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Energy Utilization of TCP in Ad Hoc Networks

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Energy Utilization of TCP in Ad Hoc Networks

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I. Introduction

Communication plays a major role in the ad- hoc networks and is used many applications. It account for a large proportion of energy usage. Energy is an important factor in the ad-hoc networks. It is very essential to lower the energy consumption in the adhoc networks. There are many techniques for reducing energy consumption and energy cost in ad-hoc networks. MAC protocols and routing protocols use energy based metrics. This approach reduces the energy cost. Additionally the energy of the TCP also can be reduced as well. There are four variants in saving the energy. The four variants in saving the TCP energy are : Reno, New Reno, SACK, and TCP-ECN-ELFN. SACK means selective acknowledgement. TCP- ECN-ELFN is a combination of ECN AND ELFN. ECN means Explicit Congestion Notification. ELFN is Explicit Link Failure Notification. ECN is a mechanism that enables the senders to respond quickly to the beginning congestion in the network. When the energy cost is measured there is a good throughput for this mechanism. There is a good total energy and idealized energy for this mechanism. The idealized energy is defined as the energy consumed by the sender for transmitting or sending or receiving. The other variant TCP- ECN-ELFN mechanism results in the lower energy consumption when compared to the SACK. The other variants of TCP that is Reno and New Reno also had a good throughput. In this paper we discuss about the energy model and summary of the various TCP variant mechanisms.

II. Related Work

The link is an approach it includes the effect of ARQ AND FEC and the combination of the two in the ad-hoc networks. There are some link layer schemas to improve the energy behavior. The key idea is to discard the packet transmission when channel conditions are worsen. When the channel conditions is good then the packet transmission is resumed. The three implementations of TCP the no, Reno, New Reno. This mainly focuses on the wired and the wireless environment.

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III. TCP-ECN-ELFN

Table 1 summarizes the changes made to the operation of TCP to include ECN and ELFN. We note that our implementation goes beyond simply adding ELFN and ECN to TCP - we no longer treat timeouts and triple duplicate ACKs as indications of congestion. Rather, we rely exclusively on ECN to a network congestion. The table also describes the intuition behind these changes.[7] describes the interplay between routing failure (due to link outage or propagation of stale routes) and TCP throughput, in detail. Briefly, successive route failures (due to link failure) lead to timeouts hence resulting in a small congestion window.. Hence, the throughput of the connection is small. The proposed in [7] and used by us is as follows. A route failure message is propagated back to the TCP sender from the intermediate node that detects the route failure. This message has the effect of freezing TCP's state and initiating the transmission of probe packets. When there is a response to the probe packet (i.e., the route is up), TCP's state is unfrozen and transmission resumes. This solution ensures that there are no timeouts(and hence no unnecessary retransmissions), and that the TCP sender begins sending packets soon after the route is up. Mobility of nodes can cause packets belonging to the same connection to be routed along different routes. This can result in the receiver getting out-of-order packets which causes duplicate ACKs to arrive at the sender. Likewise, packet loss due to link- layer errors can result in triple duplicate ACKs or timeouts. On receiving three duplicate ACKs, the sender reduces its congestion window by a half and retransmits. the out of sequence packet while in the case of timeouts, the window is reduced to one or two segments. This congestion avoidance behavior has the net effect of reducing the throughput of the connection (due to the smaller congestion window) and thus increasing overall energy consumption. We believe that the appropriate _x for this problem is for the TCP sender to retransmit the of ending packet but not adjust its congestion window. We made this medication.

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Event	TCP's Behavior	TCP-ECN-ELFN
Routing Failure	Timeout, CWND ← 1 Retransmissions Exponential backoff timer	Freeze state Probe network Unfreeze when route restored
Triple Duplicate (TD) ACKs	Retransmit packet CWND ← CWND/2 + 3	Retransmit packet
Timeout	CWND ← 1 Retransmit Exponential backoff timer	Retransmit packet
Explicit Congestion Notification	No action	CWND ← CWND/2

Figure 1

IV. Over view of TCP Variants

At present all the TCP implementations depends on tahoe. Various algorithms are incorporated on TCP for slow start, fast avoidance and fast retransmit and modifications in the formulas for estimation the RTT. RTT means round trip time. The TCP RENO is very much similar to the tahoe but there is a slight difference that is the fast retransmit algorithm this fast retransmit algorithm includes the fast recovery. When a sender receives three duplicate acknowledgment signals then it reduces by half. But as not like a tahoe it becomes the slow start. Thus the RENO increases the congestion rapidly by setting it to the minimum. Here the retransmit timer will turn off and this leads to the congestion and the low throughput.

