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Non-Congestion Control Mechanism to Improve TCP Performance in MHWN

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Abstract—The Congestion Control Mechanism to improve TCP performance is evolved significantly on different Multi-Hop Wireless Network. So that, it is known that TCP experience a serious performance degradation of problems in Wireless Network. The Congestion Control in Wireless Network is strongly dependent on the dynamic and instability of Wireless Link. It is very difficult to evaluate the characteristics of wireless link. TCP have been evolved significantly by Congestion Control Mechanism for the performance of TCP on different communication network. In Recent years many research has focused on congestion window in order to improve the TCP performance in Multi-Hop Wireless Network. It is observed that the TCP performance of Multi-Hop Wireless Network is showed with a variant called "High Speed Variant" using Congestion Control Mechanism. In this paper, we study the Performance of TCP with Non Congestion Control Mechanism (NCCM) in MHWN by using the High Speed Variant (HSV).

Keywords—*Multi-Hop Wireless Network, Congestion Control Mechanism, High Speed TCP Variants*

1. Introduction

The multi hop wireless network plays an important role at the increasing edge of internet. The multi-hop is defined as the wireless network adopting the multi-hop wireless technology without the deployment of wired links. It is similar to Mobile Ad hoc Network (MANET), but the nodes are relatively fixed. To improve the TCP performance over multi-hop wireless network is represented in a fundamental communication structure. Transportation system, Defence and building automation Analysis of two single-hop TCP flow and quantify the effects of interference and interaction b/w two flow. The connectivity, capacity and performance of TCP in MHWN is studied Congestion control mechanism of each high speed TCP variant showed in detailed manner [1]. Congestion control mechanism is implemented in TCP have evolved significantly to the better performance of TCP on different types of communication network. In recent years the wireless internet has become most popular due to the tremendous growth in continuous network connectivity.

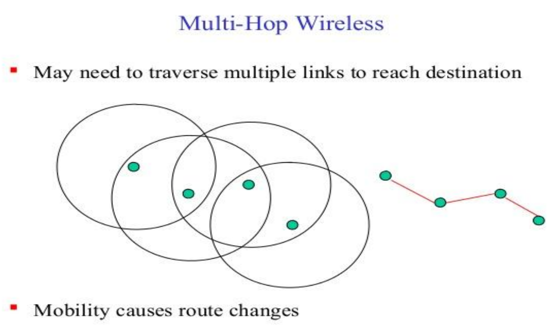

Figure.1: MHWN Basic structure

TCP has been widely adopted as a reliable DTP (data transfer protocol) for the most communication network. The characteristics of wireless network largely differ from the other wired network. TCP responds to the losses by invoking congestion control and avoidance algorithms. This results in degraded end-to-end performance in wireless networks. Recent efforts to design the better congestion control to the origin of several explicit-feedback of congestion control mechanism.

Congestion Control Mechanisms (CCM) that rely on network interaction are the explicit control protocol (XCP) and the rate control protocol (RCP). To support efficiency and stability of multi-hop wireless networks, it is crucial to develop a Congestion Control Mechanism (CCM) which provides efficient and accurate sharing of the underlying network capacity among Multiple Competing Applications. Being it is able to accurately monitor the link capacity and available bandwidth and then use that information to perform accurate congestion control is a main challenge in wireless communications.

Congestion is a problem that occurs on shared networks when multiple users access to the same resources (bandwidth, buffers, and queues). Congestion also occurs at routers in core networks where nodes are subjected to more traffic than they are designed to handle. TCP/IP networks are especially susceptible to congestion because of their basic connection- less nature.

The following basic techniques may be used to manage congestion.

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1.1. End-system flow control

This is not a congestion control scheme, but a way to prevent the sender from overrunning the buffers of the receiver. See "Flow-Control Mechanisms."

1.2. Network congestion control

In this scheme, end systems throttle back in order to avoid congesting the network. The mechanism is similar to end-to-end flow controls, but the intention is to reduce congestion in the network, not the receiver.

