An Enhanced Algorithm of Congestion Control for Transport Layer in Wireless Ad Hoc Network

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Abstract

Today's wireless ad hoc network is one of the most challenging networks for the Internet protocols. In mobile ad hoc wireless network the TCP transmission protocol is not efficiently used at transport layer. Another transport protocol has been adopted by the mobile wireless network. The wireless sensor network performance mostly affected by the communication medium, density of deployment, limitation of power resources, limitation of storage capacity and the frequent topology changes. Congestion may cause some serious problem in wireless sensor network due to congestion number of packets are lost, too much of power consumption, the Slow speed of the Internet, low network throughput, Delay in data packet delivery. The effective transport control layer protocol design is a challenging job for wireless sensor network researchers. Transport protocol design should be effective, reliable to message delivery, less power consuming, congestion control and quality of service provider. According to this type of transport protocol, we can achieve a high throughput of WSNs. In this paper, we review a number of propose congestion control algorithms and protocols in wireless ad hoc networks as well as we proposed an enhanced congestion control algorithm.

Key Words: Wireless; Ad-Hoc network; Wireless Sensor Network; Congestion Control Algorithm; TCP;

1. Introduction

The paradigm shifting to mobile communication, the MANET communication network provides three kinds of networking: Wireless Mesh Network (WMN), Wireless Sensor Network (WSN), and Vehicular Ad hoc Networking (VANET). The MANET networking is popular because there is no requirement for any fixed infrastructure. The mobile ad hoc networking is having many challenges like: security, topology, energy, routing, etc., the researcher wants to find out the most efficient solution for reducing these challenges(Paliwal & Taterh, 2018). The network is a collection of devices that are connected with each other through the communication media. MANET is the type of wireless network without the need of fix infrastructure, without predefined organization of available communication links. MANETs are self producing self administrative network comparing mobile node communication against wireless medium the cooperative mode. MANET mobile nodes lay within range of sensing communicates Each Other directly together. The data packets sending from the client to reach at the destination slowly or it may be lost during the transmission. There are a number of reasons for data packets are reaching at the destination slowly or drop during the transmission. One of the data packets are lost after sender sends it; it seems problem in the network. The problem identified as a link failure environmental issues wireless link problem and network congestion. Due to the network congestion the data packets are drop during the transmission. first we understands the root cause of the congestion and analyze some solution that was already provided , as well as find out in new solution to mitigate the congestion problem at the time of data packet routing. "A network is said to be congested in respective of the user service quality. Notice by the user decrease data transmission speed because of an increase in network load"

2. Related Work

A Mobile Ad Hoc Network (MANET) is a peer-to-peer, multi-hop connected network . MANET consists of a number of mobile nodes that are free to move randomly and organize themselves arbitrarily. The figure 1 is displayed the MANET node organization example.

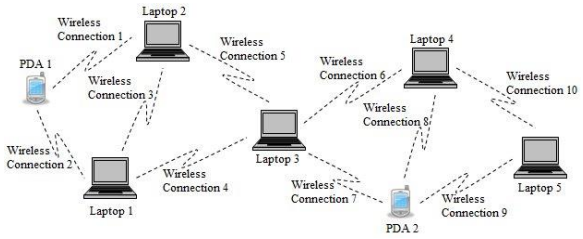

Figure 1 Mobile Ad-Hoc Network Scenario

The mobility of nodes affects the network topology and it may change rapidly and unpredictably. The network has to be able to react on topology changes and fix broken connections or calculate new routes through the network (Misra, Woungang, & Misra, 2009).In this article authors showing the impact of the background traffic effect on the existing high speed TCP protocols. They analysis different TCP variants and demonstrate the stability, bandwidth utilization, speed and fairness are clearly affected by the flow speed of the data packets. They categorized background flow of data into five different types(Ha, Le, Rhee, & Xu, 2007) .The authors are comment on the existing congestion control algorithms that these are not efficient to achieve the high throughput in high speed network and dynamic bandwidth environment. They said that the main drawback of the TCP algorithms slow searching process of bandwidth. It is very important this process consume thousand of RTT to find out the best bandwidth between end to end nodes.(Konda & Kaur, 2009) The article proposed possible solution for wireless home AP network to support VoIP and video traffic for better experience. They find out the following way within the limited resource consumption 1) AP may decides to never send back ACK, when increasing the back off. 2) It may decide delay sending back ACK, before the expiring time of back-off. 3) it may used CTS frame to silence to other stations. 4) AP could explicitly inform individual station to access time (Li, Papagiannaki, & Sheth, 2011). In this paper the author describe various TCP congestion control for multiple traffic in MANETs. The use the ns3 network simulation tool for considering ad-hoc on demand distance vector(AODV) and optimize link State routing (OLSR) protocol on the basis of different parameters as random waypoint mobility sending multiple traffic and find out the congestion control mechanism between multiple flows that had a problem in some cases (Ikeda et al., 2012). In this article the author following the approach to estimate manet environment bandwidth during the ACK waiting time. They find out if the available bandwidth is less than the actual bandwidth, it is used to avoid the congestion and same time other sender nods inform regarding to data transmission (Ahirwal, Lokhande, & Jain, 2012). In this article authors proposed two methods to controlling the congestion in wireless sensor network. One is by reducing the load or traffic control method another is by increasing the resources or resource control method. According to this article authors proposed hierarchical tree alternative path algorithm that is a resource control algorithm (Sergiou, Vassiliou, & Paphitis, 2013). The wireless sensor network is prone to traffic congestion in this article it is described and find out congestion detection strategies. This is also identified the congestion might waste of energy, information and resources. The authors study show different congestion control detection metric that are used. They conclude the different congestion control approaches with their effectiveness in different scenarios that combine the buffer length add channel load for better connection without congestion (Kafi, Djenouri, Ben-Othman, & Badache, 2014). In figure 2 shows the classification of congestion control analysis matrices.

