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Selective Repeat Arq Protocol on Multi Channels by Using Mimd Congetion Control Algorithm

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ABSTRACT

In this research address to the performance evaluation of ARQ Protocols such as the Selective – Repeat ARQ over multiple Time Varying Channels. We evaluate the resequencing delay and the resequencing buffer occupancy, respectively. Under the assumption that all channels have the same transmission rate but possibly different time-invariant error rates, we derive the probability generating function of the resequencing buffer occupancy and the probability mass function of the resequencing delay. By using MIMD and Gilbert–Elliott model for each channel, extend analysis to time-varying channels. Through examples, we compute the probability mass functions of the resequencing buffer occupancy and the resequencing delay for time-invariant channels. This project contains main performance Characteristics of a data transmission system with ARQ error control the Delay, queue length to send the packets in time. The Multiplicative Increase Multiplicative Decrease (MIMD) congestion control algorithm in the form of Scalable TCP has been proposed for high speed networks.

Keywords : Multichannel, MIMD, ARQ, Protocol, Congestion control

I. INTRODUCTION

Automatic-Repeat-Request (ARQ) is an error control technique widely used in digital data transmission. An ARQ system corrects erroneously received packets through retransmission of packets. The idea of using ARQ strategies was first introduced by Chang , after which three classical ARQ schemes (or protocols) have been developed: stop-and-wait (SW-ARQ), go-back-N(GBN-ARQ), and selective-repeat (SR-ARQ). In SW-ARQ, the transmitter sends a packet to the receiver and waits for its acknowledgement. Based on error-detection results, the receiver generates either a negative e acknowledgment (NACK) or a positive acknowledgement (ACK) for each received packet and sends it over a feedback channel. If an ACK is received, the transmitter sends out a next packet; otherwise, if an NACK is received, retransmission of the same packet will be scheduled immediately, and this process continues until the packet is positively acknowledged. In GBN-ARQ, the transmitter sends packet to the receiver continuously and receives acknowledgments as well. When a NACK is received, the transmitter retransmits the negatively acknowledged packet immediately and all already-transmitted packets (positively and negatively acknowledged) following it. In SR-ARQ, the transmitter sends packets continuously until a NACK arrives at the transmitter, in which case the transmitter retransmits the negatively acknowledged packet without re- sending the transmitted packets following it. To preserve the original arriving order of packets at the receiver, the system has a buffer, referred to as the resequencing buffer, to store the correctly received packets that have not been released.

Since ARQ protocols achieve reliable transmission of packets over intrinsically unreliable channels such as lossy wireless links, they have been extensively used in the next-generation wireless packet data networks to provide high-speed data integrated with voice services. In a modern high-speed wireless data network, however, multiple parallel channels between adjacent transmitter–receiver pairs are often created using advanced wireless communication technologies (e.g., OFDM systems ,and MIMO) to increase the data transmission rate. Unlike packet transmission over a single channel, in a Multichannel communication system, multiple packets are sent at a time, one packet per channel, and packet transmission errors can occur across every channel

Different performance studies on multichannel ARQ protocols have been listed in literature. Chang and Yang studied performance of the three classical ARQ protocols for multiple identical channels (i.e., all channels have the same transmission rate and the same time-invariant error rate). In that study, exact expressions for the throughput, which is the average number of packets successfully transmitted per unit of time, and the mean transmission delay, which is the average time between the instant when a packet is transmitted for the first time and the instant when it is successfully received, have been derived. Mean- while, Wu*etal.* Conducted a throughput performance study on multichannel ARQ protocols based on the same model as that in . Fujii *et al.* analyzed the transmission-delay distribution function of GBN-ARQ for parallel channels that have the same transmission rate but possibly different time-in- variant error rates. a resequencing analysis (e.g., the resequencing buffer occupancy and the resequencing delay) for SR-ARQ over parallel channels, all of which have the same transmission rate but possibly different time-invariant error rates. In a wireless communication system, however, the transmission condition of a wireless channel changes over time, and consequently, the channel is often severely affected by time- Varying losses.

