AN AUGMENTATION OF TCP FOR COMPETENCY ENLARGEMENT IN MANET

Rachana Buch[1], Ashish Kumar Srivastava[2], Nitul Dutta[3]
Marwadi Education Foundations Group of Institutions, Gauridad
Rajkot
Email: rachana.buch7@gmail.com[1], ashishkumar.srivastava@marwadieducation.edu.in[2], nitul.dutta@marwadieducation.edu.in[3]

Abstract

The Transmission Control Protocol (TCP) was mainly designed for wired network, where there is very less chances of packet loss due to transmission errors. But in Mobile Ad hoc Network (MANET) there is no fixed topology or wireless topology, so error occurs due to link failure as a result of movements of nodes. The TCP protocol for wired network is not performed well for MANET. Most of the MANET based TCP is analyzed the performance under different mobility pattern in existing literature. More frequent dynamism is also not considered in most of the protocols. In this report TCP protocol is modified to use in Mobile Ad Hoc Network (MANET). The modified TCP will reduce ratio of packet loss which is occur due to link failure, congestion, node mobility or link breakage. To achieve the goal we will adopt simulation study through ns-2 simulator. We aimed at controlling the congestion window in TCP by taking into consideration of the mobility pattern of nodes. Two bits of TCP header (Reserved bits) may be manipulated by the source and destination to indicate the mobility of node. Congestion window may be adjusted based on the specified two bits.

Keywords: TCP, Transmission Control Protocol, MANET, Mobile Ad hoc Network, Network, Link Failure, Packet Loss, Node Mobility, Link Breakage.

I. INTRODUCTION

Transmission Control Protocol (TCP) is one of the main protocols in TCP/IP networks. TCP works on transport layer in OSI model. The IP protocol deals only with packets, whereas TCP enables two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and also guarantees that packets will be delivered in the same order in which they were sent. The TCP was mainly designed for wired network, where there is a very less chances of packet loss due to transmission errors, and most of the time packet losses is due to congestion in the network. Now a days, mainly research is done on effective error and congestion control mechanism for wired and wireless network. Instead of effort made by many researchers, there is still need for further improvements in the transport layer protocol to make it suitable wireless communication. However, the problem itself has lots of challenges and issues to be addressed for effective use in wireless environment. These issues mainly includes characteristic of wireless media including signal fading, multipath propagation, etc. Being a potential protocol for next generation network, the TCP protocol needs much attention to make it acceptable for the wireless environment. The traditional assumption of assuming packet loss in the transport layer due to congestion only and it need to be improve packet loss due to other reasons that exist in the wireless environment. TCP is reliable protocol because uses acknowledgement mechanism and also provide end-to-end packet delivery. TCP achieves good performance in wired network but when it used over wireless network it degrades the performance. In wireless network, a central node which is called base station or access point exists in the network that all the connections are done through central node. But when we configure the network in ad hoc mode, every couple of nodes can communicate with each other independent of the central node. MANET allows wireless connectivity directly between wireless nodes without connecting through an access point (infrastructure mode Networks). Each device in a MANET is free to move independently in any direction, and changing its links to other devices frequently where wireless LAN is a wireless computer network that links or more devices using a wireless distribution method within limited area such as home, school, computer laboratory or office building. This gives users the ability to move around within a local coverage area and still be connected to the network and can provide a connection to the wider internet. There are two basic modes of operation of wireless LAN:

1) Infrastructure mode: In which wi-fi networks are deployed.

2) Ad hoc mode: In which peer-to-peer connections are there where station communicate. So need to improve mechanism of TCP for good performance for wireless network.

II. TRANSMISSION CONTROL PROTOCOL

A. Details of TCP

TCP is a transport layer protocol. In OSI network architecture stack TCP provides a number of service for higher layers [11]. It guarantees that a stream of bytes sent from the sender side is delivered reliably and in the same order to receiver side. The counterpart to the reliable TCP service is the UDP, which provides a datagram service where latency is reduced at the cost of data delivery. A few key features set TCP apart from UDP:

1. Data packets are arranged in order before handing over to all.
2. On request for lost packet from destination, retransmission process can be occurred.
3. It uses acknowledgement mechanism and also provide reliable data transfer.
4. TCP controls flow of data packets or decrease the speed of packets as per destination requirement.

