Real-Time Systems Spring 2006

Exercise 5/6 (Tue 11.4.2006)

Lets consider a node (for example a router or switch) that receives from different links packets from four separate senders (A-D). All the sends have their own connection to their receiver. The packets leave this node via the same link to be split again in further links on their way to the receivers. Lets also assume, that the packets from A and D must traverse via two nodes and three links to reach their destination. The packets from B and C will traverse three nodes and four links.

	p	e	d
A	4	1	8
B	8	1	10
C	12	3	12
D	8	3	16

The table above describes the resources each sender needs to (or has already) receive for the connection. They send the massages:

- A always sends the packet immediately when a new period starts. However, it only sends packets from 4 to 12.
- B starts to send packets immediately but stops at time 20.
- C distributes its packets evenly over the whole duration of its period. It will send with full load all the time.
- D always bursts its packets of this period immediately at the beginning of the period.

In the tasks 1-3 you are asked to simulate the mechanisms presented in the course book. The simulation should continue until all packets from B have been forwarded to the next node. Make all necessary additional assumptions to allow you to simulate the mechanisms

1) WFQ: Weighted Fair Queueing.

2) D-EDD ja J-EDD.

3) WRR. Please rather simulate Stop and Go (S&G). The Greedy WRR will be accepted instead.

4) Consider a connection that is allocated a fraction BW of the total bandwidth, and packet transmissions on all connections are scheduled according to the virtual clock algorithm. Suppose that the connection first becomes busy at time t_{-1} and remains busy until time t. Show that if the total length of all packets arriving on the connection in the busy interval $(t_{-1},t]$ is no greater than $BW(t - t_{-1})$, the virtual clock of the connection is no greater than t, and the virtual clock of the connection is greater than t if the total length of all packets arriving in the interval exceeds $BW(t - t_{-1})$

(Liu: 11.1 a)

ESSAY: Write a one or two page essay or report. Return it on paper at the latest on the weekly meeting. If you cannot participate, you may send it (in pdf format) via email to the lecturer. It is also possible to submit on paper by giving it to the janitors in the first floor. Then you need to address it to Tiina Niklander.

Submitted essays will give you one additional point for the course. There will be one essay for each exercise session to write.

This week you can choose one of following two articles and write the essay based on the ideas that came to your mind when reading the article. It is more preferable to write more like a learning diary. However, this week you may write a summary of the article.

Choose one of the following articles:

a) Paulo Pedreiras, Paolo Gai, Luís Almeida, Giorgio Buttazzo. *FTT-Ethernet: A Flexible Real-Time Communication Protocol That Supports Dynamic QoS Management on Ethernet-Based Systems*. IEEE Transactions of Industrial Informatics, 1(3):162-172, Aug 2005.

   The article discusses about one mechanism to control the quality of service for real-time communication in a common Ethernet-based environment.

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b) M.S. Reorda, M. Violante. *On-line analysis and perturbation of CAN networks*. In Proc. of 19th IEEE International Symposium on Defect and Fault Tolerance in VLSI Systems (DFT 2004). pp. 424 - 432, 2004.

   The articles describes a method to follow on-line the communication in CAN network. It also allows controlled disturbation of the communication in the network.