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PERFORMANCE IMPROVMENT OF TCP IN AD HOC NETWORK

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Abstract- Transmission Control Protocol (TCP) is the dominating end-to-end transport layer protocol which provides secure and reliable data transfer together with some other protocols in the protocol stack. Its performance is good in wired networks where packet losses are due to congestion. Recent works in transport protocols for ad-hoc networks have investigated the impact of ad-hoc network characteristics on TCP's performance, and proposed schemes that help TCP overcome the negative impact of such characteristics as random wireless loss and mobility.. If standard TCP is applied on wireless networks its performance degrades. in this paper we contend that there are several other factors that influence TCP's performance degradation. we contend that existing approaches to improve TCP performance over mobile ad-hoc networks have focused only on a subset of the factors affecting TCP performance. We identify a comprehensive set of factors, aimed at improving performance by reducing the number of route failures, predicting route failures before they occur and minimizing the latency for route error propagation. We show improves on the throughput performance of a default protocol.

Keywords- TCP, MANETs, LFN, Network, Wireless, routing protocol, data transmissions, destination, TCP performance, TCP's timers.

INTRODUCTION

Popularity of the internet packet data services for applications like e-mail, file transfer, web surfing etc. are increasing rapidly. The operation of TCP in wireless/mobile communications has been an important research issue in recent years, owing to the impressive growth experienced in that area of modern telecommunications during the past decade. the unmodified, standardized operation of TCP is not well aligned with the peculiarities of cellular environments. Terminal movement across cell boundaries, leading to handover, is misinterpreted by common TCP implementations as sign of congestion within the fixed network. To handle such congestion, TCP unnecessarily slows down transmission by reducing window sizes, and performing retransmissions, if relevant need arises.

And hence, TCP [1] which is the dominating end-to-end protocol on the internet today carrying the traffic. It provides a secure and reliable connection between two hosts in a multi-network environment appeared in numerous clones In the next generation of wireless communication systems, there will be a need for the rapid deployment of independent mobile users. Significant examples include establishing survivable, efficient, dynamic communication for emergency/rescue operations, disaster relief efforts, and military networks. Such network scenarios cannot rely on centralized and organized connectivity, and can be conceived as applications of Mobile Ad Hoc Networks. A MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links. Since the nodes are mobile, the network topology may change rapidly and unpredictably over time. The network is decentralized, where all network activity including discovering the topology and delivering messages must be executed by the nodes themselves, i.e., routing functionality will be incorporated into mobile nodes.

The mobile-stations that form the ad-hoc network perform the additional role of routers. Since each station in the network is potentially mobile, the topology of an ad-hoc network can be highly dynamic. wireless networks that can operate without the services of an established backbone infrastructure Such networks have traditionally been considered to have applications in the military and disaster relief environments.

Since TCP (Transmission Control Protocol) is by far the most used transport protocol in the current Internet, Over the past decade, a tremendous amount of research has focused on developing network protocols for ad-hoc networks [2], [3]. While the IEEE 802.11 multiple access protocol is primarily considered for the medium access control (MAC) layer, robust and simple protocols such as dynamic source routing (DSR) and ad-hoc on-demand distance vector (AODV) have emerged as the primary mechanisms at the routing layer. With the research at the MAC and routing layers gaining maturity, some researchers have lately shifted focus to the transport layer performance in ad-hoc networks [4], [5], [6]. studying TCP's performance over ad-hoc networks is of obvious interest. proposed schemes that help TCP overcome the negative impact of such characteristics as random wireless loss and mobility.

While we discuss related work in detail later in the paper, the primary mechanism proposed to handle mobility in related works involves sending an explicit link failure notification (ELFN) to the source from the link failure point. The source, upon receiving the ELFN *freezes* TCP's timers and state, re-computes a new route to the destination, and either releases the timers and state, or re-starts them from their respective initial values. The set of applications for MANETs is diverse, ranging from small, static networks that are constrained by power sources, to large-scale, mobile, highly dynamic networks. The design of network protocols for these networks is a complex issue. Regardless of the application, MANETs need efficient distributed algorithms to determine network organization, link scheduling, and routing. However, determining viable routing paths and delivering messages in a decentralized environment where network topology fluctuates is not a well-defined problem. While the shortest path (based on a given cost function) from a source to a destination in a static network is usually the optimal route, this idea is not easily extended to MANETs. Factors such as variable wireless link quality, propagation path loss, fading, multi-user interference, power expended, and topological changes, become relevant issues. The network should be able to adaptively alter the routing paths to alleviate any of these effects. Moreover, in a military environment, preservation of security, latency, reliability, intentional jamming, and recovery from failure are significant concerns. nodes prefer to radiate as little power as necessary and transmit as infrequently as possible, thus decreasing the probability of detection or interception. A lapse in any of these requirements may degrade the performance and dependability of the network.

