Enhanced TCP for Congestion Control in MANET

Vinita Dewariya
Research Scholar, Department of CSE/IT
Madhav Institute of Technology and Science, Gwalior, India
Vinitadewariya1990@gmail.com

Neha Bhardwaj
Assistant professor, Department of CSE/IT
Madhav Institute of Technology and Science, Gwalior, India
bhardwaj.neha08@gmail.com

Abstract—Mobile ad-hoc network is a decentralized network, where nodes are mobile. It is dynamic in nature. nodes autonomously join or leave the network. Due to its characteristics, this network faces various problems. One of the major problem is congestion. it occurs in congestion there is huge data packet in the network that cannot be control easily. The existing approach works well in the wired scenario and provides good results but in the wireless scenario, it does not work properly. In our proposed work the performance the existing compound TCP for wireless scenario is improved upgrade TCP give satisfactory result in high speed huge network. Upgrade TCP is a TCP for fast speed and huge network. Upgrade TCP execute congestion control with the help of a combination of open congestion window or delay based method, for transmission data or packet or mutual understanding among all sender or receiver we apply synchronization in TCP handshaking mechanism. In our propose work, we explain working of upgraded TCP.

Keywords—*MANET, Congestion, TCP*

I. Introduction

Mobile ad-hoc network (MANET) is basically network. That does not require any base station for communications and governing its functionality. The network is a self-sufficient transitory association of mobile nodes that keep up a communication with every different mode over wireless links. Nodes that lie within every other's range can keep up a communication immediately and are responsible for dynamically discovering each other. As a way to allow communication between nodes that are not in the range of others, intermediate nodes act as routers that forward packets generated from different nodes to their destination. These nodes are energy constrained that is, these nodes are battery-powered devices the network moreover, devices are free to become a member of or leave the network and they may transfer randomly. And have unpredictable topology alterations. In this power-restrained, dynamic, disbursed multi-hop atmosphere, nodes have to arrange themselves dynamically to be able to furnish the quintessential community functionality in the absence of fixed infrastructure or significant administration.

Congestion Control [1] is a problem of the network it occurs when there is huge data that the network cannot control anymore. Congestion is a problem for wired and wireless network. Because of congestion problem packet loss, packet delay or lockout can occur in the network. It takes a long time to overcome that situation. There are number of methods or techniques that used to control congestion, for example, exponential back off, congestion control in TCP, priority Schemes, Queue management. Exponential back off is used in CSMA/CA. CSMA/CA is the sensing scheme of 802.11. Whenever senders want to send data they first sense the channel. If the channel is busy it wait for a random amount of particular time and again sense the channel if the channel is free then sender sends data immediately otherwise again sender wait for a particular time. The random period calculated by exponential back off algorithm. Congestion control in TCP consists slow start, congestion avoidance, fast retransmission and recovery. TCP consist a method to control the transmitting rate of the sender. The TCP flow starts at very low level and increases exponential to the threshold. The congestion window increase by one segment whenever a successful transmission happens in TCP flow. When congestion occurs in network Priority scheme marks the packet with different priorities and drop low priority packet when it is needed. It is helpful to improves other methods and priority scheme is not real congestion control method. For congestion control, there is a Queue management which is used to control the queue traffic and to control the queue. In the network, it is a necessity that when several nodes transmit their data to a bottleneck link their needs a queue mechanism to avoid the congestion or to better utilize the network.

In comparison to a basic de-multiplexing protocol, a more advanced transport protocol is one that offers reliable communication. As a transport layer protocol, TCP gives reliable communication, all together conveyance of messages. It is a full duplex protocol, implying that every TCP connection supports a couple of streams, one streaming in every course. It additionally incorporates a flow control network for each of these streams that permit the collector (on both ends) to confine the measure of information the sender can transmit at a given time. Obviously, TCP bolsters the de-multiplexing system of UDP to permit numerous application programs on a given host to simultaneously convey over the Internet. Be that as it may, the de-multiplexing key utilized by TCP is the 4-tuple < source port; source host; destination port; destination host >to recognize the specific TCP connection. At the heart of TCP is the sliding window calculation. Despite the fact that this is the same basic calculation we have seen before for DLC, in light of the fact that TCP keeps running over the system as opposed to a solitary connection, there are numerous essential contrasts that confound TCP [2,3,4]. Parameters of a connection, for example, RTT and transmission capacity are altered and known. Therefore, a window size can be registered (a review that a window size of ¼ 1 + RTT (bandwidth frame size frames are suitable). TCP has no clue what connections will be crossed by the packets. Moreover, RTT might change contingent upon distinctive times of the day, regardless of the fact that the same set of connections is utilized. This data is additionally important to decide fitting time-outs. Finally, the sender and the recipient correspondence over TCP might have diverse rates; thus, the beneficiary must have ready to restrict the measure of information the sender can transmit (window size).