1.3. Network-based congestion avoidance

In this scheme, a router detects that congestion may occur and attempts to slow down senders before queues become full.The recent work in congestion control mechanism focuses on improving the TCP performance over Multi- Hop Wireless Network. The improvements are focused on the basic mechanism of AIMD (Additive Increase/Multiplicative Decrease algorithm). In AIMD mechanism, TCP sender updates the congestion window (CWND) if an ACK is received or if the congestion is deleted. For each ACK received, the CWND is updated as

$$CWND \leftarrow CWND + 1/CWND$$

This is known as the AIMD algorithm. When the Congestion is deleted either through the timeout or through the duplicate ACK. CWND is updated as

$$CWND \leftarrow CWND/2$$

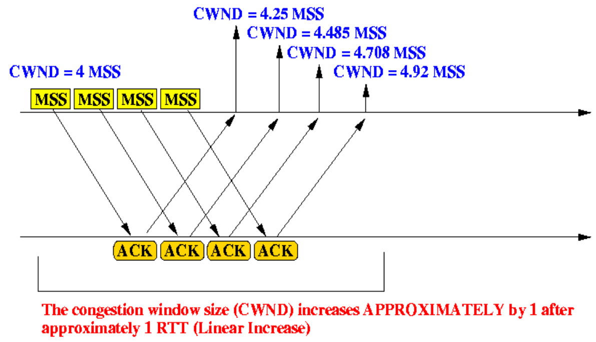

Figure.2: CWND Mechanism

This is known as the Multiplicative Decrease phase of the AIMD algorithm. The congestion control in wireless network is strongly dependent on the dynamic and instability of wireless links. The TCP performance of Congestion Control Mechanism in Multi-Hop Wireless Network is showed with a new variant called “High Speed Variant”. In this paper, we study the Non-Congestion Control Mechanism (NCCM) to improve the performance of TCP over MHWN by using the High Speed Variant (HSV).

2. High Speed Variant (HSV)

The High Speed Variant is used to improve the performance of TCP connection with a large Congestion Window. The HSVTCP (High Speed Variant TCP) introduce average packet drop rate and the Congestion Window. In this paper we report an important first step in this direction. We describe a new TCP-variant that is suitable for deployment in high speed and long distance networks, as well as conventional networks [3]. The new TCP variant, HSVTCP, is shown to be fair when deployed in homogeneous networks, to be friendly when competing with conventional TCP sources, to rapidly respond to changes in available bandwidth, and to utilize link bandwidth efficiently.

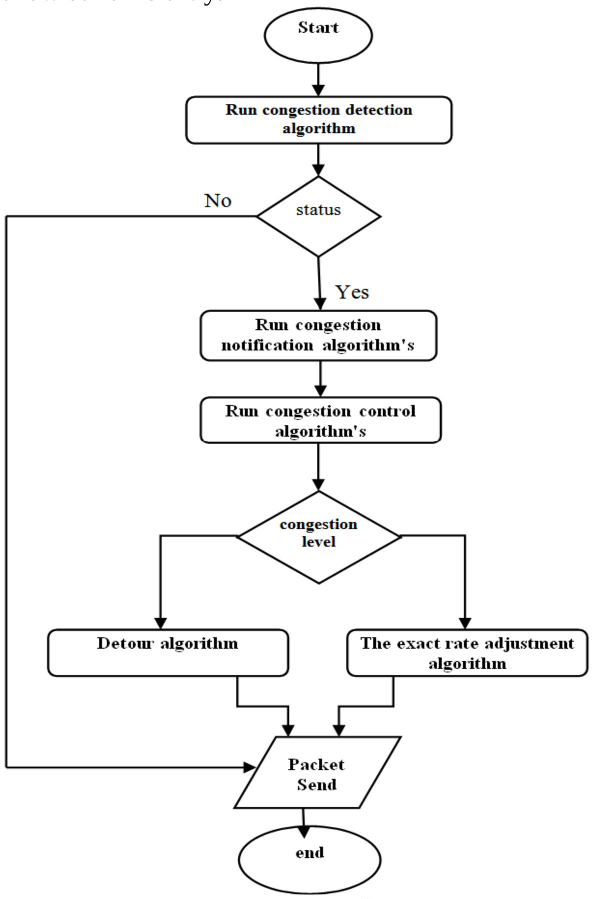

Figure.3: Congestion flow chart

HSVTCP is shown to behave as a conventional TCP variant when deployed on conventional network types. Congestion control is achieved dynamically by adapting the window size according to an additive-increase multiplicative-decrease (AIMD) law [2]. TCP operates a window based congestion control algorithm. The TCP standard defines a variable CWND called the congestion window. The congestion control protocols for deployment

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in High Speed and long distance network has the much interest in the network community.

