# Investigation of TCP Congestion Control with Reliable Communication Technique in MANET

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## ABSTRACT

A Mobile Ad Hoc Network (MANET) is a self-organizing, infrastructure less, multi-hop network. The wireless and distributed nature of MANETs poses a great challenge to system security designers. Congestion takes place in MANETs with limited resources. In these networks, shared wireless channel and dynamic topology leads to interference and fading during packet transmission. Packet victims and bandwidth dilapidation are caused due to congestion, and thus, time and energy is wasted during its recovery.

This approach and apply Enhanced TCP technique and get improve result of TCP previous technique and eliminate the congestion from the network after that analyze result through various network parameter like routing overhead , throughput, packet delivery ratio , TCP packet analysis etc.

## Keywords

AODV, Congestion control, TCP, NS-2, routing.

## 1. INTRODUCTION

Ad hoc network is a wireless network without having any fixed infrastructure. Each mobile node in an ad hoc network moves arbitrarily and acts as both a router and a host [1]. A wireless ad-hoc network consists of a collection of "peer" mobile nodes that are capable of communicating with each other without help from a fixed infrastructure. The interconnections between nodes are capable of changing on a continual and arbitrary basis. Nodes within each other's radio range communicate directly via wireless links, while those that are far apart use other nodes as relays. Nodes usually share the same physical media; they transmit and acquire signals at the same frequency band. However, due to their inherent characteristics of dynamic topology and lack of centralized management security, MANET is vulnerable to various kinds of attacks.

Routing is the process of selecting paths in a network along which to send network traffic. Routing is performed for many kinds of networks, including the telephone network (Circuit switching), electronic data networks (such as the Internet), and transportation networks. Nodes in traditional wired networks do not route packets, while in MANET every node is a router. Nodes transmit and receive their own packets and also forward packets for other nodes. Due to mobile nodes, topologies are dynamic in MANET, but are relatively static in traditional networks. Connectivity and interference are indicated by link layer information. A traditional router has an interface for each network to which it connects, while a MANET “router” has a single interface. Routed packet sent forward during transmission also gets transmitted to the previous transmitter.

In mobile wireless ad hoc networks the key issue is network congestion and traffic blocking. The congestion occurs in mobile ad hoc networks due to limited availability of resources. The packet transmission in these networks experience interference and fading owing to shared wireless channel and dynamic topology. The network is loaded because of transmission errors. The multimedia communication in MANET is developing with increased demand in recent times. Real time traffic lead to high bandwidth and it results in congestion. Further, congestion causes packet losses and bandwidth degradation and hence can waste time and energy on congestion recovery [2].

## 2. CONGESTION CONTROL IN MANET

Congestion takes place in MANETs with partial resources. In these networks, shared wireless channel and dynamic topology leads to interference and fading during packet transmission. Packet victims and bandwidth dilapidation are caused due to congestion, and thus, time and energy is wasted during its recovery. Congestion can be prevented using congestion-aware protocol through bypassing the affected links [3]. Severe throughput degradation and massive fairness problems are some of the identified congestion related problems. These problems are generated from MAC and protocol routing and transport layers [4].

Congestion control is the main problem in ad-hoc networks. Congestion control is associated to controlling traffic incoming into a telecommunication network. To avoid congestive crumple or link capabilities of the intermediate nodes and networks and to reduce the rate of sending packets congestion control is used extensively [5]. Congestion control and dependability mechanisms are combined by TCP to perform the congestion control without explicit feedback about the congestion position and without the intermediate nodes being directly intermittent [5]. Their principles include packet conservation, additive increase and multiplicative decrease in sending rate, stable network. End system flow control, network congestion control, network based congestion avoidance, and resource allotment includes the basic techniques for congestion control [6].

Packet failure in MANETs is primarily caused due to obstruction. The packet loss can be condensed by involving congestion control over a mobility and failure adaptive routing protocol at the network layer [7]. The congestion non-adaptive routing protocols, leads to the following difficulties:

- **Long delay**: The congestion control mechanisms takes much time for detecting congestion. Usage of new routes in some critical situations is advisable. In an on demand routing protocol, the main problem is the delay stirring for route searching.
- **High overhead**: It takes effort in new routes for processing and communication for discovering it. It also takes effort in multipath routing for maintaining the multi-paths, though there is another protocol.

- **Many packet losses**: The packets may be lost when the congestion is detected. To decrease the traffic load, a congestion control solution is applied either by decreasing the sending rate at the sender, or dropping packets at the intermediate nodes or by both methods. But high packet loss rate or a small throughput occurs at the receiver [8].

