A Simple method in ATP for Wireless Network

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Abstract- **Adhoc transport protocol (ATP) has been projected for Mobile Adhoc network to get through the precincts of TCP..ATP helps in decoupling of congestion control and in reliability mechanism and also shows improvement in avoidance of congestion window fluctuations. It shows better performance than default TCP, TCP-ELFN and ATCP. The major drawback of ATP is that it cannot exchange and use information of TCP. Avoiding lossy wireless links and adjusting epoch timer can improve the efficiency of ATP. This paper represents that ATP is suitable for Mobile Adhoc Network..**

Index Terms- **ATP, Mobile Adhoc Network, TCP, TCP-ELFN, ATCP,**

1. INTRODUCTION

wireless network, are distinguished by the lack of infrastructure. Nodes are open to travel and arrange in an random mode. Mobile ad-hoc networks can function in an unrelated way. So Wireless networks are distinguished by insufficient wireless bandwidth, wholly vibrant topology due to node mobility, unstable propagation uniqueness and network scalability. Therefore it has many issues at the network layer, medium access layer, transport layer and physical layer. At network layer the main problem is of routing packets due to dynamic topology, power limitation and error prone nature of wireless medium.The Medium Access Scheme has choice, which is also a challenge for ad hoc networks. On the other hand Random Access seems to be useful, but with the drawback of “hidden” and “exposed” terminal problems. [1].At physical layer power control is the intended. Transmission power of nodes needs to be coordinated so that it is lofty to arrive at proposed recipient while resulting in the least interference to interference to other nodes. Iterative power control algorithms have been devised in [2,3].At transport layer TCP and UDPare two protocols. UDP is simple.It is changeable and connectionless so it does not suit for ad hoc networks. TCP is transmission control protocol, and is responsible, byte-stream based, and connection oriented protocol is adjusted to give good performance in wired network but is unsuitable for MANET. TCP has four major problems as described below:

- TCP cannot distinguish between losses caused by route failure and congestion.
- TCP suffers from frequent path break.

- Contention on wireless channel.
- TCP Unfairness.

First two problems are found in MANETS whereas other two affects SANETS [4].At the transport layer, some mechanisms are attentive for examining the use of transmission control protocol (TCP) as the transport layer protocol, and refining its function either through lower layer mechanisms that cover the characteristics of adhoc networks from TCP, or through appropriate modifications to the mechanisms used by TCP [5–12]. TCP is connection oriented and reliable transport protocol that provides process to process communication using port numbers and also provides a stream delivery service..However Ad-hoc networks are operate in conditions where an communications is occupied or to install one is not cost -effective. A mobile ad-hoc network can also be used in applications, such as in disaster recovery, where the total communication is damaged and resorting communication swiftly is critical. By using a mobile ad-hoc network, an infrastructure could be set up in hours instead of weeks, as is required in the case of wired line communication.

Following Figure 1 shows the classification of these problems.

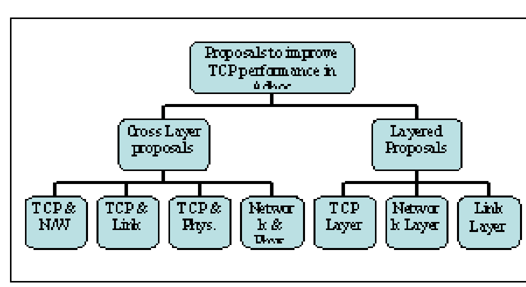

Figure 1: Classification 1 for transport layer protocol [18]

2. RELATED WORK

Various approaches have been operated to enhance the TCP performance in wireless Adhoc network. Figure 2 depicts the existing transport layer solutions for adhoc as well as other wireless networks.

K. Chandran et al provided a simple feedback based Scheme (TCP-F) to minimize the problem of frequent route failures in adhoc wireless network [10]. G. Holland improved TCP performance by decoupling the path break information from congestion information by use of Explicit Link Failure Notification (TCP-ELFN)[8].

