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Reliable communication using modified TCP over Wireless Network

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ABSTRACT

Existing Transport Protocols like TCP is well-tuned to the traditional networks made up of wired links and fixed hosts. TCP provides reliable end-to-end delivery of packets between hosts in packet-switched computer communication networks. It provides reliability by retransmitting packets that are not delivered within a specific timeout interval. Because of the relatively low error rates on the wired network, TCP correctly manages the losses in a congested network. TCP reacts to packet losses by dropping the transmission window at the sender and initiating congestion control mechanisms like slow start that reduce the load on the network. TCP reacts to packet losses by dropping its window size and initiating congestion control or avoidance mechanisms in a network consisting of wireless links characterized by high bit-error rates, intermittent connectivity, and handoff-related losses. This is because it does not distinguish between transmission-related losses and losses due to congestion. Such a TCP reaction results in an avoidable reduction in the link bandwidth utilization and, consequently, significant degradation in performance in the form of poor throughput and high interactive delays. This paper presents some modifications to the existing TCP protocol. We have modified the TCP protocol to make it suitable for wireless communication environments. We have studied the performance of our modification in comparison to some other existing TCP protocols.

Keywords: *Congestion Avoidance, Fast Recovery, Fast Retransmission and Slow Start, Mobile Ad-hoc Network, WTCP, MTCP*

1. INTRODUCTION

TCP [1] is used as a transport protocol on the Internet to provide a reliable byte stream service to the upper layers by exchanging data and acknowledgment (ack) packets between senders and receivers. A sliding window limits the number of unprocessed packets and uses the arrival of Ack as a clock to send new data packets to the network[2]. It also transmits confirmation packet.. Tahoe is developing periodic windows, including slow start and congestion avoidance periods. In the slow start phase, the window grows rapidly to the estimated capacity of the network. Then congestion avoidance is deployed to find more network capacity[3]. This increase continues until one of the intermediate buffers overflows, and one of the packets sent is lost. The timer expiration detects packet loss, and the window size is reduced to one packet. The slow start is then used again to fill the link and initiate the self-clocking mechanism.

The TCP protocol provides a standard general-purpose method for reliably transmitting data. TCP provides a standard way to access remote computers on unreliable networks for applications. This reliability is provided by adding services to the IP.

TCP reliability is achieved by resending data that has been sent but not confirmed by the recipient within a certain amount of time. Therefore, outbound TCP must keep the outbound data in memory until it acknowledges the outbound data. TCP assumes that IP is inherently untrusted, so TCP adds a service that guarantees end-to-end data transmission. TCP has very low expectations for the services provided by the network. So it can run on a variety of hardware. The lower tier only needs unreliable datagram services. TCP is the primary transport protocol used to provide reliable full-duplex virtual circuit connections [4]. The most common use of TCP is to run it over IPv4 or IPv6. TCP provides reliable transmission for applications but does not guarantee the time for delivery of segment to the receiver [5-7].

2. PREVIOUS WORK

Some of the related works in this direction are as follows:

I-TCP : This protocol segments a TCP into two parts, one for fixed part and another for wireless part. Standard TCP is used for the fixed network[8]. So, computer over the internet does not recognizes any change for this part. Data is forwarded from the last fixed host to the wireless node. In this way I-TCP archives good performance by splitting of connections. However, this deviates from the idea of basic end-to-end delivery of data. Here wireless host need not use basic TCP instead it uses a optimized one. Here last node in the fixed path shield the wireless host from the source. Also, the source is unaware of any direction change of the wireless host.

Mobile TCP:
Loss of packet is frequent in wireless communication. TCP at the sender end cannot distinguish between the exact cause of the packet loss. The fixed host always interprets the packet loss as congestion and reduces the window size drastically. This does not give good throughput in all cases. Mobile TCP[9] distinguishes the packet losses due to handoff and those due to interface switching. It lets the base station tell the sender whether the loss is due to handoff in the same network or if it is due to interface switching. According to the nature of packet loss Mobile TCP changes the parameters window size, RTTetc. This protocol perform well as it has got some information regarding the packet loss. So, it can handle the handoff well. But the characteristics of the wireless link have not been taken care by this protocol. So other issues for throughput degradation remains as it is.

WTCP:
The WTCP[10] is another variant of TCP and is designed to perform well in wireless environment. It is already well known that assumptions off basic TCP used to fail in wireless links. The throughput is get reduced drastically. However, on wireless access links, a large number of segment losses will occur because of wireless link errors or host mobility. The way of handling the packet loss in case of WTCP (Wireless-TCP) is different. This protocol rigorously simulates WTCP performance in the presence of congestion and wireless losses. The result shows that this simulation significantly improves the throughput of TCP connections due to its unique feature of hiding the time spent by the base station. It locally recovers from wireless link errors so that TCP's round trip time estimation at the source is not affected. WTCP uses the receiver to perform rate control computations which is different idea from the basic TCP. This reduces the acknowledge related problem. Sometime throughput of WTCP decreases due to this modification.

3. PROPOSED SOLUTION
The data rate and the performance of TCP is generally lower in wireless networks than in fixed. The congestion control algorithms assume that the data loss is mainly due to the congestion and the data loss is a rare phenomenon. Therefore, most of the time the data loss is misinterpreted as congestion which starts slow start mechanism. This reduces the average data rate.