Applications of MANETs include the battlefield applications, rescue work, as well as civilian applications like an outdoor meeting, or an ad-hoc classroom. With the increasing number of applications to harness the advantages of Ad Hoc Networks, more concerns arise for security issues in MANETs. The nature of ad hoc networks poses a great challenge to system security designers due to the Wireless network is more susceptible to attacks ranging from passive eavesdropping to active interfering, Mobile devices tend to have limited power consumption and computation capabilities which makes it more vulnerable to Denial of Service attacks and incapable to execute computation-heavy algorithms like public key algorithms

In MANETs, there are more probabilities for trusted node being compromised and then being used by adversary to launch attacks on networks, in another word, we need to consider both insider attacks and outsider attacks in mobile ad hoc networks, in which insider attacks are more difficult to deal with Node mobility enforces frequent networking reconfiguration which creates more chances for attacks, for example, it is difficult to distinguish between stale routing information and faked routing information. Without knowing exactly who you are talking with, it is worthless to protect your data from being read or altered. Once authentication is achieved in MANET, confidentiality is a matter of encrypting the session using whatever key material the communicating party agree on. Note that these security services may be provided singly or in combination.

RELATED WORK

In a IEEE 802.11 based MANET, there is interference caused by the MAC layer due to maximum spatial reuse and that by TCP data and ACK along forward and return paths. Because of this the upper bound of BDP is further tightened as kN, where N is the RTHC of the path, and k is a reduction factor due to transmission interference at the MAC layer

This serves to keep the network uncongested, and reduces the number of congestion related packet losses. I-ADTCP tries to remain in congestion avoidance phase at all times by detecting and reacting to incipient congestion. Compared to a small fixed CWL setting (1 or 2 packets) as in [7][8] although dynamically setting the CWL in I-ADTCP has better performance in most cases, but it may not outperform a small fixed CWL in every scenario. This is because the adaptive upper bound may be too high for certain scenarios in a dynamic MANET. Nevertheless, it is generally applicable to any path in MANET, and its performance is usually better than that of a small fixed CWL setting. For IADTCP new field for hop count is required in IP header to deliver the RTHC. For the simulations Optimal value of the CWL derived is specifically for IEEE 802.11 MAC layer protocol.

PROPOSED TECHNIQUE

TCP Losses:

Every route failure induces up-to a TCP-window worth of packet losses. While the losses have an absolute impact on the performance degradation, the TCP source also reacts to the losses by reducing the size of its window. Note that ELFN will prevent this negative impact on TCP's performance by appropriately freezing TCP's state.

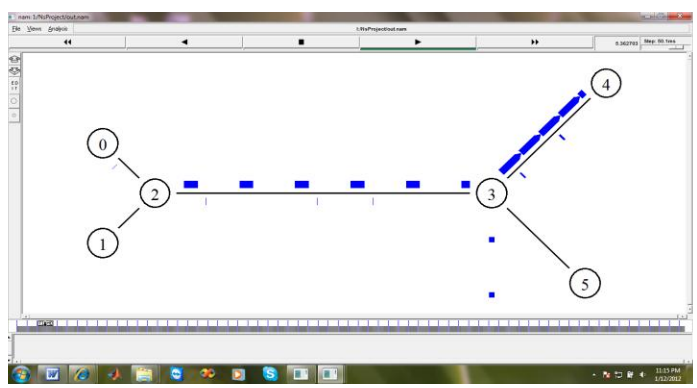

Figure-1 NS2 Simulation on performance of TCP

MAC Failure Detection Time:

Since the MAC layer (802.11) has to go through multiple retransmissions before concluding link failure, there is a distinct component associated with the time taken to actually detect link failure since the occurrence of the failure. Importantly, the detection time increases with increasing load in the network. While an external mechanism to detect link failures (e.g. through periodic becomes at the routing layer) would solve this problem, it comes at the cost of beacon overheads and associated trade-offs.