TCP congestion control algorithm is ineffective in network, where the window size may become large. We analyse the performance of High Speed TCP Variant by various protocols in static as well as the mobile topologies. The congestion control algorithms of TCP are very essential for the reliability of data transmission [3]. The success of TCP in wired networks motivation its extension to the wireless networks. The performance degrades significantly by increasing the number of hops in the wireless networks.

Among these, Multi-Hop Wireless Network the performance degradation of TCP is main problem which is reported in RTOs by Non-Congestion Control Mechanism. The two main types of Non-Congestion RTOs are as follows (1) spurious RTOs due to sudden delays or Re ordering of packets and (2) RTOs due to random packet loss caused by wireless transmission errors. These types of RTOs are unavoidable in MHWN.

In this paper, we develop a new TCP algorithm for differentiating non-congestion RTOs (TCP NRT), which are caused by transmission errors and sudden delays on the network path, and thereby improve the performance of TCP in MWN

TCP NRT consists of three key components. They are as follows:

1. Detection of non-congestion RTOs (NRT-detection): To detect non-congestion RTOs from congestion RTOs using the (ECN) mechanism.

2. Differentiation of non-congestion RTOs (NRT-differentiation): To differentiate the RTOs due to random packet losses from spurious RTOs by using the comparison of the first ACK after the expiration of RTOs.

3. Reaction to non-congestion RTOs (NRT-reaction)

To guide the TCP sender, for control the unnecessary reduction of CWND size and to control the needless retransmissions according to the types of RTOs. With the help of these components, TCP NRT can improve the performance of TCP in MHWN s.

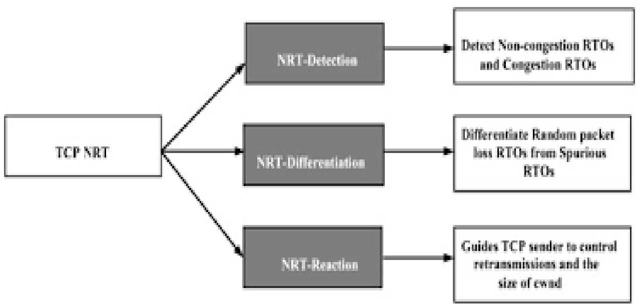

Figure.4: TCP NRT Classification

4. Detection of non-congestion RTOs (NRT-detection)

To differentiate the RTOs due to random packet losses from spurious RTOs (together we call non-congestion RTOs), first we should distinguish these RTOs from congestion RTOs. In order to detect non-congestion RTOs and congestion RTOs, we modified the ECN as it has been approved as an Internet official protocol [1]. To avoid been the packet drop rate of congestion window the dropped packet will trigger the duplicate ACK message from the receiver. This is because ECN provides higher network efficiency, fairer distribution of bandwidth, less packet losses, and less traffic and benefits to short flows present a strong case for its implementation. This type of probabilistic packet drop prevents the router from entering the fully congested state and helps reduce the queue delay [2]. An ECN-capable router is configured with three main parameters.

They are the minimum threshold (min), maximum threshold (max), and the maximum marking probability (P Max).When a packet arrives at the router. ECN calculates the average queue length (AQL), and if the AQL is below min, the router will not mar the packet [9]. If the AQL exceeds min and below max, the router marks the packet with probability (P),

$$P = \left(\left(\text{avg} - \text{min}^{\text{th}}\right) / \left(\text{max}^{\text{th}} - \text{min}^{\text{th}}\right)\right) P_{max}$$

As a result, the sender reduces the size of CWND to control the sending rate in advance before the network becomes heavily congested. In this subsection, we explain in detail how TCP NRT differentiates the RTOs due to random packet losses from spurious timeout.

5. Detection and differentiation of non-Congestion RTOs

In this example, consider that the last ACK Is not marked. As a result, the sender confirms that the RTO happened due to a non-congestion event, either random packet loss or sudden delay.

This subsection explains how TCP NRT reacts after the TCP sender detects and differentiates the RTO s. When the value of CWND reaches the value of the sender enters the CA state. During this phase, the sender increases its CWND size linearly for every RTT. This linear growth of transmission rate helps the sender to slowly probe the available network bandwidth.

In this section, we explain the simulation methodology and performance metrics we use to evaluate the effectiveness of the TCP NRT algorithm in MHWN s. In order to make sure of the efficiency of our algorithm, the performance of TCP NRT is compared to that of related works such as l, DSACK, F-RTO, EQRTO, and New Reno

[1]. If the packet triggered by RTO is not found at the Macand network layers, we assume that the corresponding RTO is triggered due to sudden delay, and we treat those RTOs as spurious RTOs.

