



DAT204 Exam h2017

Datakommunikasjon (Universitetet i Agder)



Skann for å åpne på Studocu

☑ **DAT204-G, general information**

Subject code: DAT204

Subject name: Datakommunikasjon

Date: 6. 12. 2017

Duration: 3 timer

Permitted aids: Calculator

Comments: The exam is in English and each question gives from 1 to 2 points per correct answer, in total 100 points. Wrong answer gives 0 points for all assignments except multiple answer assignments, which give a negative score for wrong answers and a lowest threshold of 0 points per assignment. A negative score is not possible for multiple answer assignments. Some assignments contain several questions. The exam contains a mix of multiple choice, multiple answer and calculation assignments. There is an open text field on the last page which may be used for writing additional comments and assumptions to the assignments of the exam. This text field does not give any points in itself, but it may impact the judgement of other assignments. It is not necessary to use the text field, since correct answer on all questions will give full score. If the question is not correct, then you may however get additional points if you explain a partially correct solution or good assumption in the text field.

There are sometimes requests for using exam answers for educational and teaching purposes. The University needs the candidate's permission to use this. The answer will be anonymous.

Do you permit that your exam answer is used for such purposes?

Velg et alternativ

☐ Ja

☐ Nei

1 **Select protocol**

Which of the following protocols run as a service on the application layer?
(2 points)

Select one alternative

- ☐ DNS
- ☐ ARP
- ☐ IP
- ☐ IEEE 802.11
- ☐ ICMP

Maks poeng: 2

2 UDP sockets

Below are some statement related to how UDP sockets work. Which statement is true? (2 points)

Select an alternative

- ☐ UDP traffic towards different applications in a server uses a common socket if the traffic comes from the same client.
- ☐ A UDP session socket is identified by the sender and receiver port and IP address.
- ☐ UDP traffic towards the same application in a server uses different sockets when the traffic comes from different clients.
- ☐ UDP traffic towards the same application in a server uses a common socket even if the traffic comes from different clients.

Maks poeng: 2

3 HTTP protocol

Below are some statements related to the behaviour of different types of HTTP connections. One of the following statements is true, select the correct alternative. (2 points)

Select one alternative.

- ☐ With nonpersistent TCP connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.
- ☐ The Date: header in the HTTP response message indicates when the object in the response was last modified.
- ☐ A user requests a Web page that consists of a HTML page and three images. The web client will then send one request message and receive four response messages.
- ☐ Two distinct Web pages can be sent over the same persistent connection.

Maks poeng: 2

4 E-mail transfer

Suppose Alice sends an e-mail to Bob using a Web-based e-mail account (for example Gmail). Bob reads email using his e-mail client (e.g. Outlook or Thunderbird), which uses a mail access protocol for presenting the e-mails that are stored on his e-mail server. This mail access protocol keeps e-mails and email folders on the server also after they have been downloaded. (3 points)

List the three application layer protocols that are used to move the e-mail from Alice to Bob in the correct time sequence.

Alice -> (POP3, MIME, HTTP, IMAP, HTML, SMTP) ->
(HTTP, SMTP, IMAP, MIME, POP3, HTML) -> (SMTP, MIME, IMAP, HTTP, POP3, HTML) -> Bob

Maks poeng: 3

5 TCP congestion handling

Below are some claims about how the TCP protocol works. Select the correct claim. (2 points)

Select one alternative.

- ☐ Congestion avoidance is related to the Receive window in the TCP header.
- ☐ TCP timer expiry triggers fast recovery.
- ☐ Fast recovery denotes the phases in a TCP transmission where the congestion window increases exponentially fast.
- ☐ Congestion avoidance denotes the phases in a TCP transmission where the congestion window increases linearly.

Maks poeng: 2

6 TCP claims

Below are some claims about how the congestion and flow control in TCP works. Select the correct alternative. (2 points)

Select one alternative

- ☐ The number of unacknowledged bytes can be larger than the receiver buffer (if the variable "Congestion Window" is larger than "Receive Window").
- ☐ TCP flow control ensures that the network is not being overloaded.
- ☐ The parameter "Receive Window" is a part of the TCP congestion control algorithm.
- ☐ For a TCP connection, the number of unacknowledged bytes can not be larger than the receiver buffer.