MAC Packet Arrival:

When a failure is detected as described above, the link failure indication is sent only to the source of the packet that triggered the detection. If another source is using the same link in the path to its destination, the node upstream of the link failure will wait until it receives a packet from that source before informing it of the link failure. This also contributes to the magnitude of the delay after which a source realizes that a path is broken.

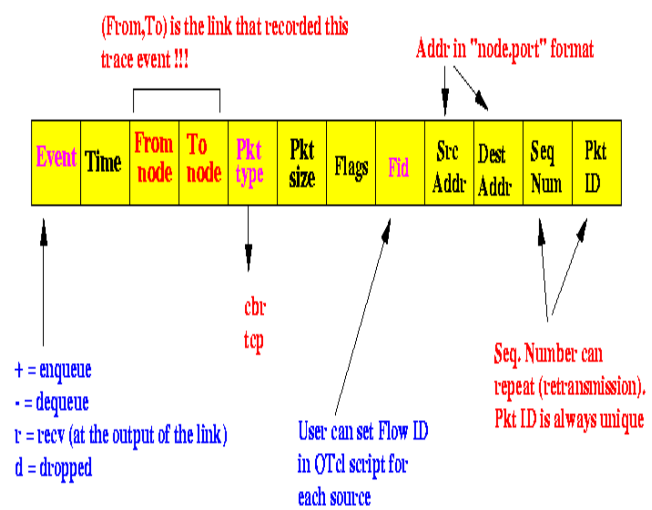

Figure-2 Packet Format of TCP

The total number of packets sends decrease when the speeds of the nodes are increased. However, among these protocols, performs better at higher This type of situation is happened due to the network's topology pattern and parameter in the simulation and behavior of timeout threshold and congestion window at these points.

PERFORMANCE EVALUATION

A comprehensive list of the metrics for TCP performance Evaluation of Congestion Control Mechanisms" by S. Floyd. In the first step, this tool tries to implement some commonly used metrics described there. Here we follow the RFC and classify the metrics into network metrics and application metrics. They are listed as follows.

Throughput:

For network metrics, we collect bottleneck link utilization as the aggregate link throughput. Throughput is sometimes different from Throughput, because Throughput consists solely of useful transmitted traffic, where throughput may also include retransmitted traffic. But users care more about the useful bits the network can provide. So the tool collects application level end-to-end Throughput no matter what the transport protocol is employed. It is observed from Fig. 3 For long-lived FTP traffic, it measures the transmitted traffic during some intervals in bits per second. For short-lived web traffic, the Pack Mime HTTP model collects request/response Throughput and response time to measure web traffic performance.

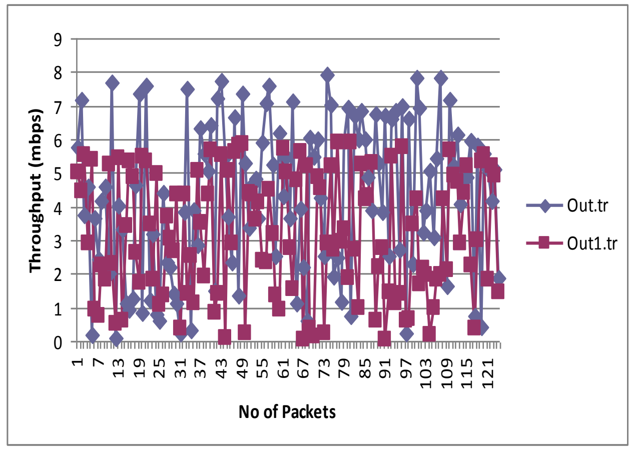

Figure-3 Throughput of NS2 Simulation on performance of TCP

Total Number of Packets Sends:

We have measured the performance of TCP the number of total packets sent. If the numbers of nodes are limited, the intermediate transmission path of the node link becomes broken then there is huge probability of packet losses and timeouts. As a result, the total number of packets sent is low. Another reason for small number of packet transmission is node link is broken or hang. For an optimum number of intermediate nodes, packet transmission is good. It is observed from Fig. 4 that the performance of out.tr is a better than the others for increased number of nodes as it uses modified quick start procedure under this packet loss and timeout conditions. But if the number of nodes increases more, the optimum value of congestion and nodal delay also increases and hence the total number of packets sent falls again.