Throughput is one of the most important performance metrics in the TCP. We define throughput as the number of packets sent divided by the transmission time. We measured throughput in terms of the number of hops, number of flows, varying bandwidths, different packet loss rates, and varying delays using chain and grid topologies. It defines exactly how a scheme detects the different types of RTO s

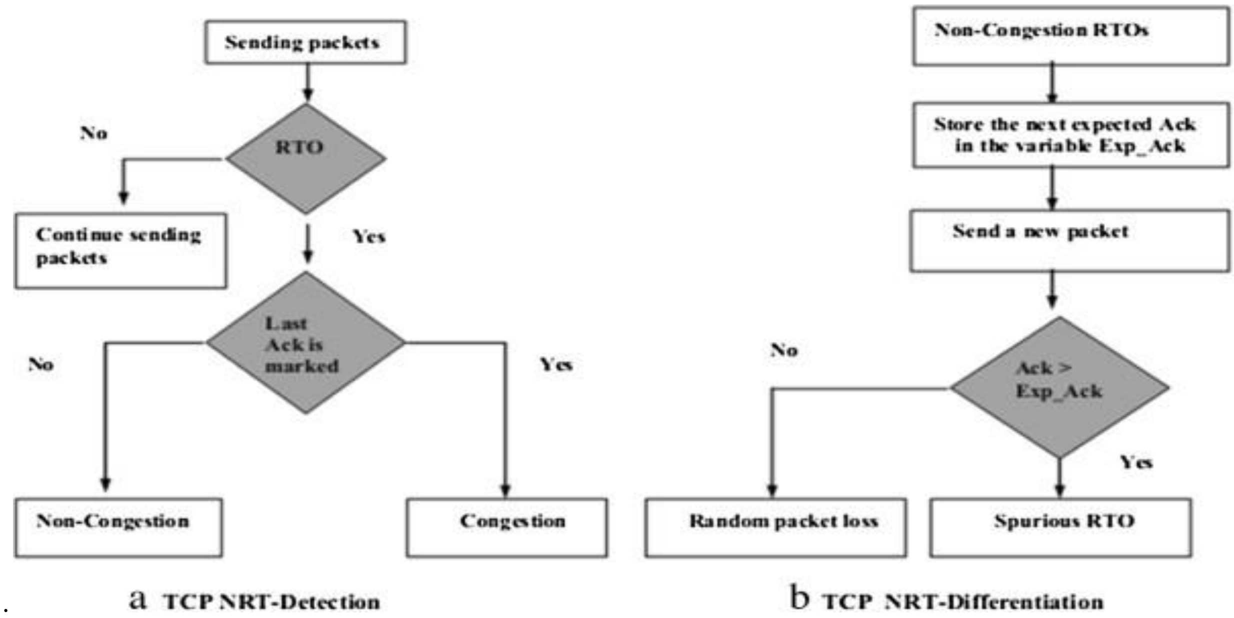

Fig. 5: Flow diagram of TCP NRT- Detection and Differentiation

6. Comparison with the existing solution

In this section, we compare the existing solution with the TCP NRT using RTO s which detects the congestion RTO s due to the random packet loss we can see that only TCP NRT can guide the sender congestion window mechanism by detecting and differentiating the congestion and non-congestion RTO s and thereby increase the performance of TCP in MHWN s.

7. Conclusions

In this paper, the Non-Congestion Control Mechanism (NCCM) to improve the TCP performance of Multi-Hop Wireless Network (MHWN) we used a high speed variant along with the RTOs and TCP NRT. In this paper, we introduce an efficient algorithm called non congestion retransmission timeouts (TCP NRT) which is capable of recovering packets after the RTOs by reducing unnecessary retransmission and the reduction of congestion window size in order to improve the performance of TCP in Multi-Hop Wireless Networks. Result shows a minimum of packet loss rate.

Further when the network co exist with both the congestion and non-congestion RTOs, the throughputs of TCP NCCM increases more when compared to the other solutions. In future it could control its congestion control mechanism when it receives the duplicate ACK or RTOs in case of loss of ACKs in addition to the sudden delay or random loss of packets. Thus the effects of non-congestion losses on the performance of High Speed TCP variant with the parameters such as convergence speed, RTT fairness, TCP NRT, RTOs is studies the TCP performance of Multi-Hop Wireless Networks using the Non-Congestion Control Mechanism.

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