Optimizing Network Delay by enhanced TCP retransmission schemes in Wireless Networks

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Abstract: Transmission control Protocol (TCP) is the transport layer protocol handles the maximum internet traffic, thus maintaining performance of transmission control protocol is important, which impacts the performance of internet. However, end-to-end turnout in TCP degrades notably when operated in wireless networks, since random packet losses and packet rearrangement area unit thought of as congestion. In wireless networks, because of high bit error rate and changing level of congestion, retransmission timeouts for packets lost in transmission is inevitable. transmission control protocol misinterprets this loss to congestion and invokes congestion control by triggering quick retransmission and quick recovery, resulting in under-utilization of the network resources. This paper presents numerous performance improvement mechanisms by that transmission control protocol doesn't take into account each packet loss as congestion. These mechanisms facilitate transmission control protocol to distinguish between congestion and packet loss and increase throughput performance.

Index Terms - transmission control protocol, quick retransmission, quick recovery, retransmission timeout, Wireless transmission control protocol

I. INTRODUCTION

To communicate two or more network devices TCP offers efficient ordered data transmission with reliability by avoiding redundancy and congestion's is the trusted transport layer protocol for internet/intranet based wired / wireless communication systems' is performance is predictable under wired environment where not in wireless topologies due to uncontrolled congestion, retransmission and timeout errors. In wireless networks, RTT is high will lead timeouts and causes retransmission. Even though if the network maintains good RTT timeout are in common due to unpredicted nature of wireless networks impacts higher throughput. To maintain constant amount throughput in wireless networks enhanced retransmission approaches are interesting and attracting by researchers.

II. RELATED WORK

The satellite and wireless communication [1] network is the collection of transponders (has receivers) configure with various frequency ranges allocated for uplink signals from the earth to satellite. Throughput of the network decides the protocol performance, and not easy to maintain constant throughput value. To achieve better throughput some of the past researchers are combined TC schemes with link layer retransmission. [2] merging Selective Link layer, ARQ (Automatic repeat request) along with explicit loss notification maintains wireless links are reliable and addressed packet loss issues. In [3] Q-AOMDV supports Quality of service in terms of counting hop, bandwidth utilization, end to end delay in MANET and outperforms than AOMDV.The performance of Q-AOMDV evaluate with metrics PDF (Packet delivery Fraction), Average end-to-end delay, NRL (Normalized Routing Load). [4] adopts PDR (Path diversified retransmission) to increase throughput and overcomes the issues of RTT estimation and packet reordering in multipath Wireless Mesh Networks. [5] T-DLRP (Time based – Detection of the Loss of fast Retransmitted Packets) intellectually identify the packet losses and retransmit quickly without waiting for retransmission timeout using the schemes FRL detection, differentiation, retransmission. In [6] Park discussed about the cause of time out, based on the cause it handles congestion window decrease or increase retransmission time-off back value. The techniques understand congestion or not based on the estimation of queue length and determine RTO cause.

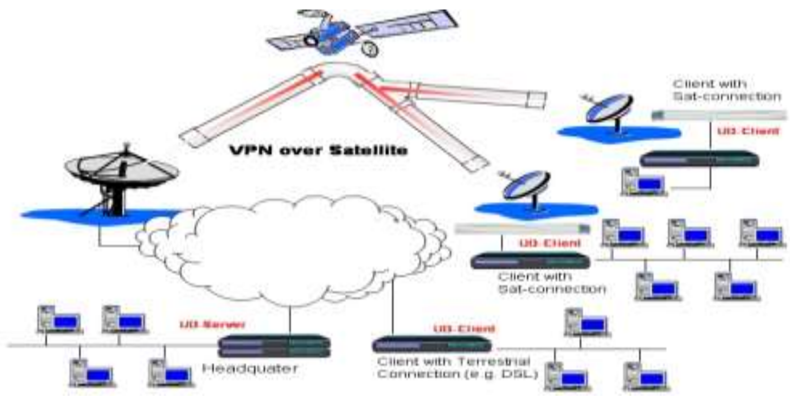

Figure.1. Satellite Wireless Network Topology [1]

III. PROPOSED SCENARIO

In this paper we are proposing the new version of algorithm maintains the congestion window at constant value during retransmission occurs, which improved the throughput and reduce the delay radically. The technique initiates the retransmission restart timer with updated value. If the retransmission timeout occurs first time in restart the timer by one and continue the process. In the same TCP connection if the retransmission occurs second or subsequent it doubles the existed value and continue the process by setup new flag values.so that retransmission never arise, timer expires. The Pseudo code illustrated in below Figure.2.

```
If (1st Retransmission) then   RTO_Current=Minimum ((1.5 * RTO_Config), Max_RTO),
Delayed Connection = 1, Timer (RTO_Current)
Else
If (2nd Retransmission) then   RTO_Current=Minimum ((2 * RTO_Config), Max_RTO)
Delayed Connection = 0, Timer (RTO_Current)
Else
Calculate ss_Threshold = (Send_Max – Send_Unpacked) / 2;
If (ss_Threshold <= 2* send_mss) Then ss_Threshold = 2*send_mss;
Else cwnd =1;
```