II. Enhanced TCP

Transmission Control Protocol (TCP) is a transport-layer protocol that is currently used as a standard over the Internet. However, the congestion control mechanism through of TCP New Reno, which is the most popular version of TCP, cannot make sufficient use of the network bandwidth in high-speed and long-distance networks [5]. Several methods have been proposed to solve this problem and improve the congestion control. These proposed methods based on two different approaches the loss based congestion control method & delay based congestion control method. In the former methods, the occurrence of congestion is determined from the loss of packets [6, 7]. The loss-based method can obtain a high throughput in a high-speed and long distance network. The congestion control mechanism based on delay method continues observing roundtrip times and adjusting the size of the congestion window according to change of the round-trip times [8]. However, The TCP that handles the congestion control based on delay method has a problem; The throughput degrades remarkably [9, 10]. Compound TCP is the new version of tcp that combines both of the approaches i.e. loss based method and delay based method. Compound TCP can make the maximum use of the bandwidth in a high-speed and long distance network. Moreover, Compound TCP can keep up with TCP New Reno in terms of fairness when it competes with the connection of TCP New Reno. On the other hand, when TCP New Reno is used in a wireless LAN environment, a degradation of the fairness among TCP New Reno connections is observed [11], [12], [13]. Like TCP New Reno, Compound TCP is based on the congestion control mechanism of a loss-based method. Therefore, when Compound TCP is used in a wireless LAN environment, the throughput among connections may become unfair. Compound TCP is a TCP for a high-speed and long-distance network. Compound TCP carries out the congestion control by combining the congestion control of a loss-based method that uses the packet loss as the index of congestion, and the congestion control of a delay-based method that uses network delay as the index of congestion.

Compound TCP carries out a window-based congestion control and adjusts the number of packets sent to a network. The number of packets is based on size of the loss window in the case of the congestion control mechanism of a loss-based method and the size of the delay window in the case of the congestion control mechanism of a delay-based method. The size of the loss window has two phases called the slow start phase and the congestion avoidance phase. The amount of increase in the size of the loss window changes with each phase. Compound TCP has two types of detection methods for the packet loss. When a packet loss is detected by the reception of the duplicate ACKs, it is judged that a slight congestion has occurred in the network, and Compound TCP decreases the size of the loss window to half of the current value. In contrast, when a packet loss is detected by the timeout, it is judged that a serious congestion has occurred in the network, and Compound TCP decreases the size of the loss window to one. Further, in the case of the delay window, the operation changes with each phase of the slow start phase and the congestion avoidance phase as in the case of the loss window size. The size of the delay window does not change in the slow start phase, but it changes only in the congestion avoidance phase. The amount of increase/decrease in the size of the delay window in the congestion avoidance phase is calculated.

DOI- 10.18486/ijcsnt.2016.5.1.03
ISSN-20536283

III. Related Work

Hisamatsu et al [14], examined the congestion control schemes of Compound TCP+, a protocol that improves the throughput fairness of Compound TCP connections in wireless LANs. In Compound TCP+, the change in the loss window size depends on the delay window. When the size of delay window is greater than zero, it is concluded that the network is not in a congested state. At this time, Compound TCP+ increases the loss window similar to the case of Compound TCP. When an appropriate ACK is received, and the delay window size is equal to zero, the network is considered to be in a lightly congested state. If the loss window increases as in the case of Compound TCP, the congestion will worsen, and lead to buffer overflow at the access points. Therefore, when the delay window size is zero, Compound TCP+ changes the loss window at every round-trip time.

Youssef Bassil et al [15] proposed a TCP congestion control scheme comfortable for wireless as well as system atmospheres. It is created by using any particular minute of the reticent minutes of the TCP legend to designate the variety of the connection above which a construction is recognized. If the connection is bound, the TCP reticent bit is fixed to 0 signifying a bound way; while, if the connection is wireless, the minute is fixed to 1 signifying a wireless way. Moreover, the system usages the SNR (Signal-to-Noise) part of perceiving the consistency of the association. In wired mode, any recreation is reflected a cramming defeat; and hence, cramming is evaded by exhausting the usual TCP start-slow procedure.