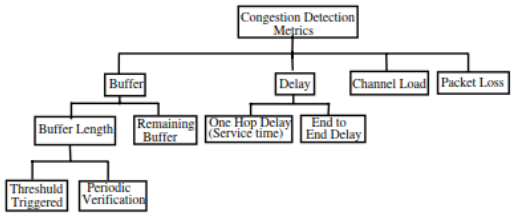

Figure 2 Classification of congestion detection matrices

In this review article the authors review the research paper to comparing some important techniques in term of congestion detection congestion notification and congestion mitigation as well as the future direction of the research work that proposed in the paper (Ghaffari, 2015). In this research review article the authors presented the sink mobility issue due to sink mobility in MANET network many problems arises. They focus the four categories of mobility as uncontrolled mobility, location restricted mobility, path restricted mobility and unrestricted mobility (Gu, Ren, Ji, & Li, 2016). In this research article the authors discussed and evaluate the performance of IEEE 802.11ac standard with respect to IEEE 802.11n using the ns3 simulator. The performance measured matrices on the parameter jitter,

throughput and delay. The IEEE802.11ac have very high throughput can be achieve up to 7Gbps in the 5GHz band. They simulate the network according to payload 1472 bytes, constant rate and constant mobility position. These protocols standards are not showing much difference in term of performance, throughput and delay (Ravindranath, Singh, Prasad, & Rao, 2016)

3. Proposed Algorithm

We proposed an algorithm for increasing the congestion window size. It is very important for TCP protocol. Because the TCP congestion control algorithm is continuously probing the communication channel. The probing is to fetch the maximum available bandwidth. If channel capacity is available and not used by another source than increased the congestion window size to transfer high-speed data. It is represented in algorithm cwnd. If channel occupied by other data and due to continuous data packets sending drop the data packets, then congestion window decrease and control the data transmission speed. Congestion window size is regulating the data packet transmission speed. The congestion window size is used to send data packets by the sender and it is able to make TCP most successful data transmission protocol. TCP transfer data packets and receive the acknowledgment of successfully delivered data packets. On the basis of received acknowledgment congestion window size decided because of acknowledgment type is used to take the decision to increase the congestion window. This successfully delivered acknowledgment received, and then the congestion window increased. There is an algorithm straight question, how much congestion window increase and what is the effect of the increasing congestion window data transmission. The acknowledgments are not received and data packets are not delivered successfully. Then the congestion window increases suddenly to achieve successful delivery. The increase congestion window algorithm is a core of the TCP congestion control algorithm and successfully data packet transmission. The proposed congestion window increase or decrease algorithm is developed on the existing congestion control algorithms and want to achieve better throughput as well as better latency delay time without dropping data packets. That's why we decide to proposed an algorithm is congestion responsive. It reacts when congestion occurs better than existing at some specific congestion control algorithms.

4. Conclusions

In this research article first we analyze different types of congestion control algorithms. we reviewed many research article and their proposed congestion control mechanism. We compare all the proposed algorithms. Our enhanced congestion control mechanism that provides better solution. We also assure that our congestion control algorithm must be delivered data packet successfully without fail. We need to test this algorithm through implementation. This is our future work to analyze this proposed congestion control algorithm is more advance for controlling the congestion.

5. About the Author(s)

Mr. Girish Paliwal is an Assistant Professor in Amity Institute of Information Technology at Amity University Rajasthan. He has more than 17 years of academic & teaching and research experience. During his academic career, he has held various positions such as member of Board of Studies, Head of examination etc. He has appointed as paper setter and an external examiner for the viva-voce exams of B.Tech / M.Tech, MCA students of various universities. He has provided the guidance to the projects and Internship. He has published various research papers in national (2) and international journals (10) and also actively participated in various conferences (10), workshop and Seminars (25). His research areas related to data communication networking, Mobile ad hoc networking, Wireless sensor networking, congestion control algorithms and vehicular ad hoc networking. He is editorial member and reviewer of a national and international journal. He has qualification SET, PhD*, M.Tech(IT), MCA.

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