Maks poeng: 2

7 UDP claims

Below are some claims about how the UDP protocol works. Select the correct alternative. (2 points)

Select one alternative

- ☐ UDP segments that are received with the wrong checksum are discarded and retransmitted when the round-trip-time is expired.
- ☐ UDP uses selective repeat so that many segments can be sent back to back before receiving an acknowledgement.
- ☐ UDP segments with wrong sequence number are discarded.
- ☐ When UDP is used, then any fault correction is up to the application.

Maks poeng: 2

8 TCP quality of service

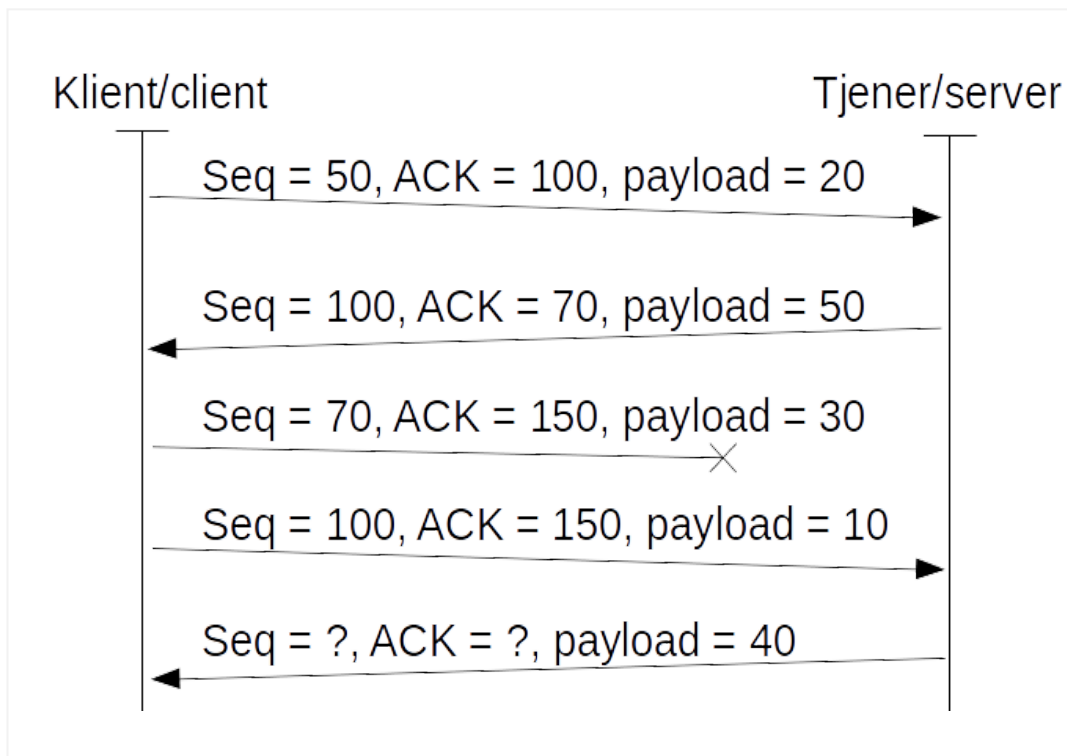
Which service quality guarantees does TCP give? (2 points)

Select any that are correct.

- ☐ Guaranteed bandwidth
- ☐ Bounded delay
- ☐ Server authentication
- ☐ In-order data delivery
- ☐ Data confidentiality
- ☐ Data integrity
- ☐ None of these
- ☐ Reliable data transfer

Maks poeng: 2

9 TCP sequence



Above is an excerpt from a TCP transmission. What will the next sequence number and acknowledgement number be in the last TCP segment? (3 points)

