S-38.115 Signaling Protocol, Exercise 2

Brax/Ilvesmäki: Networking laboratory 2003

Deadline: Fri 7.2.2003 at 8:25 before the beginning of the exercise lecture

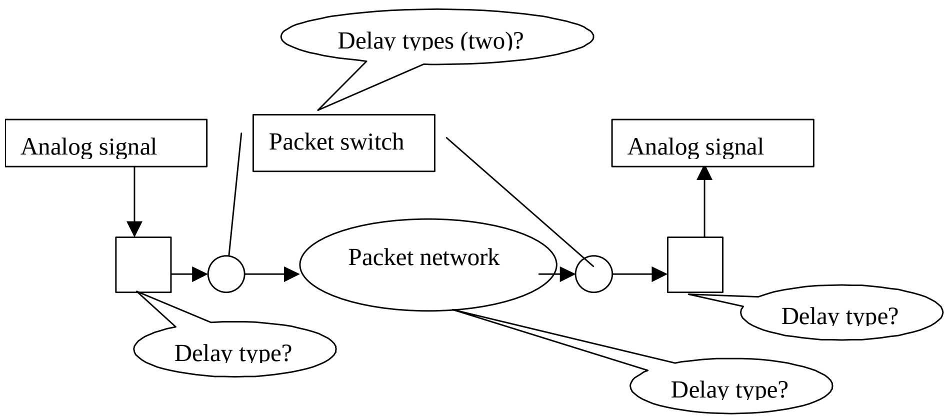
All late answers will be disregarded. Please, adhere to the deadline.

The answers are to be returned either to the exercise assistant (in person or via email to zhouyi@netlab.hut.fi) or, preferably, to a box underneath the lab's notice board on G-wing 2nd floor. Please write your *name, student number and exercise number* clearly in each answer page

Attention: for those who will return the exercises via email, please use the "Exercise x" as the *subject* in your email, where x is the series number of the exercise. And also write your *name, student number and exercise number* clearly in each answer page.

Task 1

Name the five different types of delay that data will encounter on its way to the receiver?



Task 2

The velocity of propagation for optical fiber is $2 \cdot 10^8$ m/s. A data source is transmitting at 1Gbit/s. How many bits will there be on a 1000 km of fiber optic cable? (Freeman: 9/29)

Task 3

Let us study the echo effect for packetized voice.

A) Suppose that voice is sampled 8000 times/second, and suppose each sample is coded into a 8-bit codeword, byte. Suppose we use, for user data,

a) 48 byte ATM cells
b) 1500 byte Ethernet frames

Calculate the time it takes to create one packet in both of the systems.

B) Now suppose we want to call to someone on an analog telephone, assuming digital/analog gateway between the data network and the telephone network. Unfortunately, echoes are generated at the far end (say 6000 km away) of the telephone connection. Calculate the echo delay, assuming that the analog signal travels at the speed of light (300000 km/s).
(Hui: Chapter 2. Exercise 1)

Task 4

A) Assume there is queuing delay within the packet network (***Suppose packet size is 1000 bits***), which fluctuates randomly between 2 to 20 packet durations for each packet. Compute the bounds for the queuing delay for a transmission speed of 10 Mbit/s and 150 Mbit/s. *(Hui: Chapter 2. Exercise 2)*

B) Suppose we use 100 Mbit/s connections with 1500 byte payload. How large a buffer should a switching element have if the maximum delay for one switch is 0,450 ms? How many packets can you fit into the buffer?