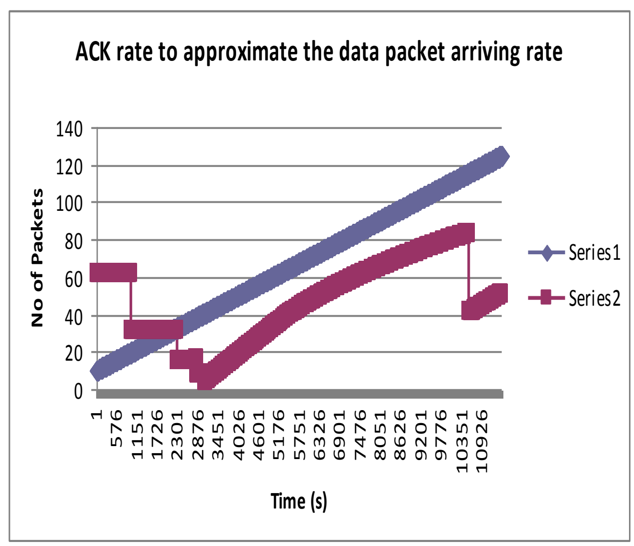

Figure 4. ACK rate to approximate the data packet arriving rate

We have changed the number of nodes and measured the performance in terms of the number of total packets sent. If the numbers of nodes are limited, the intermediate transmission path of the wireless link becomes unreliable and hence there is huge probability of packet losses and timeouts. As a result, the total number of packets sent is low. For an optimum number of intermediate nodes, packet transmission is good It is observed from Fig. 3 that the performance is a small better But if the number of mobile nodes increases more, the optimum value of congestion and nodal delay also increases. increased number of nodes as it uses modified quick start procedure under this packet loss and timeout conditions. hence the total number of packets sent falls again.

We have changed the speed of the nodes and measured the total number of packet drops With the increase of this speed, probability of timeout increases as it performs handoff and wrong estimation of Round Trip Time (RTT). that the number of packet drops increases although the performance is not uniform. But the average performance is better than other existing approaches because of its improved functional criteria in case of timeout. The reason behind this behavior depends on the ad-hoc network's topology pattern in simulation like nodes initial and final positions and their antenna parameters.

Delay:

We use bottleneck queue size as an indication of queuing delay in bottlenecks. Besides mean and max/min queue size statistics, we also use percentile queue size to indicate the queue length during most of the time.

Loss Rate:

To obtain network statistics, we measure the bottleneck queue loss rate. We do not collect loss rates for FTP and web traffic because they are less affected by this metric.
For interactive and streaming traffic, high packet loss rates result in the failure of the receiver to decode the packet. In this tool, they are measured during specified intervals. The received packet is considered lost if its delay is beyond a predefined threshold.

CONCLUSION

Multi-hop wireless ad-hoc networks have gained considerable attention over the last decade by virtue of their applications to military and disaster relief applications, and more recently even in conventional wireless packet data networks. In this paper we investigate the impact of the mobility of nodes in an ad-hoc network on TCP's performance. We identify the key factors that contribute to TCP's performance degradation as TCP losses, MAC link failure detection latency, Link failure notification latency, and Route computation time. We show that the above factors contribute both in absolute terms and in terms of their impact on TCP's behavior. We argue that existing solutions to improve TCP performance that fall under the broad category of ELFN schemes address only a subset of the factors. Finally, we propose to consisting easily implementable mechanisms at the medium access and routing layers that alleviates the impact of mobility on TCP's performance. We demonstrate through simulations that the proposed framework improves TCP's performance by about 84% over the default TCP/802.11 protocol stack, and by about 75% over an ELFN enabled protocol stack in a lightly loaded (one connection) dynamic scenario. The performance enhancement over the default and ELFN protocol stacks in a heavily loaded (35 connections).

A limitation imposed on the value of congestion window, implies a limitation on the sending window and as such decreases the packet dropping, queuing which results in increased throughput. Amount of the packets contending for access to the medium at one time is decreased which leads to better spatial reuse of the medium by decreased spatial contention. There are fewer packet drops due to packet collision, fewer link layer drops due to interference, which leads to less spurious route breakages.

Future work: ACK compression issues., more accurate Simulation traffic delay generator classify short connections and use wireless link information collected in BS to detect timeouts and use 3-dup ACKs to trigger retransmission.

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