Wu E.H et al [16] small for Jitter TCP is a TCP mobbing order used to decide container damage and classify whether they are affected by blocking or little mistake. It is founded on the jitter ratio and packet-by-packet interval that are resolute by the inter-arrival jitter i.e. the container space at the source equaled with the container design at the receiver for a pair of packs. The inter-arrival jitter can be considered as charts. JTCP can conclude the container with slower communicated period and stays it into the router file pending blocking is resolute.

Bohacek et al. [17] noticed that when you consider that packet reordering is an original event within the network (e.g., in cellular ad hoc networks), replica ACKs cannot be viewed risk-free indications of either loss within the path or of congestion. In TCP- PR (chronic Reordering), the authors do not expect the validity of inferring whatever from reproduction ACKs. Unlike earlier developed congestion controls, TCP-PR keeps a timestamp for every transmitted information packet. A loss is detected each time the timestamp of an information packet turns into older than the estimated RTT maximum (M).

Wang and Zhang [18] have been involved with TCP efficiency in MANETs, which feature route alterations with high chance and, as a result, are enormously penalized through the conventional congestion manipulate algorithms. In the course of route changes many packets will also be misplaced, causing congestion control to make the incorrect determination of reducing the cost of drift. If we will establish a time interval for the period of which the community route has changed, then we are able to get rid of the penalty in TCP throughput via briefly disabling the congestion manipulate moves in the course of this interval. This inspiration underlies the proposed TCP DOOR (Detection of Out-of- Order and Response).

Rama Krishnan et al [19] is a system mobbing system that uses two moments in the IP caption and two minutes in the TCP legend to best the position of the system. In the case of crowding, the ECN while is usual to real in the latest communicated package. When the head set gets the package with ECN fixed to real, it collections the ECN minutes of the response package to real and conducts it to the source. The sender then decreases its space scope to escape cramming. Congestion coherence (CC) is an expansion over ECN to segregate damage. In case the ECN minutes are usual to real, then the absent package occurrence is produced by cramming; then, bits are fixed to incorrect, the gone container affair is affected by bit mistake.

IV. Problem Statement

The tcp, transport layer protocol works well in wired scenario but in wireless scenario nodes are mobile. its performance is not good .compound tcp works efficiently in wireless scenario by manage its window size.

V. Proposed Work

Upgrade TCP is a TCP for fast speed and huge network. Upgrade TCP execute congestion control with the help of a combination of open congestion window or delay based method, for transmission data or packet among all sender or receiver we apply synchronization in TCP handshaking mechanism. In our proposed work, we explain working of upgraded TCP. CTCP has three phases to communicate first at the time of handshaking synchronization take place between source and destination after that in any situation if congestion occurs than loss window has two phases first one is slow to start and the second one is congestion avoidance phase, loss window size increase in each phase. The size congestion window increase or decrease with the help of given steps

Step1: congestion window open
if (cwnd<ssthresh)
{

```
/* slow-start (exponential) */
cwnd += 10*(cwnd)/8;
 }
else
 {
  window increase according to threshold value
/*Here we apply synchronization mechanism*/
if ((lastcwndaction == 0|| lastcwndaction == CWNDACTIONTIMEOUT)&&maxssthresh> 0)
{
 increment = limitedslowstart(cwnd,maxssthresh, increment);
mtcplimslowstartflag = 1
}
cwnd += increment
}

step2:   congestion window decrease at spurious_timeout
cwnd = cwnd/2

step3: closecwnd
if (ssthresh< 2)
 {
ssthresh= 2;
cwnd= 1;
}

Step4: exit.
```

VI. Simulation & Results

Simulation parameters:
The work is carried on NS2 and the parameters used are depicted in the below-given table 1. For simulation, the XY dimensions are of 1000X1000 and number of nodes are 9.

