BLG 433E COMPUTER COMMUNICATION

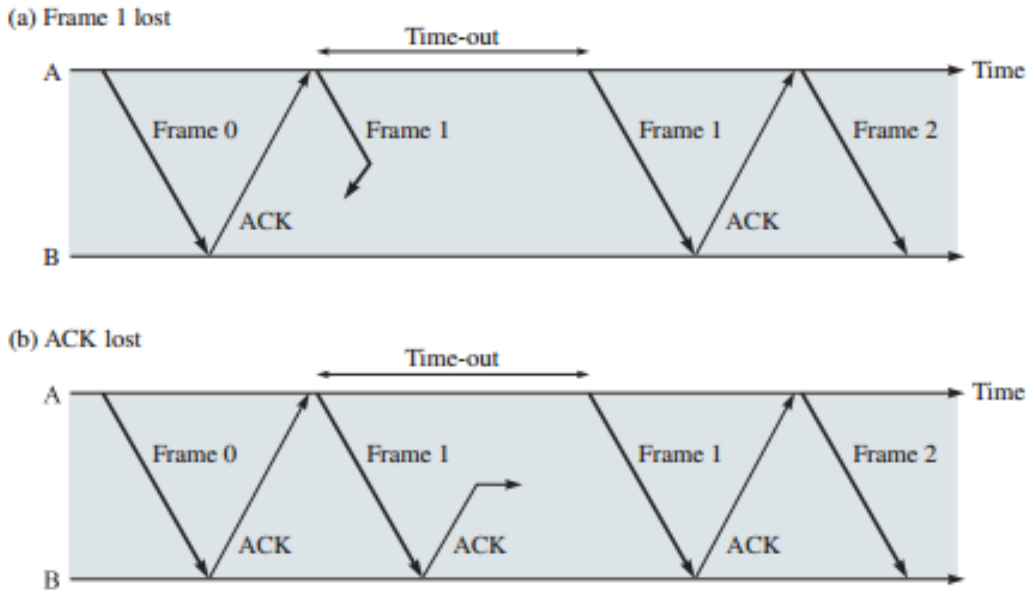
PROJECT 1 (GROUP PROJECT WITH TWO MEMBERS)

DUE DATE: 30 October, 2014

SLIDING WINDOW PROTOCOLS

TEHCHNIQUE 1. Stop-and-wait Protocol

The working principle of the protocol can be visualized below:



In parts (a) and (b) transmitting station A acts the same way, but part (b) receiving station B accepts frame 1 twice.

Figure (a) shows the sequence of events below,

1. Station A transmits frame 0 and then waits for an ACK frame from the receiver.
2. Frame 0 is transmitted without error, so station B transmits an ACK frame.
3. The ACK from station B is also received without error, so station A knows frame 0 has been received correctly.
4. Station A now proceeds to transmit frame 1 and then resets the timer.
5. Frame 1 undergoes errors in transmission.
6. The time-out expires, and frame 1 is retransmitted.

Figure (b) shows the sequence of events below,

1. Frame 1 received correctly by station B.

2. The ACK of station B undergoes errors.

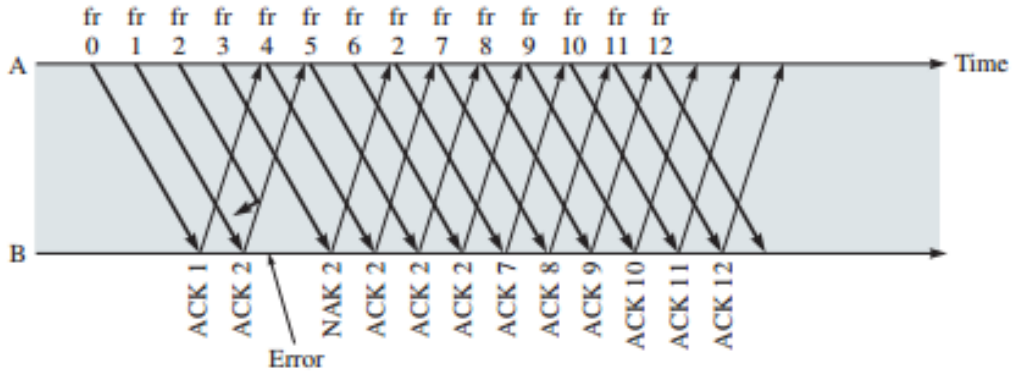
3. After receiving frame 1, station B delivers the frame to the network layer.

4. Station A does not receive ACK for frame 1, and the time-out expires.

5. Station A retransmits frame 1.

TECHNIQUE 2. A protocol using Selective Repeat

The working principle of selective repeat can be visualized as below. Make sure that the ACK frames contains the number of the frame **expected**!



