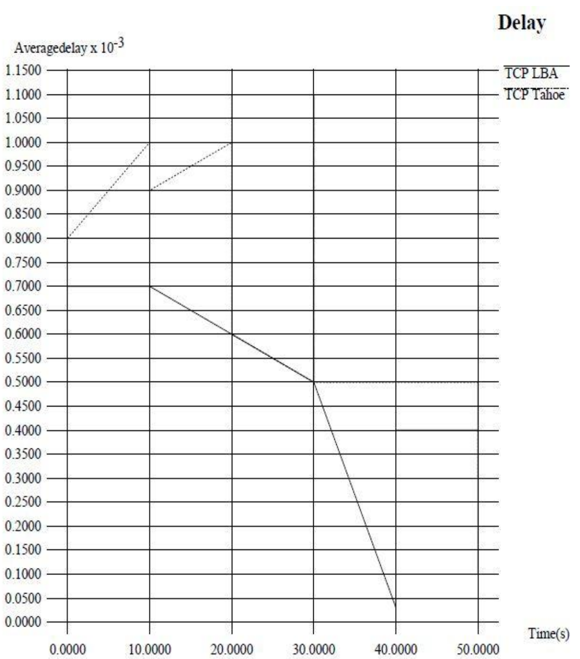

Fig. 1.3: Delay

4.2 Congestion

When the number of packets forwarded by the originator machine and these forwarded packets was received by the destination machine successfully then we say performance of the network is good. When the receiver machine doesn't cope all the packets resultant number of packets was dropped then it is called congestion. This section compares the two protocols explained in section 1.1 and 1.2. It is clearly specified that congestion occurs in TCP Tahoe approach.

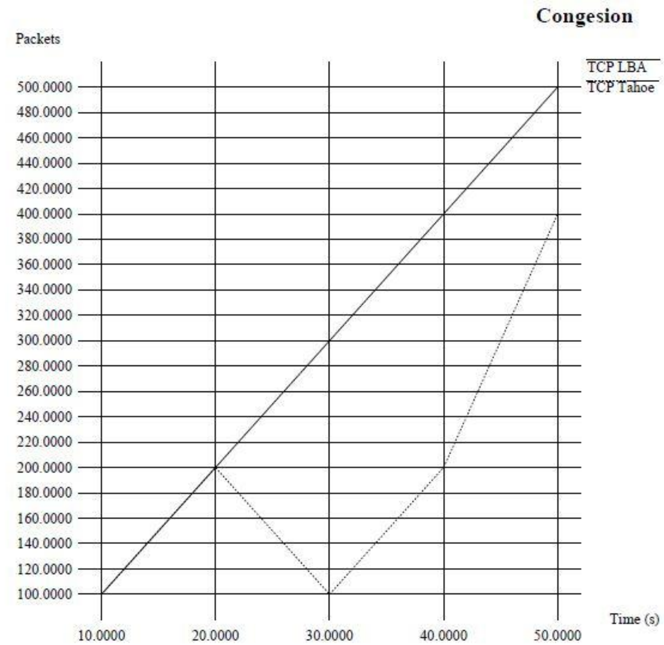

Fig. 1.4: Congestion

5. Conclusion

In this paper we present the TCP LBA Approach with modifying the algorithm with the TCP protocol. This Algorithm applies on the 52 mobile nodes with 2.4 GHz transmission range. Compared to TCP Tahoe, the TCP LBA protocol has better performance in wireless networks. The simulation has conducted in NS2 simulator [9] and the results collected from xgraph tool.

References

[1] Breeson Francis, Venkat Narasimhan, Amiya Nayak, Ivan Stojmenovic,"Techniques for Enhancing TCP Performance in Wireless Networks",International Conference on Distributed Computing Systems Workshops, 2012, pp.222-230.

[2]Wang Long et.al.," Performance Analysis of Improved TCP over Wireless Networks", International Conference on Computer Modeling and Simulation 2010,pp.239-242.

[3] W.R. Stevens, TCP/IP Illustrated, Vol. 1. Reading, MA: Addison-Wesley, Nov. 1994.

[4] Gergo Buchholcz, Adam Gricser, Thomas Ziegler, Tien Van Do, "Explicit Loss Notification to Improve TCP Performance over Wireless Networks", springer, 2003, pp.481-492.

[5] Thierry E. Klein, Kin K. Leung and Haitao Zheng," Improved TCP Performance in Wireless IP Networks through Enhanced opportunistic Scheduling Algorithms", IEEE,2004, pp.2744-2748.

[6] Gilbert Held, "TCP/IP Professional Reference Guide", CRC Press, 2001, pp.21-22.

[7] Sebastian Zoller, Markus Wachtel, Melanie Siebenhaar, Ralf Steinmetz," Efficient Real-Time Monitoring of Multimodal Transports with Wireless Sensor Networks",IEEE.

[8] XiangYang Li,"Wireless Ad Hoc and Sensor Networks",Cambridge University Press.
[9] ns-2 Simulator(www.isi.edu/nsnam/ns)
[11] Fei Peng, Jian Ma, Shiduan Cheng, Jing Wu, Lei Guo, "TCP Performance Enhancements in Wireless and Mobile Networks", International Conference on Communication Technology ICCT'98, 1998.