Simulation parameters	Values
Number of nodes	9
Sending file	TCP
Protocol	DSDV
XY dimension	1000X1000
Channel	TwoRay Ground
Antenna	Omnidirectional
Simulation Start	0.1ms
Simulation End	10ms

Table.1 Simulation Parameters

Congestion window:
In the TCP, the congestion window is one of the variables that decides the quantity of bytes that can be exceptional whenever. The congestion window is kept up by the sender. Note this is not to be mistake for the TCP window size which is kept up by the beneficiary. The blockage window is a method for ceasing a connection between the sender and the beneficiary from getting over-burden with a lot of activity. It is figured by assessing the amount of blockage there is between the two spots. At the point when an association is set up, the congestion window, a quality kept up autonomously at every host, is set to a little various of the greatest fragment size permitted on that association. A further change in the blockage window is managed by an Additive Increase/Multiplicative Decrease approach. This implies if all sections are gotten and the affirmations achieve the sender on time, some steady is added to the window size. The window continues becoming exponentially until a timeout happens or the recipient achieves its point of confinement (an edge esteem "ssthresh"). After this the blockage window increments straightly at the rate of 1/(congestion window)packets on each new acknowledgment received.

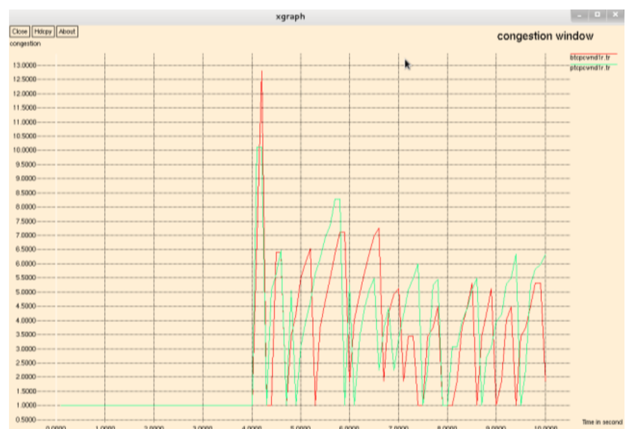

Fig.1 TCP Congestion Window Between Base And Proposed

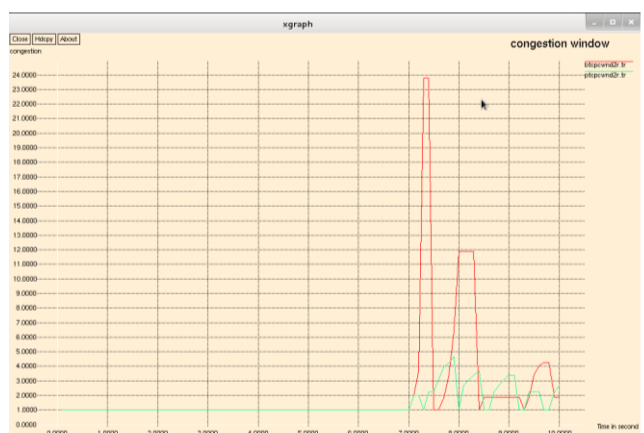

Fig.2 TCP Congestion Window Between Base And Proposed

Good put:
Good put is the application level throughput, i.e. the quantity of useful data bits conveyed by the system to a specific destination for every unit of time. The measure of

information considered rejects convention overhead bits and additionally retransmitted information parcels. This is identified as the measure of time from the first piece of the first bundle sent (or conveyed) until the last piece of the last packet is transmitted.

Fig.3 Good Put Comparison Between Base And Proposed

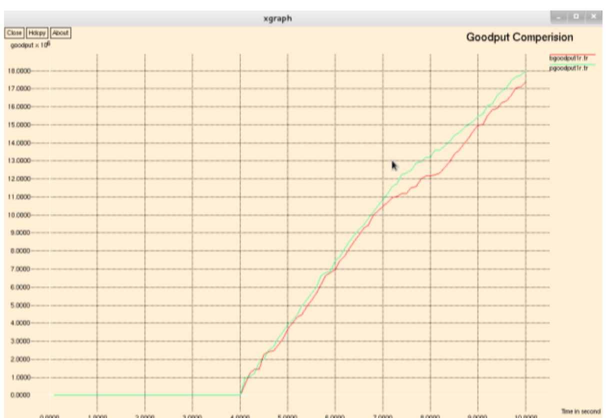

Fig.4 Goodput Comparison Between Base And Proposed

Conclusion

Congestion in MANET is an open issue that needs to be resolved. In this paper, work on enhancing the problem is existing approach. The simulation depicts that, the results of proposed approach is better than base approach. The congestion window of proposed approach is better and the good put of proposed approach is higher than base good put. In future, we can apply fuzzy set for controlling congestion. One possibility for the occurrences of congestion is the window size is increased or decreased, there is no proper synchronization. Thus applying fuzzy set in such a manner that there should be proper synchronization between sender and receiver or other recipients. Depending upon destination the size of the window at sender side will be incremented or decremented.