So, if we want to deploy TCP over wireless network, we have to face a number of issues broadly classified as follows:
Communication Errors: The main causes for communication error in wireless is distortion, noise and attenuation of signal.
Asymmetry in path: The wireless path between the source and destination is not symmetric in nature. The asymmetry happens due to loss rate, route and bandwidth.
Problem due to mobility: The wireless nodes change its region due to mobility. The mobility is the common cause for route loss and re-establishment.

All these factors badly affect the TCP communications reliability and average data rate. To overcome the above-mentioned problems, we suggest the following modifications of standard TCP (called b-TCP):

1. Store small number of the packets in buffer. Each node in the path from source to destination have buffers and the lost packets will be directly retransmitted from the buffer if it is present. The size of the buffer will be decided on statistical estimation basis.

2. In this method when the routers see the congestion then mark the packets with a special tag before forwarding the packet. The data receiver on receiving site note this marked packets and sends this congestion information to the sender in the ACK packet. The sender then invokes the congestion control methods according to the tag value.

3. Route failure is more frequent in mobile nodes than the fixed nodes. The reestablishment of route from source node to the destination node depends on the factors like Routing Protocol used, Mobility Pattern of the Mobile Nodes etc. So, we propose to rectify it by reducing the packet sending rate in mobile node. This is because these nodes have less bandwidth compared to the fixed nodes in the path.

4. In case of link failure, the path reestablishment algorithm will run from the last node in the broken path and the not from the source. If the process fails, then it would run from the source.

5. In case of acknowledgement delay window size of the source will not be reduced until it gets explicit congestion information with the help of step-2.

3.1 Simulation Results
We have studied the performance of our modified TCP.

The result of this study is based on the simulation set-up for 50 nodes around 1000m. We have simulated the protocol with NCTU ns-6.0 simulator. The obtained results have been compared with those of standard TCP and WTCP. The Fig-1 below shows that the transmission rate is high in our b-TCP.

The throughput comparison of the protocols is shown below in Fig-1 . Here we see that the throughput of our b-TCP is better.

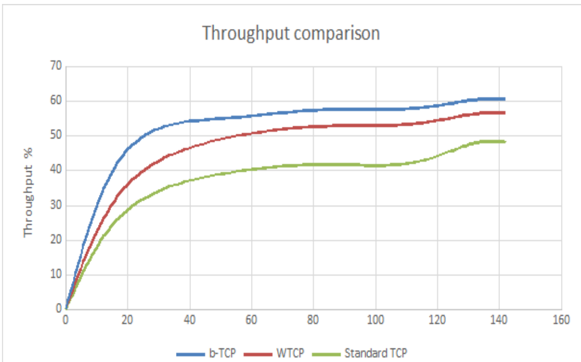

Fig-1

4. CONCLUSION
In this paper, we have presented techniques called b-TCP to improve the end-to-end performance of TCP. The packet loss in fixed network require congestion control but it is not so in case of wireless network. We observe that disconnection in wireless node is common and the modified TCP can take care of it accordingly. The proposed model can handle end-to-end communication containing wireless nodes in the path in an efficient manner. The model is robust and can handle the current day needs. However, the security of TCP communication should be taken care separately. So, the secure

communication for the proposed model can be developed in future. This will make the TCP communication more secure for communications.

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6. REFERENCES

[1] J. B. Postel. "Transmission Control Protocol". RFC, Information Sciences Institute, Marina del Rey, CA, September 1981. RFC-793.
[2] V. Jacobson, "Congestion Avoidance and Control", Proc. ACM Sigcomm 88, August 1998
[3] V. Jacobson, "Modified TCP congestion avoidance algorithm", end2end-interest mailing list, April. 30, 1990
[4] Abouzeid, Roy, Azizoglu. Stochastic Modelling of TCP over Lossy Links. In Proceedings of INFOCOM, pages 1724–1733,2000.
[5] Akyildiz, Morabito, Palazzo. TCP-Peach: A New Congestion Control Scheme for Satellite IP Networks. ACM/IEEE Transactions on Networking, 9:307–321, June 2001
[6] Bakshi, Vaidya, Pradhan. Improving the performance of TCP over Wireless Networks. In Proceedings of 17th. International Conference on DCS, pages 365–373, July 1997.
[7] Balakrishnan, Katz. Explicit Loss Notification and Wireless Web Performance. In Proceedings of GLOBECOM, November 1998.
[8] Balakrishnan, Padmanabhan, Seshan, Katz. A Comparison of Mechanisms for Improving TCP Performance over Wireless Links. ACM/IEEE Transactions on Networking, Vol. 5: pg.756– 769, December 1997.
[9] Mathis, J. Mahdavi, S. Floyd, and A. Romanow, "TCP Selective Acknowledgment Options", RFC 2018, October 1996.
[10] Amir, Balakrishnan, Seshan, Katz., Efficient TCP over Networks with Wireless Links, In Proceedings of 5th. Workshop on Hot Topics in Operating Systems, pages 35–41, May 1995.
[11] Bakre, Badrinath, I-TCP: Indirect TCP for mobile hosts, Proc. 15th International Conf. on Distributed Computing Systems (ICDCS), May 1995. IEEE, ISSN: 1063-6927, Pages:136 - 143
[12] Haas, Agrawal, "Mobile-TCP: An asymmetric transport protocol design for mobile systems," Proc. IEEE ICC' 97, ISBN: 0-7803-3925-8, June 1997
[13] Ratnam, Matta, "WTCP: An efficient transmission control protocol for networks with wireless links," IEEE Symp. Computer and Communications (ISCC), pages: 74 - 78, June 1998.

