S-38.180 Exercise 2: Integrated Services

Mika Ilvesmäki
Helsinki University of Technology
Networking laboratory

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Instructions

The exercise lecture is held on October 24th in lecture hall S2 starting at 14.15. In the lecture the correct answers will be presented and related matters may also be discussed. If you want to have the chance to get points (in order to pass the course) follow the instruction below:

- Return the exercise answers either via e-mail to lynx@tct.hut.fi or at the beginning of the exercise lecture. There are no other ways to return the exercises, so return the exercise answers either via e-mail to lynx@tct.hut.fi or at the beginning of the exercise lecture.

- If you're into optimization you may want to know that each correct exercise answer is worth of 2 points. Any mistakes, omissions, etc. result in deduction of points. Therefore, 6 points is the absolute maximum that this exercise can produce.

The exercise questions are *based* on lectures but you can not find the answers in any publications or books (that I know of). The exercise questions are ordered from the easy towards the difficult but even the difficult question (Admission control) is not that difficult. On the second exercise using excel or matlab may make the plot easier to produce. The answers are easy and simple. You should be able to figure the answers out by using the material in lectures and your common sense. No difficult mathematics here.

1 Scalability

We assume that every reservation takes 1 kbyte of state space in an IntServ router.

1. We have 1000 multimedia conference sessions where each session reserves about 1Mbps. How much bandwidth is needed on a link that has to carry all conference sessions? How much reservation space is needed in the IntServ router?

2. We have 30000 IP telephone sessions where each session reserves about 30Kbps. How much bandwidth is needed on a link that has to carry all IP calls? How much reservation space is needed in the IntServ router?

Comment the results and suggest improvements if necessary.

2 Delay

According to definitions in the textbook the end-to-end worst-case queuing delay $Q_{delay} = \frac{b}{R}$, when $p \to \infty$ and $R \geq r$. When $p > R \geq r$ then the end-to-end worst-case queuing delay is, $\frac{b(p-R)}{R(p-r)}$.

Plot both queuing delays as a function of R (service rate) when $b =$ 14999bytes $r =$ 14999bytes/s and $p =$ 100kbytes/s.

3 Admission control

1. Consider a scheduler that has three best-effort priority levels, roughly corresponding to email, FTP and HTTP. How many HTTP connections can be admitted if they require no minimum bandwidth? Can each email connection be guaranteed a bandwidth of at least 100 Kbps? How?

2. A link capacity of 155Mbps serves sources that have a peak rate of 15.5 Mbps and a peak-to-average ratio r. How many connections can be admitted with peak-rate allocation? How many connections can be admitted with average-rate allocation when taking into account the peak rate and and the peak-to-average ratio?