TCP New Reno overcome the disadvantages of the RENO. A partial acknowledgment infers that there are some un acked packets in the senders window. In RENO a partial acknowledgment gives the sender the fast recovery in a view of the multiple packet losses. Whenever the receiver gets a data is out of sequence then that un sequences data creates a hole in the buffer that is present at the receivers end. This is the reason why the receiver generates a duplicate acknowledgment. The receiver includes the starting and ending sequence addresses that is the sequence numbers. These sequence numbers are present in the SACK. The first block in the SACK represents the recently transmitted segment to the receiver. The remaining SACK block represents the recently reported blocks. This algorithm is helpful for TCP to recover from multiple segment losses of data within one round trip time. When the sender comes to know that there is a loss of the packet then it retransmits and reduces the congestion to half and does fast recovery in RENO and New RENO. SACK has a variable named pipe it gives the number of packets in the flight. This pipe variable is increased by one that is incremented for the transmission and it is decreased by one that is decremented when it receives a duplicate acknowledgment. The sender maintains a list of packets that are missed those packets zed energy cost is high for SACK.

V. Results

The greater part of the examination in impromptu systems administration utilizes the ns2 test system and to a lesser degree different test systems like glomosim to run tests. The benet of this approach is that scientists can expand upon the work of others and utilize a standard stage to check contending thoughts

Ntwk condition	Lower E_l	Higher Goodput
Mobile ad hoc networks		
Route failure	ECN-ELFN	ECN-ELFN
Pkt reordering	ECN-ELFN	ECN-ELFN
Static ad hoc networks		
Packet Loss	Newreno	ECN-ELFN
Bursty loss	ECN-ELFN	ECN-ELFN
Congestion	ECN-ELFN	ECN-ELFN

Figure 2

retransmitted. Even if the partial acknowledgements are received the pipe value is decremented by the sender. SACK has a good throughput in the many of the network conditions. SACK would consume low total energy but the sender that is using has to execute lot of code and maintain big data structures. While ns2 is a decent instrument for measuring customary system measurements, for example, throughput, misfortune, and deferral, it is ill suited to measure vitality utilization of a convention like TCP. This is on the grounds that the vitality devoured incorporates not just the radio costs (which are demonstrated to some degree in ns2) yet the hub level convention handling and information duplicate expenses. An alternative thought would be to utilize a hub level vitality simulator/emulator that gives genuinely precise vitality readings for preparing code. The issue, notwithstanding, is that these devices don't reenact the specially appointed system environment. Therefore, an romanticized test system would be one which joined a point by point hub level emulator and ns2. Nonetheless, we are not mindful of any such test system that we could have utilized. Given the above obligations, we chose to utilize a half breed methodology to measure the hub level TCP vitality. Specifically, we utilized a 4-hub system (see Figure 3) in which we measured the vitality of the sender hub straightforwardly utilizing two Agilent 34401a multi metes (determination of 1msec)one measured the aggregate framework vitality while the second measured the radio level vitality alone (Figure 2 demonstrates an example information follow) Toshiba smart phone that has a Lucent 802.11 Silver (11 Mbps) Wavelan DSSS PC card. Further, the two moderate hubs

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are situated up to go about as switches. To reproduce multi- bounce specially appointed system conduct, we ran Dummynet at hub C. Dummynet is an unreservedly accessible portion level fix that permits us to control a wide-mixed bag of system practices, for example, been advanced as an issue Standard for utilization over the Web.

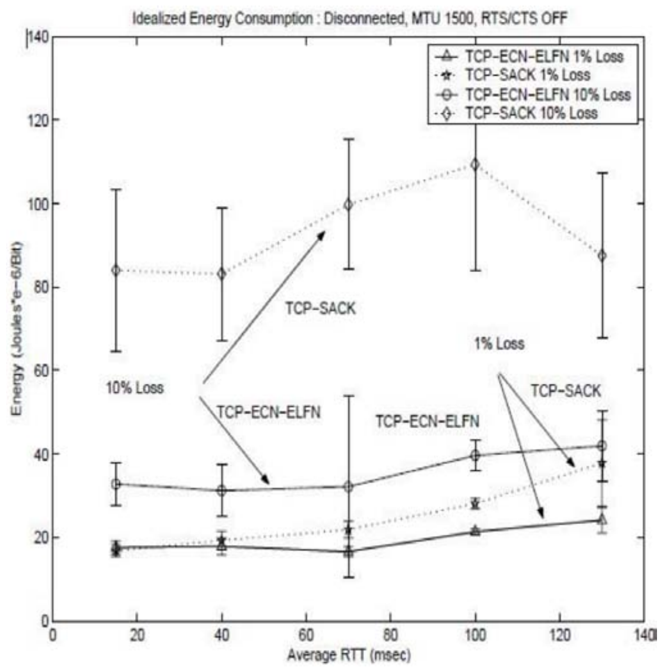

Figure 3

VI. Conclusion

In this paper we have characterized the energy cost of TCP Reno, Newreno, SACK and a modi_ed version of TCP(ECN-ELFN) that appears to be better suited for operation in ad hoc networks. The TCP-ECN-ELFN protocol relies on explicit routing failure noti_cations to freeze TCP state allowing faster recovery when the route is back up. In addition, it uses ECN to respond to network congestion. We showed that the TCP-ECN- ELFN protocol uses less energy and delivers a higher good put as compared with the other three TCP variants in all cases but one where New reno performs better (see Table 2). One of the areas of concern in using the TCP-ECN-ELFN protocol, however, is the issue of fairness. That is, will this protocol share bandwidth fairly between multiple connections. This question is fairly complex and is presently being studied in a ns2 simulation.

VII. Acknowledgment

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