Here consider a multichannel selective repeat ARQ protocol for both time-invariant and time-varying channel models. We analyze performance of the resequencing buffer in terms of the resequencing buffer occupancy, which is the number of packets waiting in the resequencing buffer for delivery, and the resequencing delay, defined as the waiting time of a packet in the resequencing buffer, in steady state. First, under the assumption that all channels have the same transmission rate but possibly different time-invariant error rates, we derive the probability generating function (pgf) of the resequencing buffer occupancy and the probability mass function (pmf) of the resequenching delay. Then, when a traditional time-varying channel model, the Gilbert–Elliott model is assumed, we analyze the pgf of the resequencing buffer occupancy and the mean resequencing delay. Through examples, we numerically compute the pmf of the resequencing buffer occupancy, from which we demonstrate that the pmf of the resequencing buffer occupancy can be efficiently obtained from its pgf by using the Lattice–Poisson algorithm, and the pmf of the resequencing delay. In addition, the mean resequencing buffer occupancy and the mean resequencing delay for both channel models grow with the increase of either the number of channels or the average error rate of channels. They decrease, however, with the increase of the variance in the error rates. That is, when the time-invariant channel error rates are assumed, the mean resequencing buffer occupancy and the mean resequencing delay decrease as the error rates of different channels become more different. Likewise, when the Gilbert–Elliott model is assumed, they decrease as the two error states become more different from each other. The main contributions of this paper include modeling and exact probabilistic analysis of the resequencing buffer occupancy and the resequencing delay for SR-ARQ over multi channels of both the Gilbert–Elliott model and the model with time-invariant error rates.

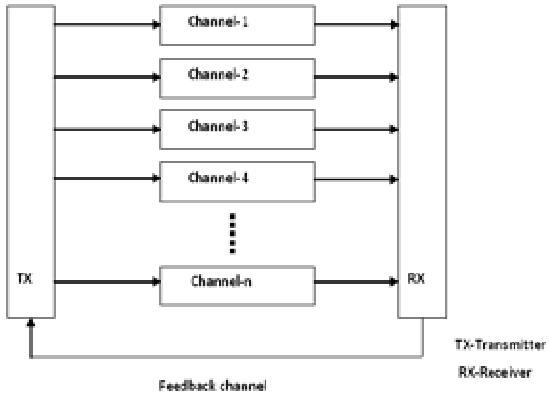

Figure 1. A multichannel system with ARQ.

II. THE MODEL

In terms of the open system interconnection (OSI) reference model for layered network architectures, an ARQ protocol is usually located at the link layer (i.e., layer 2). Below and above it are the physical layer (layer 1) and the network layer (layer 3), respectively. In the ARQ protocol point of view, the physical layer provides forward channels and feedback channels and the network layer provides data packets for transmission.

A. A Multichannel System with ARQ

A multichannel data communication system in which transmitter receiver pair communicates data packets, is illustrated in Fig. 1. The communication link between the transmitter and the receiver consists of $\geq$ parallel channels numbered from 1 to each channel, for ,is characterized by a data transmission rate and a channel model. The purpose of this project is to increase the speed of sending packets from source to destination to deliver the data in time by using multiple increasing and decreasing method along with the gilbert-elliott model it helps to send the packets. If the packet sending fails when it passing through the multiple channels it will recover automatically and it will send again till it reaches its destination path and for security digital signature is applied to void from the unauthorized parties.