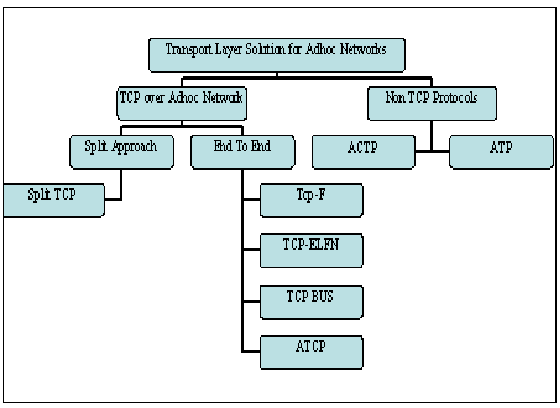

Figure 2: Classification 2 for Transport Layer protocol

Liu J et al improved TCP by using Adhoc TCP, which deals with the problem of route failure and problem of high bit rate in wireless network [12]. S Kopparty etal experienced Split TCP for mobile Adhoc Network [13]. D. Kim modified TCP into TCP-Bus that outperform TCP-F and TCP-ELFN [14]. Mesut Gunes et al presented an analysis of TCP’s performance in wireless and ad-hoc networks. It was emphasized the role of MAC layer retransmissions without breaking the end-to-end semantic of TCP. For this, the dynamic short retry limit was introduced which allows the adaptation of RTS/CTS retransmissions [15]. Hari Balakrishnan et al showed that a reliable link-layer protocol with some knowledge of TCP provides very good performance and it is possible to achieve good performance without splitting the end-to-end connection at the base station. It was also demonstrated that selective acknowledgments and explicit loss notifications result in significant performance improvements [16].
Recently, the exploration on a new transport layer protocols for MANET has expected. In reference number, as in [17], the authors experienced several design elements in TCP are not suitable for ad-hoc networks. They introduced a new reliable transport layer protocol for ad-hoc networks called ATP (ad-hoc transport protocol).
Next section explores the characteristic of TCP.

3. TCP

A. *Window Based Transmission*

TCP is a sliding-window *protocol*. The recipient informs the sender the accessible buffer space at the recipient (TCP header field "window"). The entire dimension of window is the least of sender buffer size, presented recipient window size and congestion window size.

The sender can transmit up to this quantity of data prior to wait for added buffer update from the recipient and should not have more than this amount of data in transit in the network. The sender must buffer the sent data until it has been ACKed by the receiver, so that the data can be retransmitted if neccessary. For each ACK the sent segment left the window and a new segment fills the window if it fits the (possibly updated) window buffer.

Due to TCP's flow control mechanism, TCP window size can bound the maximum theoretical throughput despite of the bandwidth of the network path. Using too small a TCP window can degrade the network performance lower than expected and a too large window may have the same problems in case of error recovery.

The TCP window size is the most important parameter for achieving maximum throughput across high-performance networks. To reach the maximum transfer rate, the TCP window should be no smaller than the bandwidth-delay product.

Window size (bytes) => Bandwidth (bytes/sec) x Round-trip time (sec) .

However, window based transmission mechanism in ad-hoc networks shows spurtiness in transmission of packets. The impact of such burstiness of traffic has two undesirable effects[17]

• round-trip time estimates*:* TCP depends on an exact round-trip time (*rtt*) estimation to fix the timer for its retransmission timeout (RTO). Coupled with the low bandwidths available to flows, the spurtiness shows artificially increasing the round-trip time estimates for packets later in a spurt. For example, the *ith* packet in a spurt experiences an *rtt* of $rttbase + (i - 1) * L/r$, where *rttbase* is the base *rtt* of underlying path, *L* is the length of a packet, and *r* is the available rate. Essentially, the round-trip time of a packet is impacted by the transmission delay of the previous packets in the burst due to the typically small available rates. It is observed that the *rtt* values fluctuate periodically. TCP sets its

RTO value to *rttavg* + 4 * *rttdev*, where *rttavg* is the exponentially average of *rtt* samples observed, and *rttdev* is the standard deviation of the *rtt* samples. Hence, when *rtt* samples vary widely due to burstiness, the RTO values are highly inflated, potentially resulting in significantly delayed loss recovery.

• *Higher induced load:* Spatial re-use in an ad-hoc network is the capability of the network to support multiple spatially disjoint transmissions. Unfortunately, due to the burstiness and the short term capture of channel by either the data stream or the ACK stream, the load on the underlying channel can be higher than the average offered load. For example, if a flow's instantaneous rate is 10 packets per second, while the ideal inter-packet separation that would allow for optimal use of the underlying channel is 100ms, bursty transmissions can result in higher contention at the MAC. We refer to the artificially (short-term) increased load on the underlying channel as the induced load. If the offered load is not high, the higher induced load will not result in any major performance degradation. However, if the offered load itself is high the utilization at the MAC layer can suffer significantly.

B. slow-start

Slow Start monitors that the speed at which new packets should be inserted in the network is the speed at which the acknowledgments are come back by the other end.

Slow start inserts another window to the sender's TCP: the congestion window(cwnd). When a new connection is known with a host on another network, the congestion window is initialized to one segment (i.e., the segment size announced by the other end, or the default, typically 536 or 512). Each time an ACK is received, the congestion window is improved by one segment. The sender can send out the minimum of the congestion window and the advertised window. The congestion window is flow control forced by the sender, while the advertised window is flow control forced by the receiver. The first is based on the sender's estimation of perceived network congestion; the next is related to the amount of available buffer space at the receiver for this connection.

