Computer Communication
EDA344, EDA343, DIT423

Time and Place: Wednesday 14 March, 2018, 14.00-18.00 SB

Course Responsible: Marina Papatriantafilou (Tel: 772 5413), Ali Salehson (Tel 772 5746)

Allowed material:

- English-X (X can be French, German, Swedish, etc) dictionary
- *No other books, no notes, no calculators, no electronic devices.*

Grading:

CTH students (EDA344 or EDA343): 3: 30-40 p, 4: 41-50 p, 5: 51-60 p

GU students (DIT423): Godkänd 30-44, Väl godkänd 45-60 p

Instructions

- **Write clearly your course-code (EDA344/EDA343/DIT423)**
- **Start answering each assignment on a new page; use only one side of each sheet of paper; please sort the sheets according to the question-ordering and number them.**
- Write in a **clear manner** and **motivate** (explain, justify) your answers. If it is not clear what is written for some answer, it will be considered wrong. If some answer is not explained/justified, it will get **significantly lower or zero** marking.
- If you make any **assumptions** in answering any item, do not forget to clearly state what you assume.
- A good rule-of-thumb for the extend of detail to provide, is to include enough information/explanation so that a person, whose knowledge on computer communication is at the level of our introductory lecture, can understand.
- Please answer in English, if possible. If you have large difficulty with that (with all or some of the questions) and you think that your grade might be affected, feel-free to write in Swedish.
- Inspection of exam: date, time will be announced through pingpong and the web page www.cse.chalmers.se/edu/course/EDA344DIT423/

Good Luck !!! Lycka till !!!!

1. General questions, applications, security (12 p)

   (a) (2p) Why are the terms client and server still used in peer2peer applications?

   (b) (3p) Explain what we mean by the term "cookies" in data communication applications and how cookies-mechanisms work.

   (c) (3p) i. Explain how web caching can reduce the delay in receiving a requested object. ii. Can it reduce delay for all objecs or only some? Why?

   (d) (4p) i. Suppose A and B are sending packets to each other over a data network. Suppose T positions itself in the network so it can capture all packets sent by A (respectively B) and send whatever it wants to B (respectively A). List 2 malicious things T can do from this position.
   ii. Consider that A and B are an end-host and the local DNS server. Describe the implications that T's malicious behaviour, which you named in the first part of the question, can have.

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ANSWER HINT
- each node can be both client and server, but not both in the same session
(there can be 2 parallel and symmetric sessions between pairs though)

- special numbers, when stored in a DB they can be used to index
 other stored info about the user that accepted to be associated with the number.

- local copies are accessible faster;
all benefit due to reduced traffic at eg the first hop router.

- spoof source address, modify content;
others receive messages directed to A;
 A gets wrong IP address for its request.
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2. Reliable Data Transfer and Transport layer (12 p)

   (a) (8p) i. Define what are the requirements of reliable data transfer.
   ii. Describe how to solve the problem of reliable data transfer using acknowledgements, over an unreliable channel that can introduce errors but does not lose messages.
   iii. Describe how to solve the problem of reliable data transfer, using acknowledgements, over an unreliable channel that can introduce errors and can lose messages.
   iv. Is it possible to have reliable data transfer over an unreliable channel without the use of acknowledgements? If yes, explain how; if not explain why not. Make sure that you list any assumptions you might need.

   (b) (4p) Suppose that two TCP segments sent by A arrive in order at B. The first acknowledgment is lost and the second acknowledgment arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgments sent in this sessin. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number.

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ANSWER HINT
- guaranteed delivery, in-order, no duplicates;
sender always waits for an ack/nack to arrive before moving on
msg or ack can be lost, hence sender needs timer for timeouts for retransmission
yes, with forward error control
(eg error correction, piggybacking a duplicate of a msg with the next one, ...)
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- done in class,  session 2, transport layer
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3. Multimedia, Congestion Control and Internet in evolution(12p)

    (a) (3p) Describe the concept of a leaky token bucket. What can it be used for? Provide an example.