B. Challenges and Issues

In wired TCP, Packet losses due to congestion where in wireless TCP, packet losses due to link failure most of the times and packet will no reach to the destination successfully. TCP solutions for Wireless network assumes only one segment in wireless communication.

Signal attenuation, due to this issue a decrease in intensity of the electromagnetic energy at the receiver, which leads to low signal-to-noise ratio (SNR).

Doppler shift, due to this issue the relative velocity of the transmitter and the receiver. Doppler shift causes frequency shifts in the arriving signal, thereby complicating the successful reception of the signal.

Due to multipath fading Electromagnetic waves reflecting off objects or diffracting around objects can result in the signal traveling over multiple paths from the transmitter to the receiver. Multipath propagation can lead to fluctuations in the amplitude, phase, and geographical angle of the signal received at a receiver.

Due to effect of multiple failures on the same route is always possible that multiple route failure occur independently along different links of the route. This is however not a serious concern in case of TCP-F as the source will then receive an RFN from the nearest and behave accordingly.

Due to the effect of congestion on the feedback mechanism is possible that in a congested network, the Route Failure Notification (RFN) and Route Re-transmission Notification (RRN) packets may be lost delayed.

TCP throughput drops or sometimes it may loss when mobility occurs. Due to mobility or link failure congestion take place and it may also drop the packet.

When node moves or congestion occurred node will be put in standby mode and packet transmission will freeze for sometimes.

Due to high Bit Error Rate (BER), bit errors causes packets to get corrupted which result in lost TCP data segments or acknowledgment.

Due to route re-computation, when an old route is not available for longer time, then the network layer at the sender attempts to find a new route to the destination.

Due to network partitions, it is likely that the ad hoc network may periodically get partitioned for several seconds at a time.

If the sender and the receiver of a TCP connection lie in different partitions, all the senders' packets get dropped by the network resulting in the sender invoking congestion control.

Due to multipath routing, some routing protocols maintain multiple routes between source destination pairs, the purpose of which is to minimize the frequency of route re-computation.

As the number of hops on a path increases, the probability of a link failure and consequential packet losses on the path increases.

Due to node mobility, limited communication range of radios, such constant node mobility immediately leads to frequent link breakages and there for route changes and packets may get lost.

Due to wireless link errors, Wireless links posses high bit error rates that cannot be ignored. But TCP interprets packet losses caused by bit errors as congestion. As a result, its performance suffers in wireless networks when TCP unnecessarily invokes congestion control, causing reduction in throughput and link utilization.

Congestion Control is widely considered to be a key issue for MANETs. It has severe throughput degradation and massive fairness problems.

A problem with Explicit Link Failure Notification (ELFN) schemes is that still a number of data packets and ACK may get lost before the state is frozen. This has negative effects after the state is restored: missing packets or missing ACKs will then cause timeouts or duplicate acknowledgments.

The traditional Additive Increase (AI) mechanism does not increase the TCP window size fast enough to fully utilize the available bandwidth.

In fact, if the sender reduces the sending rate on each packet loss, TCP cannot quickly take the available bandwidth after congestion disappears.

Especially in high-bandwidth delay network case, it takes intolerable duration between congestion events for a standard TCP flow to achieve a steady state throughput. This will result in slow sending rate and low bandwidth utilization.

The problem of TCP lies in the Congestion Control mechanism i.e., multiple TCP connections can share network and link resources simultaneously.

Once the sender receives three duplicate acknowledgement causes by non-congestion loss, the TCP sender assumes that a packet has been lost due to network congestion and reduces the size of the congestion window needlessly.

