MIEEC / MIEIC

Communication Services / System and Network Services

Winter Semester 2016/2017

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Duration: 90 min

Instructions

Please write your name and student number on all answer sheets.

This exam is open book.

The use of communication devices (e.g., computer, smartphone, mobile phone, etc) during the exam is strictly forbidden.

The points assigned to each question are shown in parenthesis next to the question number. Partial credit is possible, so give each question a try.

Show all your work and reasoning. This is the only way to be able to give partial credit to your answers.

If you get stuck in a question, leave it for later and go on to solve the others.

The exam consists of 10 short questions and 2 problems. I suggest that you use 45min to answer the short questions briefly, while the other hour is used for the problems. This is only a suggestion and you can use the time as you wish.

Voluntary Code of Ethics

Please sign below if you agree to comply with the following sentence.

I give my word of honour that I shall not use any unauthorised means to answer this exam.

Good luck!

Name:

Short Questions

Each question is valued 1/10.

1. Which of the following are true about the Chord distributed hash table?
   A. Has O(log(N)) lookup latency
   B. Has high overhead on node changes
   C. Uses content-based naming
   D. Provides anonymity

   Mark the correct sentence(s).

2. Which of the following are advantages of using content-based naming for p2p file transfers?
   A. The receiver can download a chunk using parallel TCP streams.
   B. The receiver can route around failed links.
   C. The receiver can download a chunk of data from any source, not just the original seed.
   D. The receiver can verify that it received the correct data.

   Mark the correct sentence(s).

3. Provide three reasons a company might prefer to pay a content-delivery network to host their webpage instead of putting it onto a peer-to-peer network for free.
   a.

   b.

   c.

4. We saw no examples of of chunk-based peer-to-peer networks that use flooding. What would make such a network inefficient?

5. How can super-nodes improve the performance of peer-to-peer networks? Does your answer apply to any node being a super-node, or does it assume any requirement(s) on super nodes? In case of the latter, please name the requirement(s).

6. HTTP 2.0 promises to improve the efficiency of the web, which currently uses HTTP1.1. Which of the following mechanisms will bring about those improvements?

   a. Requesting contents in any order and independently of replies
   b. Delivering contents in a different order from which they were requested
   c. Enabling transmission of compressed contents
   d. Improving caching through new header options

7. MPEG-DASH is a framework to enable clients to adapt streamed multimedia content quality to the available network resources. The adaptation algorithm itself is left to the client's implementation. It has been observed that a conservative adaptation algorithm can interfere with the TCP congestion control, causing a degradation of the video quality beyond what would be expectable from fair bandwidth sharing with another TCP flow. The causes of the degradation can be

   a. Too high rate of the interfering TCP flow

   b. Increasingly smaller segments cause even lower

   c. Bandwidth estimator being based on packet arrival times

   d. Bursty requests that cause TCP connection to reset and restart with closed window

8. Name one measure that could be taken at the client side to overcome each of the problems that you identified in the previous question.

   Note: You need to propose as many measures as you identified problems.

Name:

9. Name 2 challenges to measure the quality of experience (QoE) on the Internet. Additionally, name two metrics for measuring QoE for Web user and video over HTTP, explaining their meaning.

10. Explain how the playout buffer works, and how its dimension impacts video over HTTP QoE metrics.

Problems

Please show all your calculations.

1. You are in charge of doing traffic enforcement for a large ISP and a customer gives you the traffic pattern that consists of a bursts of traffic sent at rate R and of length T1, separated by periods of length T2 where no traffic is sent. You are asked to specify the tightest token bucket parameters that will let this traffic stream through (i.e. no packets will be dropped). "Tightest" means that you first minimize the token bucket rate and, for the minimum token bucket rate, you then minimize the bucket size.
    a. That is the minimum token bucket rate Rb?
    b. What is the minimum token bucket size Sb?
    c. The customer complains that some packets get dropped but he also admits that they may occasionally have shorter bursts that are sent at a slightly higher rate. What would you suggest to accommodate this?

2. Ana is developing on a Web site that has multiple replicated servers located throughout the Internet. He plans on using DNS to help direct clients to their nearest lightly-loaded server, and comes up with the following hierarchical scheme. Ana has divided his server replicas into three groups (east, west, and central) based on their physical location. A typical query occurs as follows:
   When a client makes a query for www.distributed.hb.eu, the root .eu name server is contacted first. It returns the name server (NS) record for ns1.hb.eu (along with a corresponding A record). The TTL of this record is set to 1 day.
   The ns1.hb.eu name server is then queried for the address. It examines the source of the name query and returns an NS record for one of {east-ns, central-ns, west-ns}.distributed.hb.eu (along with a corresponding A record). The choice of which name server is based on where ns1 thinks the query came from.
   Finally, one of {east-ns, central-ns, west-ns}.distributed.hb.eu is contacted and it returns an address (A) record for the most lightly loaded web server in its region.

   All the following questions are based on this design.
       a. Harry's name server software has only two choices for TTL settings for A and NS records - 1 day and 1 minute. What are reasonable TTLs for the following records? Briefly explain your choice.
       NS record for {east-ns, central-ns, west-ns}.distributed.hb.eu:

       A record for {east-ns, central-ns, west-ns}.distributed.hb.eu:

       A record returned for the actual Web server:

Ana's web site is especially popular among FEUP students. The FEUP network administrators estimate that there is one access from FEUP every 10 minutes. Each access results in the application resolving the name www.distributed.hb.eu. Assume the following:

- No other queries are made from FEUP
- All FEUP clients use the same local name server
- Web browsers do not do any caching on their own.

b. How many accesses will be made to the following name servers each HOUR to resolve these queries? Use your answers to the previous question, and explain your calculation.
ROOT:

ns1.hb.eu:

one of {east-ns, central-ns, west-ns}.distributed.hb.eu:

c. Ana finds that many people are far away (i.e. communication has high latency) from the name servers that they use. Why might this be a problem for his scheme?