    (b) (3) Assume host A is streaming a video from Server B using UDP. Also assume that the network suddenly becomes very congested while Host A is seeing the video. Is there any way to handle this situation with UDP? What about TCP? Is there any other option?

    (c) (3p) What are the advantages and disadvantages of packet forwarding based on only the packet's IP address?

    (d) (3p) What is a Content Distribution Network (CDN)? Explain how it is organnized and give an example of how a user request gets served using a CDN.

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ANSWER HINT
- in book, chapter multimedia; limit rates for congestion control,
eg for policing sending rate of an application.

- tcp will adjust automatically; udp not, application must do it,
 eg by calculating a rate and  limiting it through eg leaky bucket.

- done efficiently,  by simple bit-masking;
can only chose one path per destination, cannot distingusih traffic types/flows

- cf book, section on CDN
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4. Data Link Layer and Wireless (12p)

    (a) (2p) Suppose that error detection is handled by some link layer protocol by adding cyclic redundancy check bits R to a datagram D. An error is detected on reception while no errors occurred within the D datagram. Is this situation possible? Explain why or why not.

    (b) (6p) What are the approaches taken to handle (i) bit errors and (ii) medium sharing in Ethernet and 802.11 link layer protocols? Compare and justify briefly the choices made in each case.

    (c) (4p) Give a short description of the way mobility is handled by direct and indirect routing. Compare the pros and cons of the two approaches.

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ANSWER HINT
-the error is in R

-bit errors: in Ethernet, few errors so only CRC; in Wifi,
higher bit error rates, so CRC + retransmission
-MAC protocol: in Ethernet, CSMA/CD (censing+collision detection);
in Wifi, CSMA/CA (censing+collision avoidance)
as CD is not feasible in Wireless environments (expensive, hidden terminal, fading)


-description: see section 7.5; indirect routing better handles mobility
but causes "triangle routing problem"; direct routing solves triangle routing
but needs extra mechanism to handle mobility.
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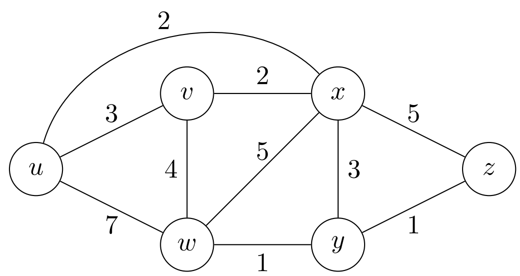
5. Network Core and Routing (12 p)

(a) (8p: 4+2+2) Consider the following network topology and assignment of IP addresses:



Router	IP address
u	129.16.22.0
v	129.16.22.64
w	129.16.22.32
x	129.16.22.48
y	129.16.22.40
z	129.16.22.44

As in the figure, the routers (or nodes) are connected to each other by links whose cost is indicated beside.

i. What is the smallest CIDR address block (in number of IP addresses) for this particular subnet?

ii. Execute Dijkstra's algorithm on the topology above to find the shortest path (with minimal cost) from node u to all other nodes. Present the execution of the algorithm step by step, indicating the updates at each step. Provide the routing table from node u based on these results.

iii. Summarize the calculated routing table by aggregating addresses with a common prefix. Entries may be given in binary or in CIDR notation.

(b) (4p) Describe an advantage and a disadvantage in using a centralized routing algorithm and when using a distributed one. Provide an example algorithm for each paradigm.

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ANSWER HINT
-(a)i 192.16.22.0/25
-(a)ii tree: u->v, u->x, x->y, y->w, y->z.
routing table: for v, next-hop is v, for all others x
-(a)iii all addresses forwarding to x are aggregated to 129.16.22.32/27


-(b)cf also p 418-419 in the book 7/e; briefly:
centralized:
pros: best path, can be tuned/administrated;
cons: scale poorly, poor face to updates,
ex: Dijkstra's algo

distributed:
pros: scales, adapt to changes in network configurations, automated;
cons: not most efficient routes, slow to converge, count-to-infinity...
ex:  BellmanFord algorithm
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