III. TCP FOR MANET

The challenges for TCP in MANETs span all the layers below the transport layer in the OSI network stack. [11] At the physical layer, interference and fading may result in bit errors and lost packets. At the MAC layer, the medium access may induce delay and is not able to totally avoid collisions potentially causing packet loss if retransmission mechanisms are unable to salvage the problem. Retransmission will also create delay and jitter. Some MAC protocol implementations are able to dynamically change the data rate based on the transmission success. At the network layer, the routing protocols delay in detecting topology changes may lead to periods without connectivity. Also, the end-to-end transmission time will change as a result of changing paths between the source and destination. The IEEE 802.11 wireless stack [12, 13] is by far the most common wireless platform that is used for ad hoc networking today. Many MANET challenges have been identified based on work with 802.11 platform and in some cases the problems and subsequent solutions have focused more on mending the 802.11 standard than on addressing MANET problems generically. However, it is important to note that the 802.11 stack implements several mechanisms that are necessary for a functional MANET based on a Carrier Sense Multiple Access (CSMA)/ Collision Avoidance (CA) MAC protocol. The performance of several proposed MANET adaptions of TCP (TCP-F, ELFN, ATCP, Fixed RTO and TCPDOOR) is investigated in [14].

Numerous enhancements and optimizations have been proposed over the last few years to improve TCP performance over one-hop wireless networks. These improvements include infrastructure based WLANs [15,16,17,18], mobile cellular networking environments [19,20], and satellite networks [21,22].

A. *TCP in MANETs challenges and Solutions*

The Transmission Control Protocol (TCP) is the protocol that saved the Internet, most importantly because of its congestion control mechanism. It is a vital building stone in IPbased networks, but it faces serious challenges when used in MANETs, since MANETs are challenged with interference and high grade of mobility, from which wired networks are spared. This report is aimed at introducing the TCP protocol, describing the challenges that TCP faces in MANETs, and give an overview of ongoing research to adapt TCP to MANETs.

Many challenges are included in this survey paper. Only overview is given in this survey paper.

B. *A Survey of TCP over Mobile Ad Hoc Networks*

The Transmission Control Protocol (TCP) was designed to provide reliable end-to-end delivery of data over unreliable networks. In order to adapt TCP to MANET environment, improvements have been proposed in this paper to help TCP to differentiate between the different types of losses. Indeed, in MANETs losses are not always due to network congestion, as it is mostly the case in wired networks. In this paper, an overview of this issue and a detailed analysis of major factors involved.

Many Challenges and proposals are included i.e. TCPF, ATCP, ELFN TCP, Split TCP, Bus TCP. End-to-end and reliable delivery of packets. This process is time consuming process. TCP can no distinguish between looses induced by network congestion or other types of losses. Route failure or packet loss occurs due to congestion overhead.

C. *A Feedback Based Scheme For Improving TCP Performance In Ad-Hoc Wireless Networks*

In this paper, a feedback scheme, the source can distinguish between route failure and network congestion. The main idea is to inform the source by a Route Failure Notification (RFN) when the route is disrupted allowing the source to freeze its timers and stop sending packets as the source cannot reach the destination. When the route is re-established, the source on being informed through a Route Re-establishment Notification (RRN), resumes by un-freezing timers and continuing packet transmissions.

Packets are rarely lost in wired network. Route Failure

Notification (RFN) and Route Re-transmission Notification (RRN) is useful at time of failure. Same route is affected by multiple failures. Time consume on route re-transmission process. Effect of failure on multiple transport connections.

D. *Analysis of TCP Performance over Mobile Ad Hoc Networks*

Mobile ad hoc networks have attracted attention lately as a means of providing continuous network connectivity to mobile computing devices regardless of physical location. In this paper, the effects that link breakage due to mobility has on TCP performance. Through simulation, the TCP throughput drops significantly when nodes move, due to TCPs inability to recognize the difference between link failure and congestion.

Provide information about link failure and route failure so packet sending process may freezes for some times. Host Unreachable message as a notice to the TCP sender to avoid packet collision. When TCP sender receives an Explicit Link Failure Notification (ELFN), its disables re-transmission timers and enters in Standby Mode so it may more time consuming process.Bit Rate Error (BER) value is more then wired TCP.

E. *ATCP: TCP for Mobile Ad Hoc Networks*

Transport connections set up in wireless ad hoc networks have some problems such as high bit error rates, frequent route changes, and partitions. In this paper, there is an implementation of a thin layer between Internet protocol and standard TCP that corrects these problems and maintains high end-toend TCP throughput.