## 3. RELATED WORK

This paper is presenting survey about existing work done in the field of MANET routing protocol, congestion control under MANET.

Vishnu Kumar Sharma et. al. in his work titled "**Mobile Agent Based Congestion Control Using AODV Routing Protocol Technique For Mobile Ad-Hoc Network**" [7]. In his technique, the information about network congestion is collected and distributed by mobile agents (MA) A mobile agent based congestion control AODV routing protocol is proposed to avoid congestion in ad hoc network. Some mobile agents are collected in ad-hoc network, which carry routing information and nodes congestion status. When mobile agent movements through the network, it can select a less-loaded neighbour node as its next hop and update the routing table according to the node's congestion status. With the support of mobile agents, the nodes can get the dynamic network topology in time.

Congzhou Zhou et. al. in his work titled **"Distributed Bottleneck Flow Control in Mobile Ad Hoc Networks"[9]** in this technique, they introduce a distributed bottleneck flow control scheme for MANETs. To perform flow control, each node monitors its channel to determine the residual capacity and only assigns a portion of that capacity to its active flows. The rate constraints are collected along the path from the source to the destination and rate on the bottleneck node along a path is communicated to the source node. As a result, the source node changes its sending rate as the flows on the nodes on the path change or as the nodes on the path change. By constraining nodes to acquire only a fraction of the available bandwidth, that flow control scheme can adapt to the dynamic nature of MANETs and provide fair bandwidth access.

Senthil Kumaran et. al. [10] presented an **Congestion Free Routing in Ad-hoc networks (CFR)**, based on dynamically estimated mechanism to monitor network congestion by calculating the average queue length at the node level. While using the average queue length, the nodes' congestion status divided into the three zones (safe zone, likely to be congested zone and congested zone). CFR utilizes the non-congested neighbors and initiates route discovery mechanism to discover a congestion free route between source and destination. This path becomes a core path between source and destination. To maintain the congestion free status, the nodes which are helping data packet transmission periodically calculate their congestion status at the node level. When a core node is noticed that it fell in to likely to congested zone and alerts to its neighbors. The predecessor core path node is aware of this situation and initiates an alternate path discovery mechanism to a destination. Finally it discovers a new congestion free route to the destination.

Krishna Gorantala et al. [11] they proposed Additive Increase/Multiplicative Decrease window size, TCP maintains a new state variable for each connection, called Congestion Window, which is used by the source to limit how much data it is allowed to have in transit at a given time. The congestion window is congestion control‘s counterpart to flow control‘s advertised window.

V. Thilagavathe et. al. [12] In this proposal , Cross layer Congestion Aware REQR is proposed as an extension work of [13] to overcome the congestion problem encountered in transport, data link and network layers. In transport layer, if the rate of packet delivered through the route exceeds the predefined threshold, it will lead to congestion problem. In MAC layer the congestion occurs due to the signal interference. If the congestion problem occurs in both the layers at the same time, a node formulates a list containing affected route entries and this information is broadcasted to the corresponding nodes. The nodes upon receiving the message send the congestion information to source so that data packet rate of the source is reduced or another congestion free route is selected.

Khuzairi Mohd Zaini et. al. in his titled "**An Interaction between Congestion-Control Based Transport Protocols and MANET Routing Protocols" [14]** The purpose of this proposal is two folds. First, studied the behaviour of TFRC and TCP over AODV and DSR as the underlying routing protocols in terms of throughput, delay and jitter. The second objective was to identify whether MANET routing protocols have an impact on transport protocols or not.

Yao-Nan Lien et al [15] proposed a new TCP congestion control mechanism by router-assisted approach. Their proposed TCP protocol, called TCP Muzha uses the assistance provided by routers to achieve better congestion control. To use TCP Muzha, routers are required to provide some information allowing the sender to estimate more accurately the remaining capacity over the bottleneck node with respect to the path from the sender to the receiver. With this information, TCP Muzha will be able to enhance the performance of both TCP and network.

## 4. PROBLEM STATEMENT

Mobile ad-hoc network survive through congestion problem because no any node give the information about congestion and also dynamically establish route without the prior knowledge of congestion, so that this paper represents the congestion free communication mobile ad-hoc network using TCP Acknowledgment Base Congestion Control with Reliable Communication Technique in MANET and improve the performance of the network.

In this approach it uses network simulator-2 and apply Enhanced TCP technique and get improve result of TCP previous technique and eliminate the congestion from the network after that analyze result through various network parameter like routing overhead , throughput, packet delivery ratio , TCP packet analysis etc.