Figure.2. Handling RTO for delay in Wireless Networks

```
case TCPS_ESTABLISHED:
case TCPS_FIN_WAIT_1:
case TCPS_FIN_WAIT_2:
case TCPS_CLOSE_WAIT:
case TCPS_CLOSING:
case TCPS_LAST_ACK:
case TCPS_TIME_WAIT:

        if (SEQ_LEQ(th->th_ack, tp->snd_una)) {
                if (tlen == 0 && !dupseg && tiwin == tp->snd_wnd) {
                        tcpstat.tcps_rcvdupack++;
                        if (TCP_TIMER_ISARMED(tp, TCPT_REXMT) == 0 ||
                          th->th_ack != tp->snd_una)
                                tp->t_dupacks = 0;
                        else if (tp->t_partialacks < 0 &&
                                 (++tp->t_dupacks == tcprexmtthresh ||
                                 TCP_FACK_FASTRECOV(tp))) {
                                tcp_seq onxt;u_int win;
              int sack_bytes_rexmt;
      if ((tcp_do_newreno &&
                 SEQ_LT(th->th_ack, tp->snd_high)) ||
                 (TCP_SACK_ENABLED(tp) && tcp_sack_output(tp, &sack_bytes_rexmt)))
   {
                                        tp->t_dupacks = 0;
                                        break;
                                }
```

Figure.3. Pseudo code for retransmission in TCP New Reno

IV. SIMULATION AND RESULTS

The Overall simulation carried out in to two approaches, namely single-hop and multi-hop. The NS2 simulation parameters and preconfigured values are illustrated in the below table.1. The comparison results presented in Figure 4 (Single-hop) and Figure 5 (Multi-hop).

Table 1: Simulation setup parameters

Parameter	Value
MAC data rate	24 Mbps
MAC buffer size	256 KB
MAC Long Retry Limit	4
MAC Short Retry Limit	7
Routing Protocol	AODV
TCP Version	New-Reno
TCP Duplicate ACK Threshold	3
Initial RTO	2 seconds

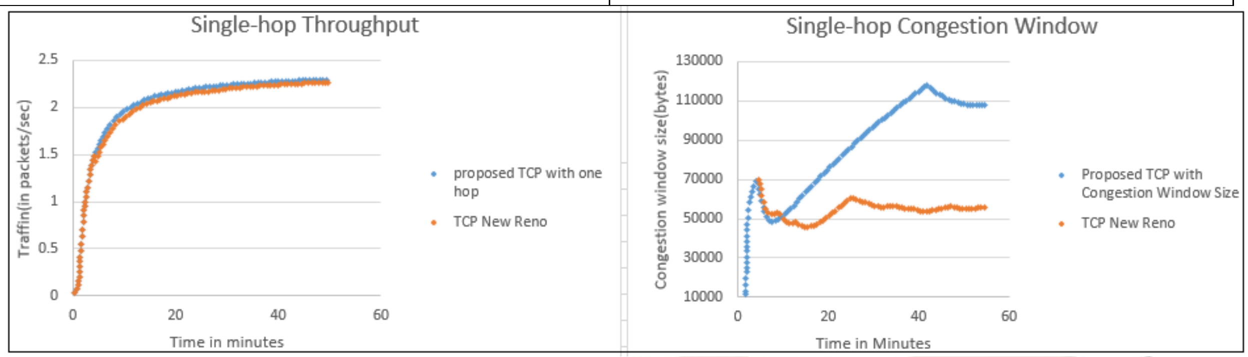

Figure.4. Throughput and Congestion window with proposed approach in Single-Hop Scenario

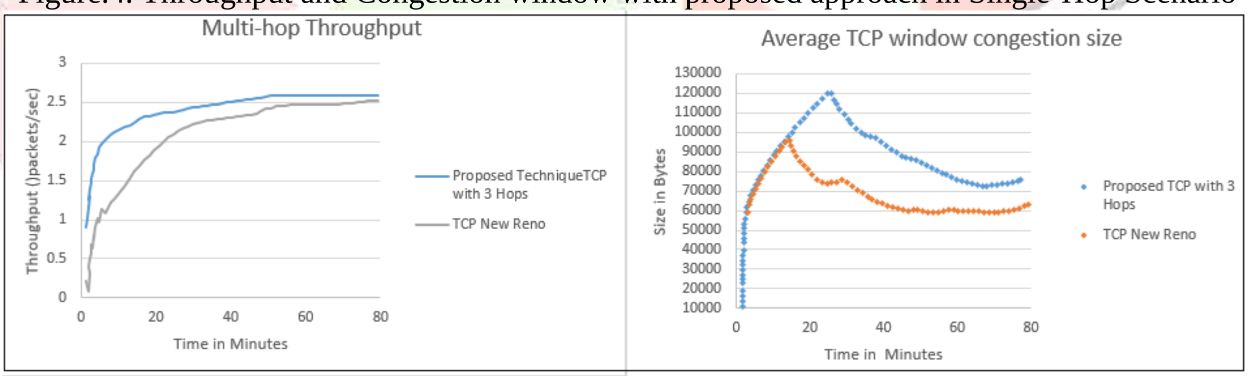

Figure.5. Throughput and Congestion window with proposed approach in Multi-hop Scenario

In Single-hop scenario (Figure 4 illustrated) during our simulations we observed that on an average 3 – 5% throughput increase is achieved. However, congestion window shows considerable improvement as reduction of congestion window is avoided by allowing its retransmission timeout to run little longer for TCP connections where delay is expected and during our simulations we observed that congestion window is maintained on an average 35 – 40% higher than TCP New-Reno. Where as in Multi-hop scenario (Figure 5 illustrated) achieved on an average a 4 – 10% higher throughput than TCP New-Reno and congestion window is around 45 – 50% higher than what is observed with TCP Reno.

Table.2. illustrates the comparison of congestion window and throughput by proposed technique as below:

Scenario	*Congestion window size (in bytes)*	*Throughput (Packets/ sec)*	*Percentage Improvement*	
			Throughput	*Congestion Window*
Single-hop	5400	0.45	3-5	35-40
Multi-hop	5100	0.11	4-10	44-50

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