Ad Hoc TCP (ATCP) Re-transmits failed packet or reorders it. Explicit Congestion Notification (ECN) used to quickly notify sender of congestion. Route change force by mobility. Partitions are formed and recombined by the mobility. In ATCP ICMP Destination Unreachable message puts sender in persist mode until new route found.

F. *Split TCP for Mobile Ad Hoc Networks*

When TCP used in MANETs the fairness and throughput has been suffered. This is a direct value of TCP wrongly attributing packet losses due to link failures or mobility of nodes to congestion. This problem causes an overall degradation throughput, it affects connections with a large number of hops, where link failures are more likely. Split TCP separates the functionalities of TCP congestion control and reliable packet delivery.

The TCP source then freezes the connection until the route is restored. When link failure occurs in one segment other segment will be affected.

G. *A Survey on TCP Over Mobile Ad Hoc Networks*

In this paper authors will survey on TCP performance in MANETs. Then describe the problems of TCP in ad-hoc networks, and then present the design and existing solutions to improve TCP throughput. Author uses a detection- response framework to categorize different approaches and analyze the possible design options.

Freezes its current state for route disruption problem as soon as the route breaks i.e. sender stop sending more packets and resume as soon as a new route is found. When a TCP sender receives an ELFN, it disables its re-transmission timers and enters a Standby Mode, which is similar to the snooze state of TCP. The main advantage of freezing TCP is, the sender can react very quickly to the link failure, and therefore minimizes the number of packet losses and subsequent delays.

The disadvantage of relying on a network layer feedback is, it results in a reinvention of feedback support in each new ad hoc routing protocol. There is potential danger of malfunction if the RFN or RRN packets are lost. Route disruption problem is one of the main disadvantages.

H. *A Survey on Congestion Control for Mobile Ad-hoc Networks*

Congestion Control is a key problem in MANETs. The standard TCP congestion control mechanism is not able to handle the special properties of a shared wireless multihop channel well. In particular the frequent changes of the network topology and the shared nature of the wireless channel pose significant changes.

It uses Selective ACK (SACK), Duplicate ACK (DACK), Cumulative ACK schemes as per need. An intermediate node generates an RFN message when it detects a link failure on the route. ECN used to quickly notify sender of congestion. Route changes force by mobility. Unsteady packet delivery delays. Route changes due to node mobility as well as inherently unreliable medium result in packet losses.

I. *Split-TCP Based Acceleration Gateway over Packet Lossy Networks*

The Conservative Additive Increase Multiplicative Decrease mechanism of traditional TCP causes the link under-utilization in the WANs due to the WANs intrinsic nature of high latency and high packet loss. Split-TCP Based Acceleration Gateway (STAG) is built on embedded network equipment and act as a transparent proxy. In STAG, a new improved congestion control method named Rapid TCP is adopted, which determines whether or not to decrease the congestion window based on the packet loss trend.

Rapid TCP doesnt traditionally reduce the congestion window quickly when the network transmission loss occurs. In the fast recovery phase, Rapid TCP chooses a different window adjustment strategy based on the current congestion window size. This arrangement significantly increases the transport speed and thus reduces the latency of WAN application. STAG achieves the traffic control by limiting the data sending rate of the server. STAG is able to support approximately 20,000 concurrent sessions for every giga-bytes of RAM, at the configuration of 8KB CircleQueue and 16KB buffer for each Clint-Server session. STAG performs better with increasing bandwidth. STAG can more efficiently utilize the network bandwidth with a high speed up ratio because the proposed Rapid TCP provides an active CWND growth mechanism. The throughput of Cubic increases very slowly with increasing bandwidth in a long delay or a high loss rate environment. The packet transmission rate of the Server-STAG session is higher than that of the Client-STAG, which may cause a long packet queue at the server side. Due to the conservative multiplicative decrease (MD) mechanism, the transmission rate of a TCP session is reduced significantly upon the detection of the congestion, and is not able to recover immediately even if the congestion disappear momentarily. Rapid TCP handles the long delay and high packet loss in WAN network environments.