1. Frame 2 is lost and cannot be received by station B.

2. Whenever an out-of-sequence frame is observed at the station B, an NAK frame is sent by station B with number of expected frame, frame 2. (NAK2)

3. When station A receives the NAK frame, station A retransmits frame 2.

4. Furthermore B receives and buffers the other frames (3, 4, 5, 6), when it is waiting for the frame 2.

5. When station B receives frame 2, it also sends buffered frames 3,4,5,6 to the network layer.

6. Finally, A transmits the next frame (frame 7) after retransmitting frame 2.

IMPLEMENTATION (60 POINTS)

- ✓ You need to implement unidirectional data flow in unreliable links.
- ✓ There are station A and station B.
- ✓ Frames of 1000 bits are sent over a 1-Mbps channel using a geostationary satellite whose propagation time from the earth is 270 msec.
- ✓ The headers are very short. Three-bit sequence numbers are used.
- ✓ ACK timeout is 550 msec.
- ✓ You need to define a buffer for selective repeat approach. Define an optimum buffer size.
- ✓ It is advised to use Future Event List (FEL) for implementing frame transmission between station A and station B. You need to define begin time and finish time of the events.

Hint: Window size for Technique 1 is 1. Define optimum window size for Technique 2 and implement selective repeat in the determined window size.

- ✓ You must prepare a simple user options menu in your program. User can select one of the two options by typing 1 or 2. The user option menu should include two options below:

  Option 1. Test your program with three given series
  Option 2. 1000 frames sent by station A

Option 1. Test your program with three test sets

You can check completeness of your implementation using the test set given below:

Test 1- Stop and Wait	Station A (data frames)	**1**	**2**	**3-E**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
	Station B (ACK)	**2**	**3**		**4**	**5**	**6**	**7**	**8**	**9**	**10**		
Test 2- Selective Repeat	Station A (data frames)	**1**	**2**	**3-E**	**4**	**5**	**6**	**7**	**3**	**8**	**9**	**10**	
	Station B (ACK)	**2**	**3**		**3**	**3**	**3**	**3**	**8**	**9**	**10**		
Test 3- Selective Repeat	Station A (data frames)	**1**	**2**	**3-E**	**4**	**5**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	Station B (ACK)	**2**	**3**		**3**	**3-E**	**4**	**5**	**6**	**7**	**9**	**9**	**10**	

"E" represents error in frames. You need to create the errors in data frames and ACKs during your simulation as in test set. Your program should work based on the principles of Stop &Wait and Selective Repeat, and finally results with these series of frames.. Make sure that the table given below shows only the transmission sequence of the frames not the transmission times.

Print the data frame number and data frame sending time to the screen for all frames that are transmitted by station A.

Option 2. 1000 frames sent by station A

Run your implementation for 3 different error rates:

1. No error in 1000 data frames
   - *Print simulation time for sending 1000 frames and utilization rate for Technique 1 and Technique 2 to the screen.*
2. Error rate for data frames %5
   - Creating error in random data frames, that is transmitted by station A, with %5 percentage
   - *Print simulation time for sending 1000 frames and utilization rate for Technique 1 and Technique 2 to the screen.*
3. Error rate for data frames %10
   - Creating error in random data frames, that is transmitted by station A, with %10 percentage
   - *Print simulation time for sending 1000 frames and utilization rate for Technique 1 and Technique 2 to the screen.*

REPORT (40 POINTS)

Write your compilation command in your report.

1. (15 Points)

- ✓ How do you implement Technique 1 and Technique 2? Explain your data structures in detail.
- ✓ How does your implementation work? Explain in detail.
- ✓ Explain the frame series in test sets (Option 1) by paraphrasing the principles of Technique 1 and Technique 2.

2. (5 Points) How did you determine the size of the sliding window in Technique 2? Explain.
3. (5 Points)How did you determine the size of buffer in Technique 2? Explain.
4. (5 Points) What is the maximum window size for Technique 2? Explain.
5. (5 Points) Draw a graph for presenting relationship between error rate and simulation time.

Submission

You should be aware that the Ninova system clock may not be synchronized with your computer, watch, or cell phone. Do not e-mail the teaching assistant or the instructors your submission after the Ninova site submission has closed. If you have submitted to Ninova once and want to make any changes to your report, you should do it before the Ninova submission system closes. Your changes will not be accepted by e-mail. Connectivity problems to the Internet or to Ninova in the last few minutes are not valid excuses for being unable to submit. You should not risk leaving your submission to the last few minutes. After uploading to Ninova, check to make sure that your project appears there.

Policy: You may discuss the problem addressed by the project at an abstract level with your classmates, but you should not share or copy code from your classmates or from the Internet. You should submit your own, individual project. Plagiarism and any other forms of cheating will have serious consequences, including failing the course.

If a question is not clear, please let the teaching assistant know by email (ozens@itu.edu.tr).

Submission Instructions: Please submit your homework through Ninova. Please zip and upload all your files using filename HW1_ studentID.rar. In the zipped file, you must include your completed report_StudentId file and all your program and header files. Report format should follow the ITU-CE Software Reports Guide (http://www.cs.itu.edu.tr/lisans/yazilim-odevleri-kilavuzu/view).

All your code must be written in C++, and we should be able to compile and run on it on SSH using g++. You should supply one main.cpp file that calls necessary routines for all questions (Multiple .cpp files are acceptable, as long as you state the compilation instructions in your report). Header files or instructions that you fail to submit may cause you lose a portion of your grade. When you write your code, try to follow an object-oriented methodology with well-chosen variable, method, and class names and comments where necessary. Your code must compile without any errors; otherwise, you may get a grade of zero on the assignment.