## 4. PROPOSED SOLUTION

In this approach paper presents acknowledgment base TCP congestion control in MANET environment, that provide reliable as well as efficient communication, for that purpose create a TCP socket and transmit data from sender to receiver and measure the end-to-end delay as well as normal time (without congestion) acknowledgment delay difference and store it, after the second scenario create number of TCP sender and receiver all share common mobile node, in that case particular node is heavy loaded and creates congestion but this is unavoidable. So each sender compare new acknowledgment delay difference with normal time acknowledgment delay difference and if it find delays are increasing from previous recorded time so sender change the data rate (minimum from previous) and minimize the congestion of the network.

Second approach for congestion control is dynamic queue management technique in this technique it apply queue system of each node that contain data packet if transmission rate is greater than the channel capacity but in some situation if queue is full than data will be dropped. To minimize the dropping of data it uses dynamic queue system, that gradually increases and decreases queue size according to data sending and receiving rate and minimize some percentage of congestion. Both techniques minimize congestion and increase the data receiving percentage of the network as well as decrease average end-to-end delay of the network.

## 5. NETWORK SIMULATOR

### A. Simulation Environment

The simulator it will use to simulate the ad-hoc routing protocols in is the Network Simulator 2 (ns) [16] from Berkeley. To simulate the mobile wireless radio environment we have used a mobility extension to ns that is developed by the CMU Monarch project at Carnegie Mellon University.

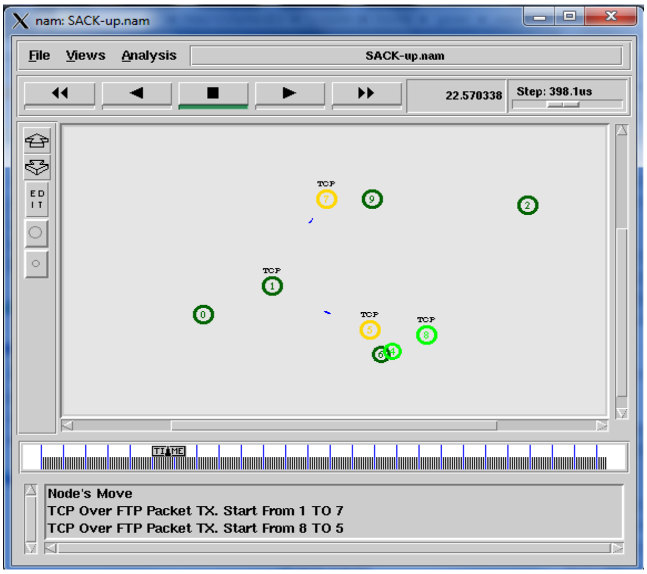


**Figure1: Network Animator**

### B. Simulation Parameter

Simulator Parameters like Number of nodes, Dimension, Routing protocol, traffic etc are given below.

| | |
|---|---|
| Simulator Used | NS-2.31 |
| Number of nodes | 50 |
| Dimension of simulated area | 800m×600m |
| Number of critical nodes | 4 |
| Number of malicious nodes | 2 |
| Routing Protocol | AODV |
| Simulation time | 35 sec. |
| Traffic type (TCP & UDP) | CBR (3pkts/s) |
| Packet size | 512 bytes |
| Number of traffic connections | 5,30 |
| Node movement at maximum Speed (m/s) | random |
| Transmission range | 250m |

**Table 1 Simulation parameter**

### C. Performance Evaluation

There are following different performance metrics have showed the results on the basis of following:

***Routing overhead***: This metric describes number of routing packets transmitted for route discovery and route maintenance need to be sent so as to propagate the data packets.

***Average Delay***: This metric represents average end-to-end delay and indicates how long it took for a packet to travel from the source to the application layer of the destination. It is measured in seconds.

***Throughput***: This metric represents the total number of bits forwarded to higher layers per second. It is measured in bps. It can also be defined as the total amount of data a receiver actually receives from sender divided by the time taken by the receiver to obtain the last packet.

***Packet Delivery Ratio***: The ratio between the amount of incoming data packets and actually received data packets.

## 6. CONCLUSION

In this paper we study about various congestion control technique like routing base congestion control, window bases, and additive increase decrease of window base as well as transport layer bases congestion control technique, all the technique provide the more reliable and efficient congestion control but MANET are dynamic nature so through that point we proposed dynamic queue as well as acknowledgment delay bases congestion control technique that system more feasible to MANET environment. And increase the performance of the network like packet delivery ratio, throughput and minimize the end-to-end delay of the network.

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