J. *Simulation for Congestion-Less Losses Control over MANET using TCP Scheme*

Transport Mobile Ad hoc Network (MANET) is a collection of independent mobile nodes that show its mobility. Due to mobility the network congestion has been occurred. TCP is the most popular connection oriented transport layer protocol used in current internet. Whenever TCP Scheme applied over MANET, TCP found new challenges in respect of network congestion and non-congestion.

As data is transmitted by the sender and then acknowledged by the recipient, the window slides further to wrap more data in the byte stream. Due to TCP NJ-Plus scheme improve the performance of TCP by distinguishing between congestion and non-congestion losses. Route changes force by mobility. Congestion control is the typically disruptive parts of TCP. In both the case static network and mobility model, the performance of the network is not much efficient for end to end delay.

IV. ANALYSIS

TCP works on transport layer and it provides reliable packet delivery. TCP uses end-to-end methodology and acknowledgement mechanism. TCP was mainly designed for wired network in which chances of packet loss is very less and it may occur either due to transmission errors or congestion most of the time. But in MANET, node can move independently in any direction. So, topology may get change any time. Due to node mobility or change in topology packet may loss, it will not reach to the destination properly.

TCP guarantees that a stream of bytes sent from the sender program on one computer is delivered reliably and in the same order to receiver program on the other computer. The counterpart to the reliable TCP service is the UDP, which provides a datagram service where latency is reduced at the cost of data delivery reliability.

The traditional assumption of assuming packet loss in the transport layer due to congestion only and it need to be improve packet loss due to other reasons i.e. link breakage, route failure, node failure etc. that exist in the wireless environment.

There are ample of research work found addresses issues in transport layer for MANET. Few of such work have been discussed below.

The work reported in [3] by Kartik Chandran et al. has said that Two Mobile Hosts (MHs) are said to be within range and said to be neighbors of each other if each can receive the others transmission. Route Failure Notification (RFN) and Route Re-establishment Notification (RRN) is used at the time of route failure or node failure or link failure in feedback based scheme. This is the main advantage of wired network in which packets are rarely lost. In MANET, more packets are lost as compared to wired network due to mobility of nodes.Kartik Chandran et al. Has observed No of Nodes (10), Throughput, Packets and Sequence number of packets having data rate of 1.28 kbps, size of window 4KBytes and size of packets is 200bytes. The issues raised are: Mobility, Efficiency (System Performance, Throughput, bandwidth) Packet loss, Route Failure, Node Failure and Topology Overhead.

The author Ahmad Al Hanbali et al. of [2] (2006) suggested another mechanism of end-to-end methodology and reliability of packet delivery is used. Many challenges and proposals are included i.e. TCP Feedback (TCP-F), Ad-hoc TCP (ATCP), Explicit Link Failure Notification (ELFN) TCP, Split TCP, Bus TCP. To improve TCP performance in MANETs in two categories: cross layer proposals and layered proposals. In cross layer proposals, TCP and its underlying protocols work jointly. In layered proposals, the problems of TCP is attacked at one of the OSI layers. Ahmad Al Hanbali et al. has Observed No of Nodes (1-N multihop channel), Throughput, Packets and sequence number of packets. The issues raised are: Mobility, Efficiency (System Performance, Throughput, bandwidth) Packet loss, Route Failure, Node Failure and Congestion Overhead.

The work reported in [4] by Nitin Vaidya et al. (2002) has provided that link failure or route failure. So, packet sending process may freezes for sometimes or it may put the whole process of sending and receiving packet in standby mode. It also send Host Unreachable message as a notice to the TCP sender to avoid packet collision. When TCP sender receives an ELFN, its disables retransmission timers and enters in Standby Mode so it may take more time to complete the process which similar to the snooze state of TCP-F. In DSR, ach packet injected into the network contains a routing header that specifies the complete sequence of nodes on which the packet should be forwarded. Nitin Vaidya et al. has observed No of Nodes (30), Throughput, Packets, Time, Transmission radius (250 m2) and

Sequence number of packets having size of packets 1460bytes, simulation area 1500*300m2 and speed of sending packets is 10 m/s-30 m/s. The issues raised are: Mobility, Efficiency (System Performance, Throughput, bandwidth) Congestion Overhead, Packet Dropping and Standby Mode.

