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Enhancing TCP in mixed wired wireless environment using Time Agents

Ashwini A. Jewalikar ,Ratnamala S. Paswan
department of computer Engg,SPPU,
Pune
[1]aajewalikar@pict.edu
PICT
Dhankawadi, Pune India
[2]rspaswan@pict.edu

Abstract— TCP Congestion Control mechanisms needs an accurate loss differentiation scheme to improve the performance of TCP in wireless environment. This paper innovates a method to improve performance of TCP in mixed wired/wireless network by selecting one of the retransmission techniques, Selective Repeat (SR), Go Back N(GBN) depending on reason of losses and their rate of occurrence .The proposed approach exploits random losses to improve the throughput of TCP in mixed wired/wireless environment.

Keywords— Data communication ,OSI Model,wireless communication,TCP congestion control retransmission pilicy,RTO

Introduction

TCP is used widely at transport layer to provide reliable data Delivery. It was originally designed for wired networks where mostly reason of the packets lost is congestion[8]. loss recovery and retransmission mechanism is used to control the congestion in the network.

wireless networks are of huge demand today and hence mixed wired/wireless networks.TCP gives a better throughput in wired environment. In case of wireless or hybrid environment, this assumption leads to throughput degradation of TCP[2][3].

TCP assumes congestion as main cause of packet loss,[8] and performs AIMD[2] This leads to unnecessary reduction of congestion window and throughput degradation of TCP in wireless and mixed wire/wireless environment[2][8]. Many loss differentiation schemes are proposed [5][6][7] which performs better than earlier versions of TCP like Reno. These algorithms identified the reasons of losses and try to adopt a suitable recovery mechanism depending on reason of loss.

I. RELATED WORK

Many enhancements are proposed for TCP like studies in Westwood[4] gives solution to differentiate loss due to congestion and loss due to wireless environment but it performs worst in pure wired network[1][2] .In wireless environment , rate of packet loss is more due to high bit error rate, hand off in case of mobility etc.

Paper[1] presents an approach to solve the loss differentiation problem over wireless WANs. We propose an algorithm which makes use of Rtts and feedback from base station rather access point in wireless LANs periodically to take decision of retransmission of a packet. The proposed algorithm can increase throughput of TCP by choosing retransmission technique adaptively depending on cause of loss along with recovery in presence of high error rates in mixed wired/wireless network.

section II presents the proposed scheme and the section III elaborates the proposed scheme with experimentation details to enhance TCP and the section IV presents the conclusion drawn of the study.

II. PROPOSED ADAPTIVE TCP

The Adaptive TCP Proposal experimented to adopt a retransmission policy. This resulted in proposing sender side modification to TCP using loss differentiation by making use of Time Agents at intermediate stations to collect timing information of received data and this information can be used to select retransmission policy.

A. Loss differentiation :

Let T is set of time samples , RTT is set of Round trip times of packets, Ts is set of time when packet is send, by source Tacks Set of time when Acknowledgement packet arrives at sender.
$T=\{t_1,t_2,t_3.....t_n\}$

$RTT = \{rtt_1,rtt_2,rtt_3,....rtt_n\}$ where RTT C T.

we calculate round trip time of a packet from base

station to ultimate destination by,

Brtt = TBs - TBack (1)

here TBs is time when packet is sent by base station.

and TBack is time when Ack comes from destination to Base station.

Base station will periodically calculate the Brtt value using (1) and estimate the actual acknowledgment time by using

Eack = AvgBrtt + (Wrdrtt) where Wrdrtt is a round trip time in wired network. Which can be calculated at base station using ,

WrdRtt = TBr - Ts

where TBr is the time when packet is received by base station from source.

Eack will serve estimation of time for an acknowledgment to come from ultimate destination.

III EXPERIMENTAL SET UP

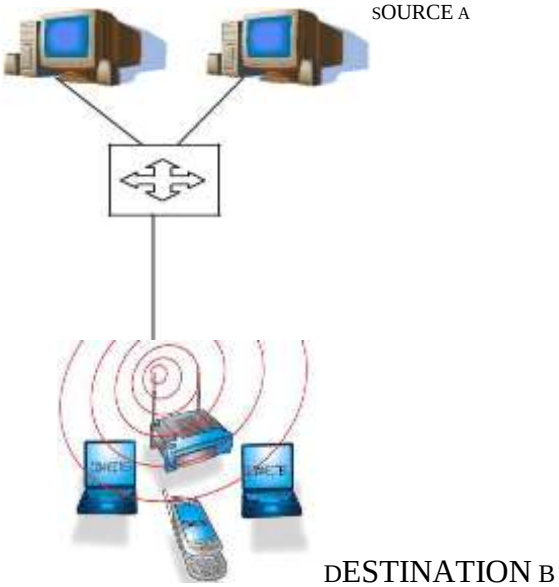

Figure 1: Experimental set up for mixed wired wireless environment.

a. Loss in wireless networks:

As a part of experimentation we find out the loss probability in wireless network.

Figure 2. Experimental set up for finding loss in wireless network.

A typical scenario is given in the figure 2.

Wire-shark on every machine helps to capture the packets and to monitor the conversations between the nodes. here we used large buffer size to avoid congestion losses. FTP requests are sent by 3 machines to server and we monitored the conversations.

Data collected is shown by TABLE I

TABLE I
PACKET LOSS IN WIRELESS ENVIRONMENT

No. of packets in N/W	Packets sent by A A → B	Packets Received by B	Packets sent by B B → A	Packets Received by A	A-B	B-A
1000	514	179	710	392	335	318
5000	2814	1837	4839	2031	977	2808
10,000	4918	3278	5554	3582	1640	1972
20,000	7828	3968	7191	6088	3860	1103

From above table we can conclude that approx. 20% packets are lost in the wireless network which is large compared to wired network hence we need a mechanism which differentiates a loss due to congestion and loss due to link error.

Now there are three possibilities

1. 3 dupacks arrives before Eack expires
2. Timeout occures before Eack expires and before 3 dupack comes
3. neither 3 dupack occures nor timeout occures before Eack expires.

In first two cases TCP will retransmit using normal technique s as in new reno but in third case without waiting for 3dupacks and timer to expire TCP retransmits the packet assuming that the packet has been lost in the wireless link.

A. *ALGORITHM ADAPTIVE TCP*

Alogorithm At Base Station

- calculate WrdRtt
- Estimate Brtt
- calculate AvgBrtt
- Estimate Eack
- Send Eack to source periodically

Here we can try to implement above algorithm at base station which will calculate Wrdtt ,estimate Brtt (2) and send Eack to source periodically to control the congestion,as explained in section II

Algorithm Adaptive TCP at sender

- **if** (3 dupacks arrives or timeout before Ertt expires)
- Retransmit packet
- else (wait for Ertt to expire)
- retransmit the packet.
- **End if**

III. CONCLUSIONS

Here we proposed The adaptive retransmission policy for TCP for improving the performance in the environments having high random losses.

The proposed algorithm can be simulated using Network Simulator NS2.

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