The sender starts by sending out one segment and waiting for its ACK. When that ACK is received, the congestion window is increased from one to two, and two segments can be sent. When each of those two segments is acknowledged, the congestion window is increased to four. This provides an exponential growth.,. But in ad-hoc networks there are two other problems associated with the slow-start mechanism:

*1)*slow-start's exponential increase mechanism is still not brutal, as prior to a connection operates at its true available bandwidth it can obtain numerous *rtt* periods .This is not a important in wired networks as connections fritter nearly all of their duration in the congestion avoidance phase.

However, in ad-hoc networks, connections are smooth to common losses that show common timeouts and leads new slow-start phases

11) TCP fairness requires that a new protocol receive no larger share of the network than a comparable TCP flow. This is important as TCP is the dominant transport protocol, and if new protocols acquire unfair capacity they tend to cause problems such as congestion collapse.

C. Loss Based Congestion

In wired networks, congestion is core foundation of losses and network congestion is identified by sender's packet RTO period. After identifying a packet loss, sender node supposes congestion in network and also suggests a congestion control algorithm. But in wireless networks, High bit error rates also gives losses, and the research has been made either to thrash the losses of TCP during link-layer consistency [19], or to improve TCP with system that can differentiate congestion losses from random errors [20]. In addition to congestion and random wireless errors, mobility, unidirectional links and inherent fading properties of wireless channel also work as chief contributor to losses perceived by connections.

D. Linear Increase Multiplicative Decrease

The linear increase phase of TCP has the same problem of slowstart. In the multiplicative decrease phase the main statement is that a crashed packet and the resultant timeout are due to congestion .

TCP replies to a timeout by dividing cwnd. Although cwnd is defined in bytes, the literature often discusses congestion control in terms of packets (or more formally in MSS == Maximum Segment Size). cwnd is not allowed below the size of a single packet.

E. Dependence on ACKs

TCP depends on the of ACKs from receiver to check the reliability and to execute the actual congestion control.This ACKs dependence identifies problems for ad-hoc networks.Thus TCP is not suitable for wireless adhoc network .

ATP is Ad Hoc Transport Protocol that is specifically designed in reference number [17] for ad hoc networks to overcome the limitations experienced by TCP and is not a variant of TCP.

ATP has various characteristics which are discussed in next section..

4. ATP

Mainly ATP has various characteristics which are discussed as in reference number [21]:

A. Layered coordination

ATP use lower layer information and starts feedback information from network nodes to support transport layer mechanism and uses feedback from the network nodes for three different purposes: (i) initial rate feedback for start-up rate estimation, (ii) progressive rate feedback for congestion detection, congestion avoidance, and congestion control, and (iii) path failure notification. ATP does not require any per-flow state maintenance at the intermediate nodes, and hence is highly scalable.

B. Rate based Transmissions

ATP use Rate based transmissions instead of window-based transmissions as in TCP. Therefore self-clocking is not required; this avoids the drawbacks due to spurtiness and helps in decoupling of congestion control and reliability.

C. *Decoupled Congestion control and Reliability*

Decoupled Congestion control in TCP consist of two phases linearly increasing phase and multiplicatively decreasing phase, while ATP's congestion control has three phases Increase phase, Decrease phase and Maintain phase. TCP does not use the feedback from the intermediate nodes and hence does not know the real scope of congestion therefore it predictably executes multiplicative decrement in congestion window extent. On the other hand ATP relies of feedback from the ATP intermediate nodes therefore its decrease phase can be less traditional than that of TCP, and it functions in maintain phase when network conditions do not change.

D. Reliability

ATP uses rate feedback by the receiver that has been taken for congestion control and selective ACKS to report back to the sender any latest holes in the data stream. Moreover receiver maintains the epoch period for periodically sending the feedback to the sender. Therefore reliability feedback is not presented for every incoming data packet but on periodic basis therefore ATP maintains a larger number of SACK block as compared to TCP-SACK.

5. Scope of Improvement

It is obvious from the existing literature that their performance subsist a space in ATP and hence there is a scope of improvement in future. We can extend it by investigating and evaluating the performance of ATP with the help of simulator for the two conditions namely, Lossy Wireless Links and Adjusting Epoch Timer according to the different wireless bandwidths..

6. Conclusion and Future work

From the study it can be shown that ATP is appropriate for wireless adhoc network and it also abridges the troubles of TCP.

ATP judges that due to the wrong packets in computation of standard delay at intermediate nodes, delay has been caused. It may be true for wireless links with the MAC layer that could not recover from the errors. However, in very lossy wireless links with MAC layer competent to recover from the errors, the delay caused by wrong packets should not report for total average delay experienced by a node.

Epoch timer is a function of bandwidth. So the epoch timer may be made to scale up and down in accordance with the network size in future.

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