The author Jain Liu et al. of [5] (2001) suggested another mechanism Ad Hoc TCP retransmits failed packet or reorders it. It also uses Explicit Congestion Notification (ECN) used quickly notify sender of congestion. ATCP retransmits failed packets which is lost through link failure or node failure or congestion overhead or mobility of nodes. ATCP also reorders the failed packet. Bit errors causes packets to get corrupted which results in lost TCP data segments or acknowledgement. A serial timeout is a condition wherein multiple consecutive retransmission of the same segment transmitted to the receiver while it is disconnected from the sender. Difference between TCP and ATCP is that TCP invokes congestion control frequently during the experiment because of lost packets or duplicate ACKs. TCP uses slow start to increase its transmit window. ATCP, on the other hand, puts the TCP sender in persist mode and retransmits the packet whose retransmit timer was about expire. Jain Liu et al.has observed Throughput, Packet, Time, Congestion Window, Bit Error Rate (10-5), Bandwidth having Packet size 100 bytes, Transfer size 1MB, Average Delay 10ms-30ms, Acknowledgement Size 40bytes. The issues raised are: Efficiency (System Performance, Throughput, bandwidth) Packet loss,

Route Failure, Node Failure, Congestion Overhead, Network Traffic and Route Retransmission.

The work reported in [8] by Christian Lochert et al.

(2007) has said that TCP uses Cumulative ACK, Delayed ACK (DACK) and Selective ACK (SACK) scheme as per requirements. Congestion control is widely used considered to be a key issue for MANETs. Congestion-related problems have been identified which are severe throughput degradation, massive fairness problems. TCP uses a time limit that depends on the measured Round Trip Time (RTT) of the connection. If Round Trip Timeout (RTO) elapse without an acknowledgement TCP concludes severe congestion. While slow start is active, the window size is not increased but one segment size for every round-trip time, but instead for every received acknowledgement, this means that during this phase the window size grows exponentially. Route changes due to node mobility as well as the inherently unreliable medium result in unsteady packet delivery delays and packet losses. Christian Lochert et al. has observed Throughput, Fairness, Bandwidth and Congestion Window having Delayed ACK value is 2, Segment of Congestion Window is 4 and Propagation Delay is 4. The issues raised are: Mobility, Efficiency (System Performance, Throughput, bandwidth) Packet loss,

Route Failure, Node Failure, Congestion Overhead, Network Traffic and Route Retransmission.

The author Feng Wang et al. of [7] suggested another mechanism TCP sender can react very quickly to the link failure and therefore minimizes the number of packet losses and subsequent delays. In MANET, route disruption problem is major problem for packet loss. The effectiveness of any performance enhancement approaches highly depends on the timeliness of responses to the route disruptions. Slow start is the reaction of TCP timeout events. When there are triple duplicate acknowledgements, TCP sender simply halves its current congestion window size and then increases it linearly. The network layer feedback includes the information provided by the underlying ad hoc routing protocols, such as the routing error messages. The transport layer feedback is the information generated by and accessible to the transport protocol, such as the timing and sequence of TCP packets. A heuristic is employed to distinguish between route failures and congestion. When timeout occur consecutively, the sender assumes a route failure has happened rather than network congestion. Feng Wang et al. has observed Throughput, Time, Route Reestablishment Delay (RRD), Speed (10m/s), Hop-to-Hop Delay, Frequency, Delivery Rate having 30 nodes, Data rate of 10kbps, Simulation area (1500m*300m), size of packers are 100bytes. The issues raised are: Mobility, Efficiency (System Performance, Throughput, bandwidth) Congestion Overhead and Route Retransmission.