B. MIMD Congestion Control

The Multiplicative Increase Multiplicative Decrease (MIMD) congestion control algorithm in the form of Scalable TCP has been proposed for high speed networks. We study fairness among sessions sharing a common bottleneck link, where one or more sessions use the MIMD algorithm. Both synchronous as well as asynchronous losses are considered. In the asynchronous case, only one session suffers a loss at a loss instant. Two models are then considered to determine which source looses a packet: a *rate dependent* model in which the packet loss probability of a session is proportional to its rate at the congestion instant, and the *independent loss rate* model. We first study how two MIMD sessions share the capacity in the presence of general combinations of synchronous and asynchronous losses. We show that, in the presence of rate dependent losses, the capacity is fairly shared whereas rate independent losses provide high unfairness. We then study inter protocol fairness: how the capacity is shared in the presence of synchronous losses among sessions some of which use Additive Increase Multiplicative Decrease (AIMD) protocols whereas the others use MIMD protocols.

Proposals to improve the performance of TCP in high speed networks have been recently put forward. Examples of such proposals include High Speed TCP, Scalable TCP, and FAST. In contrast to the additive increase multiplicative decrease algorithm used in the standard TCP, Scalable TCP uses a multiplicative increase multiplicative decrease (MIMD) algorithm for the window size evolution. In this paper, we present a mathematical analysis of the MIMD congestion control algorithm in the presence of random losses. Random losses are typical to wireless networks but can also be used to model losses in wireline networks with a high bandwidth-delay product. Our approach is based on showing that the logarithm of the window size evolution has the same behaviour as the workload process in a standard G/G/1 queue.

a. Multiplicative Increment

The multiplicative increment occurs when standard additive increment would normally occur.
In Equation shows the formula used to adjust congestion window after receiving a new ACK.

Cwnd = Cwnd + a*Cwnd
Where a is adjustable, the value of a used was 0.02

b. Multiplicative Decrement

The multiplicative decrement is same as Standard TCP except that the value of b 0.125. The connection starts in the slow start algorithm until channel is filled.

After a single drop occur around 1.4 seconds, fast retransmit and recovery algorithms are used to cut congestion window by 0.125, the value of b, and congestion avoidance is used again to reopen congestion window.

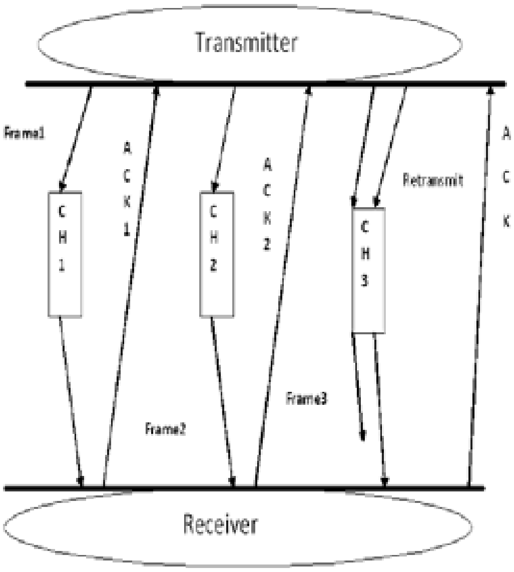

Figure 2: ACK Received

III CONCLUSION AND FUTURE WORK

A variety of techniques has been developed but we analysis performance of the MIMD and Gilbert-Elliott model where the mean re-sequencing buffer occupancy and the mean re-sequencing delay increase with the average error rate on parallel channels even the mean re- sequencing buffer occupancy decreases with the variance in the error state. On ARQ protocol logarithm of the window size process of a connection using the MIMD congestion control algorithm is equivalent to the workload process in a G/G/1queue. The throughput of the connection and the higher moments of the window size process can be computed using the Laplace-Stieltjes transform of the equivalent workload process. In Future For window dependent losses an approximate expression, analogues to the square root formula for standard TCP, can be used to compute the throughput as well as SISD or MISD can be applied for calculating error rate for single and multiplicative channels when selective sequential queues are approached.

In future work, we can apply the modeling and analytical approach presented in this paper to conducting performance studies on the ARQ protocol over multi channels with SIMD model also.

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