Comparison of time in processing frame as an error detection mechanism in network transmission

Robbi Rahim1*, Rosida Tiurma Manurung2, Darmawan Napitupulu3, R Ratnadewi4, Heri Nurdiyanto5, Itsar Bolo Rangka6, Hamzah Eterudin7, Eko Susanto8, Arif Hidayat8 and Nyoto Suseno8

1School of Computer and Communication Engineering, Universiti Malaysia Perlis, Kubang Gajah, Malaysia
2Graduate Program in Scientific Psychology, Universitas Kristen Maranatha, Bandung, Indonesia
3Research Center for Quality System and Testing Technology, Indonesian Institute of Sciences, Jakarta, Indonesia
4Electrical Engineering, Universitas Kristen Maranatha, Bandung, Indonesia
5Department of Informatics, STMIK Dharma Wacana, Metro Lampung, Indonesia
6Departement of Guidance and Counseling, Universitas Indraprasta PGRI, Jakarta, Indonesia
7Departement of Electrical, Universitas Lancang Kuning, Pekanbaru, Indonesia
8Universitas Muhammadiyah Metro, Lampung, Indonesia

*usurobbi85@zoho.com

Abstract. Errors in data transmission cannot be known directly when the data transmission process is fulfilled, but error is often prevalent in data transmission. Faulty or missing frames or bits are standard errors and to control or check errors requires a unique method, in this case, the Stop-and-wait method, Go-Back-N and Selective Reject are methods that can be used to do so, comparison of time of error checking process with Stop-and-wait method, Go-Back-N and Selective Reject is very important to get the right method to check the ignorance, from testing performed that the method of Go-Back-N is much faster than the other methods.

1. Introduction

Data communication[1]–[4] on the network is not always running correctly even often errors especially in the sequence frame that were transmitted[5]–[7], the frame could be a loss or even damaged. Damaged frames will result the data cannot be opened or may be different from the original data that received by the receiver[8].

Errors in data transmission, especially damage in frame or Bit could be repaired by using techniques such as Hamming code or reed-solomon[5], [9], [10], the use of these techniques are used to fix the frames or bits error that occurs. There are also error-control techniques such as Stop-and-Wait[11], [12], Selective-Reject[13] and Go-Back-N[6], [14] techniques, these error-control techniques already discussed by Maulana and Ikhwans[6], [13] says that the use of Selective-Reject and Go-Back-N can control errors well with different time intervals.

Stop-and-Wait, Selective-Reject, and Go-Back-N are part of the Automatic Repeat Request error mechanism where this method transforms unreliable data paths to reliably, this article discusses the comparison of the three methods to error control of the process and interval time, this comparison hope it will obtain the most optimal method for Automatic Repeat
Request mechanism. The research was conducted at Embedded, Networks and Advanced Computing Research Group (ENAC) of Universiti Malaysia Perlis using various devices to simulate frame error detection.

2. Methodology

Frame damage control process on the network transmission can be done using Automatic Repeat Request (ARQ) technique, the examination also could be done by using searching algorithm like Breadth First Search[15], Depth First Search[16], Boyer Moore[17], [18], Raita[19] and hashing search[20], [21] where’s search algorithm applied to ARQ technique to ease process frame searching that occur damage.

Comparison of Stop-and-Wait, Selective-Reject and Go-Back-N techniques is made with several criteria such as:

a. Transmission time per frame
b. Transmission time per reply
c. Time-out interval
d. The number of frames to be transmitted.

The process of controlling and detecting errors on frames or bits transmitted on the network as in the following process:

a. Transmitter sends the 1st frame (F0), the frame is lost in the middle of the transmission process.

![Figure 1](image1.png)

**Figure 1.** Transmitter sends the 1st frame (F0), and the frame is lost in the middle of the transmission process

b. The receiver does not send an ACK, the timer on the transmitter times out. Transmitter returns the same frame.

![Figure 2](image2.png)

**Figure 2.** Transmitter returns sending frame 1 (F0)

c. Frames that are damaged in the middle of the transmission process then receiver assumes the frame is invalid and then discards the frame and sends the NACK to the damaged frame number. The transmitter receives the NACK and re-sends the same frame.

The process in Figures 1 and 2 is the process for recognizing the damaged frame, but there is also the process of sending frame damage in the form of missing ACK or broken ACK, the process as follow:

a. Transmitter sends the 1st frame numbered 0 (F0).
b. The receiver receives the 1st frame (F0) correctly and responds by sending ACK1. ACK1 are missing in the middle of the transmission process.

Figure 3. ACK1 is missing in the middle of the transmission process

![Figure 3](image)

C. The timer on the transmitter is time out, and the transmitter returns the 1st frame numbered 0 (F0).

D. The 1st frame (F0) arrives well in the receiver. Since the receiver is expecting frame number 1 (F1), the frame is rejected and the receiver re-transmits ACK1.

Figure 4. The frame is rejected, and the receiver transmits ACK1.

![Figure 4](image)

e. In case of defective ACK / NACK or NACK missing, same as missing ACK case.

The experiments were performed using simulation software and some network equipment in the lab, to model the error checks in the frame bits by sending ICMP packet data on the network with random number of randomly defined and time frames.

3. Result and Discussion
Frame control and error detection test on network data communications are done under the following conditions:
a. Transmission time per frame = 2 Tick
b. Transmission time per reply = 2 Tick
c. Time-out interval = 15 Tick
d. Number of frames to be transmitted = Random
e. Error Frame = Random

As an additional note one tick = 500 millisecond, the condition setting and then proved for each existing method, and the result is obtained as the table 1 with receiver and transmitter value.

Table 1. Method Comparison Value

| No | Method       | Frame Transmitted | Time Process (Tick) |
|----|--------------|-------------------|---------------------|
| 1  | Stop-and-Wait| 10 Frame          | 154                 |
|    |              | 25 Frame          | 236                 |
|    |              | 50 Frame          | 428                 |
| 2  | Selective Reject | 10 Frame      | 53                  |
|    |              | 25 Frame          | 67                  |
|    |              | 50 Frame          | 120                 |
The above test is done for the amount of 10, 25 and 50 frames, and each method completes the controlling and correction frame takes a different time as in Table 1 and frequency of time required as in Figure 5 below:

| Method       | 10 Frame | 25 Frame | 50 Frame |
|--------------|----------|----------|----------|
| Go-Back-N    | 35       | 80       | 114      |

Figure 5. Diagram Time Comparison

Figure 5 shows in detail the time difference between each method, from the graph it is observed that the Go-Back-N method is much better than others regarding error detection and correction regarding processing time with the same improvement result for all methods, the diagram above shows in detail the process per check for the same number of frames with different methods, while to display the comparison results in terms of time can be seen in Figure 6 below:
Figure 6. Diagram Time Method Comparison

4. Conclusion
The Stop-and-wait method, Go-Back-N and Selective Reject can be used well for control and error correction of frame during data transmission, the comparison of the three methods is made simultaneously with the number of test frames 10, 25 and 50 and with the condition random error, based on the experiments it is found that the Go-Back-N method is better than the other 2 methods even though at the time of checking with 25 frames of selective reject method faster, but overall Go-Back-N is faster.

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