The author Swastik Kopparty et al. of [6] (2002) suggested another mechanism that the TCP source then freezes the connection until the route is restored. As the number of hops on a path increases, the portability of a link failure on the path increases. Split TCP can handle mobility better than the plain TCP. One link failure can cause an entire TCP session to choke, when in fact packets can be transferred on other links that are still up. Split TCP helps to take advantage of these links that are up when a link on a local segment fails, it is possible for TCP with proxies to sustain data transfer on other local segments. Thus, the hit on TCP throughput due to mobility is of much lower impact. The fairness and throughput of TCP suffer when it is used in MANETs. This is a direct consequence to congestion. While this problem causes an overall degradation of throughput, it especially affects connections with a large number of hops, where link failures are more likely. Thus, short connections enjoy an unfair advantage over long connections. Swastik Kopparty et al. has observed No of Nodes (50-100), Throughput, Packets, Time, and Fairness having Spread Region 1km*1km and Speed 010ms. The issues raised are: Mobility, Efficiency (System Performance, Throughput, bandwidth) Congestion Overhead and Topology Overhead.

The work reported in [9] by Dong Pingping et al. (2015) has said that Split-TCP Based Acceleration Gateway (STAG) is built on embedded network equipment and act as a transparent proxy. STAG can more efficiently utilize the network bandwidth with a high speed up ratio because the proposed RAPID TCP provides an active Congestion Window (CWND) growth mechanism. In STAG, a new improved congestion control method named Rapid TCP is adopted, which determines whether or not to decrease the congestion window based on the packet loss trend. STAG employs Rapid TCP, an enhanced congestion control protocol that splits the TCP connection into two, with the consideration that the split TCP connections can decrease feedback delay and react more quickly to packet loss and thus achieve higher throughput. Rapid TCP does not traditionally reduce the congestion window quickly when the network transmission loss occurs. Rapid TCP adjusts the congestion window size on the basis of the increment of the lost packets. In this way, Rapid TCP offers a robust mechanism to improve the performance of applications in wide area networks. Dong Pingping et al. has observed Throughput, Packet, Time, Speedup Ratio and Bandwidth (2mbps) having Size of Packet is 100bytes, Round Trip Time (RTT) of the links is 100ms. The issues raised are: Efficiency (System Performance, Throughput, bandwidth) Packet loss, Route Failure, Node Failure, Congestion Overhead and Route Retransmission.

The author Narendra Sharma et al. of [10] (2014) suggested another mechanism that detection of non-congestion losses and packet reordering from network congestion loss author design a new TCP scheme called TCP NJ-Plus. Due to this scheme improve the performance of TCP by distinguishing between congestion and non-congestion losses. Congestion control is the typically disruptive parts of TCP. When TCP operates in Wireless Mobile Networks (WMNs), the throughput of TCP degrades considerably due to its failure to distinguish non-congestion losses and packet reordering from network congestion. Once the sender receives three duplicate acknowledgements cause by non-congestion loss, the TCP sender assumes that a packet has been lost due to network congestion and reduces the size of the congestion window needlessly. Narendra Sharma et al. has observed Throughput, Packet, Time, Congestion Window, Segment Size (1460 kb) and Bandwidth having 5 nodes, Size of Packet is 1024 kb, Segment of Congestion Window is 5 and Destination for Loss is 250m. The issues raised are: Mobility, Efficiency (System Performance, Throughput, bandwidth) Packet loss,

Route Failure, Node Failure, Congestion Overhead, Network Traffic and Route Retransmission.

V. CONCLUSION

The target objective of this project is to provide an enhanced

Transmission Control Protocol (TCP) for Mobile Ad hoc Network (MANET). In order to understand the problem of link failure or packet loss in current scenario, few existing types of TCP protocols are critically analyzed. A new mechanism of such protocol is proposed and prepared to address issues of congestion, packet loss, link failure and node mobility. Our study of existing papers that includes pros and cons, issues and observed parameters with its values are mentioned. We aimed at controlling the congestion window in TCP by taking into consideration of the mobility pattern of nodes. Two bits of TCP header (Reserved bits) may be manipulated by the source and destination to indicate the mobility of node. Congestion window may be adjusted based on the specified two bits.

REFERENCES

[1] [Thesis] E. Larsen, TCP in MANETs challenges and Solutions, Norwegian Defence Research Establishment (FFI), pp. 1-57, September, 2012.

[2] [Research Report] A. Al Hanbali, E. Altman, and P. Nain, A Survey of TCP over Mobile Ad Hoc Networks de recherche, Research Report no. 5182, INRIA Sophia Antipolis research unit, May, 2006.

