TECHNISCHE UNIVERSITÄT BERLIN
Fakultät IV – Elektrotechnik und Informatik
Fachgebiet Intelligente Netze
Prof. Anja Feldmann, Bernhard Ager, Petr Kuznetsov, Stefan Schmid
Nadi Sarrar, Oliver Hohlfeld, Juhoon Kim, Srivatsan Ravi, Doris Schiöberg,
Benjamin Frank

3nd Assignment: Network Protocols and Architectures WS 11/12

Question 1: (30 + 10 = 40 points) *Content Distribution Networks*

(a) A Content Distribution Network (CDN) replicates the same content in many locations throughout the world. A CDN typically directs clients to the appropriate replica by returning customized answers to DNS queries (e. g., by controlling the response to a request for the IP address of `www.tagesschau.de`).

Use a DNS lookup utility like *dig* to find two sites other than `www.tagesschau.de` that use a CDN. (Hint: Examine popular web sites.) You will find the usage of CDNs by examining the DNS records provided in the *Answer Section* of the dig output. Which CDN is used (guess from the names in the DNS records)? Which observations can you make regarding the DNS records used to provide the CDN functionality? (try to explain your observations) Try to locate the IP of the used CDN cache servers using a whois database (e. g., ripe.net): In which network/ISP is the server located?

You *can* try to query the same site from different locations (e. g., university vs. home, or two different ISPs) and compare the results.

Describe your observations.

(b) Compare the DNS Time-to-Live (TTL) for different DNS records (e. g., A vs. CNAME). Do they differ? If so, which one is smaller? Why do you think this is the case? Provide two negative implications of having a small TTL value.

Question 2: (20 points) *Application Layer Protocols*

Choose *one* of the application layer protocols listed below:
SMTP, POP3, IMAP, IRC, Jabber/XMPP, NTP, NNTP, SIP, RTP, Gopher, DHCP, SSH.
If you think an interesting protocol is missing, you can also propose one. (We will not accept suggestions like HTTP and DNS that were extensively discussed.)

Start some research on the chosen protocol and try to briefly discuss it along the following lines:

(a) Briefly (!) summarize its purpose and basic functionality.

(b) Which transport layer protocol does it use?

(c) Is the protocol standardized? Can you find the standard? (Hint: `http://www.ietf.org/rfc.html`)

(d) Do you use it?

Please turn!

Question 3: $(5 + 5 = 10$ points) *TCP Sequence Numbers*

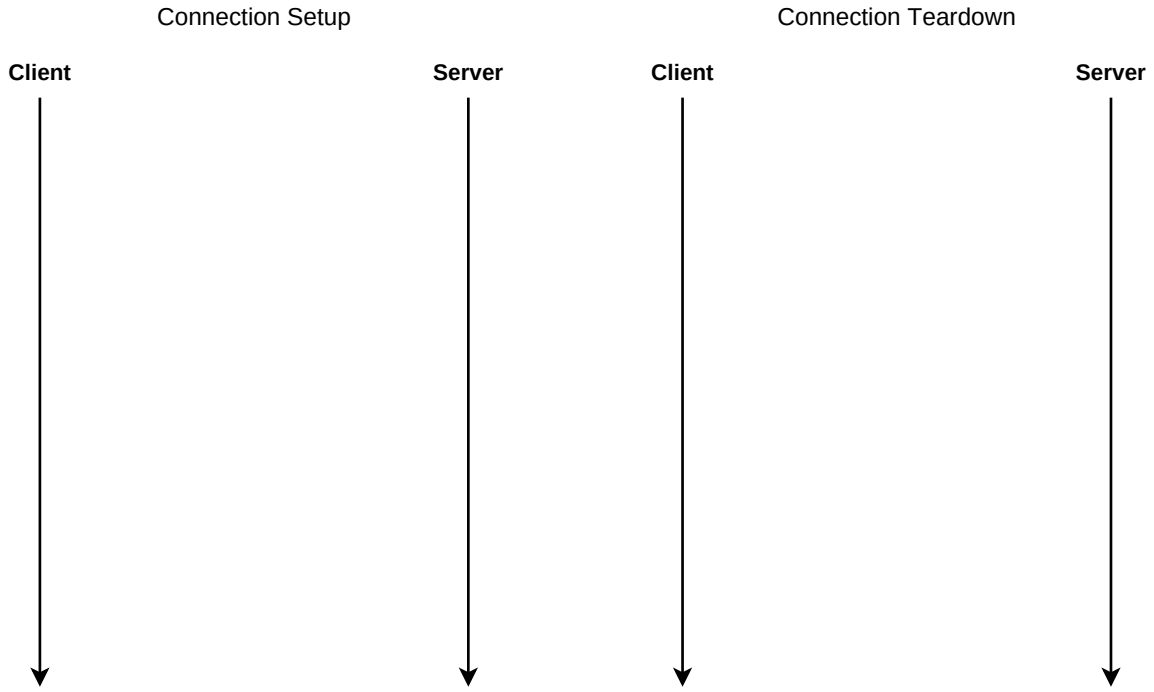
Suppose, Host A sends two TCP segments back-to-back to Host B over a TCP connection. The first segment has sequence number 340; the second has sequence number 420.

(a) How much data (in bytes) is in the first segment?

(b) Suppose, the first segment is lost but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number?

Question 4: $(15 + 15 = 30$ points) *TCP Handshake and Teardown*

TCP is the number one example for connection-oriented services. In this problem we will have a closer look at TCP's connection management.



(a) Enter a successful connection setup into a diagram (see above on the left). Label the arrows with the relevant parts of the TCP header (flags, sequence number, acknowledgment number). The initial (randomly chosen) sequence numbers of client and server are: 2500 (Client) and 10030 (Server).

(b) Enter the successful connection teardown into another diagram (see above on the right). Again label the arrows with the relevant parts of the TCP header (flags, sequence number, acknowledgement number). Assume that after the connection setup from part (a) some data was transferred: 500 bytes from client to server, and 10000 bytes from server to client. Consider these values when determining sequence and acknowledgment numbers.

Due Date: Thursday, November, 17th 2011 only until 13:55 h s. t.

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- Put your name, StudentID number (Matrikelnummer) **and** the name of your tutor on your solution.