References

[1] John Nagle. RFC 896 – Congestion Control in IP/TCP Internetworks.Tools.ietf.org.1984-01-06. http://tools.ietf.org/html/rfc89

[2] Dimitri Bertsekas and Robert Gallager, Data Networks

[3] Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach

[4] Saad Mneimneh ;"Computer Networks UDP and TCP"Hunter College of CUNY. New York

[5] D. Katabi, M. Handley, and C. Rohrs, "Congestion control for high bandwidth-delay product networks," in Proceedings of ACM SIGCOMM 2002, Aug. 2002.

[6] S. Floyd, "Highspeed TCP for large congestion windows," RFC 3649, Dec. 2003.

[7] T. Kelly, "Scalable TCP: Improving performance in high speed wide area networks," in Proceedings of PFLDnet 2003, Feb. 2003.

[8] C. Jin, D. X. Wei, and S. H. Low, "FAST TCP: Motivation, architecture, algorithms, performance," in Proceedings of IEEE INFOCOM 2004, Mar. 2004

[9] K. Tan, J. Song, Q. Zhang, and M. Sridharan, "Compound TCP: A scalable and TCP-friendly congestion control for high-speed networks," in Proceedings of PFLDnet 2006, Feb. 2006.

[10] K. Tan, J. Song, and Q. Zhang, "A compound TCP approach for high speed and long distance networks," in Proceedings of IEEE INFOCOM 2006, Jul. 2006, pp. 1–12.

[11] S. Pilosof, R. Ramjee, Y. Shavitt, and P. Sinha, "Understanding TCP fairness over wireless LAN," in Proceedings of IEEE INFOCOM 2003, Apr. 2003.

[12] C.Wang andW.Tang, "A probability-based algorithm to adjust contention window in IEEE 802.11 DCF," in Proceedings of ICCCAS 2004, Jun. 2004

[13] Y. Yang, J. Wang, and R.Kravets, "Distributed optimal contention window control for elastic traffic in wireless LANs," in Proceedings of IEEE INFOCOM 2005, Apr. 2005, pp. 35–46.

[14] Hiroyuki Hisamatsu, Hiroki Oda;" Performance Evaluation of Compound TCP+ Congestion Control Parameters in Wireless Networks". IEEE,2014

[15] Youssef Bassil;" TCP Congestion Control Scheme for Wireless Networks based on TCP Reserved Field and SNR Ratio". *International Journal of Research and Reviews in Information Sciences (IJRRIS)*, ISSN: 2046-6439, Vol. 2, No. 2, June 2012.

[16] Wu E.H.-K., and Mei-Zhen Chen, "JTCP: Jitter-based TCP for Heterogeneous Wireless Networks", Selected Areas in Communications, IEEE Journal, vol. 22, no. 4, pp. 757-766, 2004.

[17] G.S. Tomar, "Modified Routing Algorithm for AODV in Constrained Conditions", IEEE International Conference AMS 2008, pp-6, May 2008.

[18] S. Bohacek, J. Hespanha, J. Lee, C. Lim, and K. Obraczka, "TCPPR: TCP for Persistent Packet Reordering," in *Proc. International Conference on Distributed Computing Systems*, vol. 23, 2003, pp. 222–233.

DOI- 10.18486/ijcsnt.2016.5.1.03
ISSN-20536283

[19] F. Wang and Y. Zhang, “Improving TCP performance over mobile adhoc networks with out-of-order detection and response,” in *Proceedings of the 3rd ACM international symposium on mobile ad hoc networking & computing*, New York, NY, 2002, pp. 217–225.

[20] **GS Tomar**, Laxmi Shrivastava, SS Bhadauria, “Load Balanced Congestion Adaptive Routing for Randomly Distributed Mobile Adhoc Networks”, Springers International Journal of Wireless Personal Communication, Vol.75, No.2(II), pp 2723-2733, Feb 2014.

[21] Ramakrishnan and Floyd, “A Proposal to add Explicit Congestion Notification (ECN) to IP”, Internet Draft, January 1999.