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VERIFIED

371 (NAT'L STAGE) DATA******************* None
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FOREIGN APPLICATIONS********** None
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TITLE

METHOD AND APPARATUS FOR DISCARDING PACKETS IN A DATA NETWORK HAVING AUTOMATIC REPEAT REQUEST

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ABSTRACT OF THE DISCLOSURE

Techniques are provided for use with automatic repeat request (ARQ) schemes in a data network to minimize a bandwidth used by a receiver and a transmitter in the network to transfer data packets, by discarding outdated packets that have not yet been successfully transferred. In accordance with an embodiment of the invention, a bit is set in the ARQ packet header to force the receiver to accept packets subsequent to one or more erroneous or unreceived packets that have been discarded and not resent. In accordance with another embodiment of the invention, after data packets have been discarded, sequence numbers are reassigned to the non-discarded data packets that are yet to be sent to the receiver, so that a transmitted stream of the non-discarded packets will have consecutive sequence numbers.

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METHOD AND APPARATUS FOR DISCARDING PACKETS IN A DATA NETWORK HAVING AUTOMATIC REPEAT REQUEST

FIELD OF THE INVENTION

The present invention relates to Automatic Repeat Request (ARQ) techniques for transferring data in fixed/wireless data networks.

BACKGROUND OF THE INVENTION

ARQ techniques are commonly used in data networks to ensure reliable data transfer and to protect data sequence integrity. Data packets are encoded with an error detecting code, so that when a transmitter in the data network sends or transfers data packets to a receiver in the data network, the receiver receiving the data packets can detect corrupted, erroneous or lost packets and thereby request that the transmitter retransmit the affected data packets. The integrity of a data sequence is normally protected by sequentially numbering packets and applying certain transmission rules.

There are three main ARQ schemes: Stop-and-Wait; Go-Back-N; and Selective Reject (sometimes referred to as Selective Repeat). All three methods provide mechanisms for transferring packets to a receiver in a data network in an appropriate order. In terms of throughput efficiency as a function of the signal to noise ratio, generally Selective Reject is most efficient, Stop-and-Wait is least efficient, and Go-Back-N is intermediate. Also, various mixtures of the Selective Reject and Go-Back-N techniques exist, and fall between pure Selective Reject and pure Go-Back-N techniques in both efficiency and complexity.

With respect to Go-Back-N, several different variants exist which differ in terms of how they use positive acknowledgments (PACKs), negative acknowledgments (NACKs), retransmission timers, polling schemes, etc.

One type of Go-Back-N technique uses both PACKs and NACKs that have the following characteristics:

A PACK for a data packet having a sequence number N(R) gives a cumulative positive acknowledgment for data packets having sequence numbers before N(R), but does not positively acknowledge the data packet having the sequence number N(R), as shown for example in FIG. 1A.

The NACK positively acknowledges all data packets before the data packet it negatively acknowledges. The data packet which the NACK negatively acknowledges is indicated by N(R), as shown for example in FIG. 1B.

FIG. 2 shows a simplified ARQ transmitter window, in which five variables are used to keep track of a transmitter state. The five variables include: a bottom sequence number, BSN; a top sequence number, TSN; a maximum top sequence number, TSN_{MAX}; an instant sequence number, ISN; and an expected sequence number, ESN.

BSN denotes the oldest packet in the transmitter buffer, and can also indicate that all packets before the BSN packet have been acknowledged or discarded. Packets prior to the packet indicated by TSN have been sent. ESN denotes the expected sequence number of a packet to be received. ISN indicates the sequence number of the next packet to be sent. When a packet is sent for the first time, TSN and ISN will be identical. However, when a retransmission is performed, ISN will start over from the first retransmitted packet and progress in consecutive order, one packet at a time, up to TSN. TSN cannot exceed TSN_{MAX}, which is defined by the window size W. Assuming that a sequence number field has k bits, 2^k different sequence numbers can be created. Thus, the maximum size W of the window shown in FIG. 2 is 2^k-1.

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