[3] K. Chandran, S. Raghunathan, S. Venkatesan, and R. Prakash, A Feedback Based Scheme For Improving TCP Performance In Ad-Hoc Wireless Networks, IEEE Pers. Commun., vol. 8, no. 1, pp. 1-17, 2001.

[4] G. Holland and N. Vaidya, Analysis of TCP performance over mobile ad hoc networks, Wirel. Networks, vol. 8, no. 2, pp. 275288, 2002.

[5] S. Liu J. Singh, ATCP: TCP for mobile ad hoc networks, IEEE Jounral Sel. Areas Commun., vol. 19, no. 7, pp. 1-16, July, 2001.

[6] S. Kopparty, Srikanth V. Krishnamurthy, Michalis Faloutsos, and Satish K. Tripathi ”Split TCP for mobile ad hoc networks,” Global Telecommunications Conference, GLOBECOM’02. IEEE, vol. 1, pp. 138-142 , 2002.

[7] F. Wang and Y. Zhang A Survey on TCP over Mobile Ad-Hoc Networks, pp. 1-15, Nova Science Publishers, 2005.

[8] C. Lochert, B. Scheuermann, and M. Mauve, A survey on congestion control for mobile ad hoc networks, Wirel. Commun. Mob. Comput., vol. 7, no. 5, pp. 655676, June, 2007.

[9] D. Pingping, W. Jianxin, H. Jiawei, and W. Haodong, Split-TCP Based Acceleration Gateway over Packet Lossy Networks, China Communications, vol. 12, no. 5, pp. 100112, May, 2015.

[10] N. Shanna, Simulation for Congestion-Less Losses Control over

MANET using TCP Scheme, International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT), pp. 410415 , 2014.

[11] Zimmermann, Hubert ”OSI reference model– The ISO model of architecture for open systems interconnection,” Communications, IEEE Transactions communications, vol. 28, no. 4, pp. 425-432, 1980.

[12] IEEE, Wireless LAN medium access control (MAC) and physical layer (PHY) specification, IEEE standard 802.11, June, 1999.

[13] , Wireless LAN medium access control (MAC) and physical layer (PHY) specification, IEEE standard 802.11-2007, June, 2007.

[14] U. Ibom, Tcp performance over manet, in Information Networking, ICOIN International Conference, pp. 1 5, jan, 2008.

[15] L.Andrew, S. Hanly, and R. Mukhtar, CLAMP: Differentiated capacity allocation in access networks, in proc. of IEEE Int. Performance Computing and Communications Conf., Phoenix, AZ, USA, pp. 451-458, Apr, 2003.

[16] H. Balakrishnan, V. Padnabhan, S. Seshan, and R. Katz, A comparison of mechanisms for improving TCP performance over wireless links, IEEE/ACM Transactions on networking, vol. 5, no. 6, pp. 756-769, Dec, 1997.

[17] H. Balakrishnan, S. Seshan, E. Amir, and R. Katz, improving TCP/IP performance over wireless networks, in proc. of ACM MOBIHOC, Berkeley, CA, USA, pp. 2-11, 1995.

[18] A. V. Bakre and B.R. Badrinath, Implementation and performance evaluation of indirect TCP, IEEE/ACM Transactions on Networking, vol. 46, no.3, pp. 260-278, Mar, 1997.

[19] K. Brown and S. Singh, M-TCP: TCP for mobile cellular networks, ACM SIGCOMM Computer Communication Review, vol. 27, no. 5, pp. 19-43, Oct, 1997.

[20] H. Balakrishnan, S. Seshan, and R. Katz, Improving reliable transport and handoff performance in cellular wireless networks, ACM Wireless Networks, vol. 1, no. 4, pp. 469-481, Dec, 1995.

[21] R. Drust, G. Miller, and E. Travis, TCP extensions for space communications, in proc. of ACM MOBICOM, Rye, NY, USA, pp. 15-26, 1996.

[22] T. Henderson and R. Katz, Transport protocols for Internet-compatible satellite networks, IEEE Journal on Selected Areas in Communications, vol. 17, no. 2, pp. 345-359, Feb, 1999.