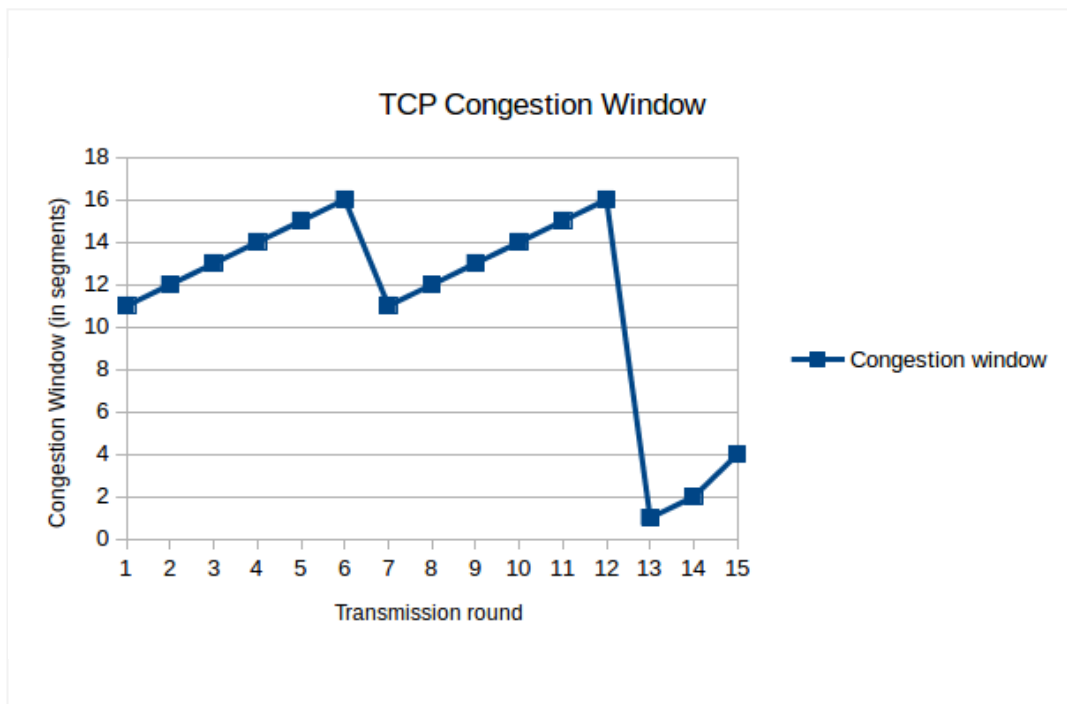
Seq= ACK=

The third message is lost during transmission. How does TCP Reno ensure that this message is delivered?

(Message is retransmitted on timeout., Message is retransmitted after receiving triple duplicate ACK., Message is dropped, it is up to the application layer to retransmit it., The link layer will ensure reliable data transfer in this case.)

Maks poeng: 3

10 TCP Congestion Window



The figure shows the size of TCP Reno's congestion window in number of segments as a function of transmission round. Answer the following questions. (5 points)

Identify an interval where congestion avoidance is operating.

([13,15], [12,13], [7,12], [6,7])

How is segment loss identified in transmission round 7?

(Timeout on ACK, RM cell with

Congestion Indication (CI), Triple duplicate ACK, Explicit Congestion Notification (ECN))

How is segment loss identified in transmission round 13?

(RM cell with Congestion

Indication (CI), Triple duplicate ACK, Timeout on ACK, Explicit Congestion Notification (ECN))

After segment loss is detected in transmission round 13, what is the slow-start threshold set to?

Assuming the Maximum Segment Size (MSS) is 1460 bytes and the round-trip-time RTT=135 ms, what is the average bandwidth in Mb/s the TCP connection uses in transmission rounds [1,12]?

Maks poeng: 5

11 Routing standards

What is the de-facto standard for inter-AS routing? (2 points)

Select one

- ☐ The Link-State Algorithm (LS)
- ☐ The Distance-Vector Algorithm (DV)
- ☐ BGP - Border Gateway Protocol
- ☐ OSPF - Open Shortest Path First
- ☐ RIP - Routing Information Protocol

Maks poeng: 2

12 IP Address Assignment

How are IP addresses usually assigned to PCs that are connected to a network? (2 points)

Select one alternative

- ☐ ARP
- ☐ BGP
- ☐ DNS
- ☐ DHCP
- ☐ NAT

Maks poeng: 2

13 Packet scheduling

Which packet scheduling discipline ensures that a data flow gets a defined fraction (of arbitrary size) of the total bandwidth? (2 points)

Select one alternative

- ☐ Weighted Fair Queueing
- ☐ First In First Out (FIFO)
- ☐ Round Robin (RR)
- ☐ Priority scheduling

Maks poeng: 2

14 Routing algorithms**Enter the routing algorithms that fit the expression (5 points).**

(RIP, OSPF, IGMP, BGP) uses Dijkstra's algorithm to find the shortest path.

(RIP, IGMP, OSPF, BGP) is dominated by routing policies instead of focusing on finding the path with lowest cost in the network.

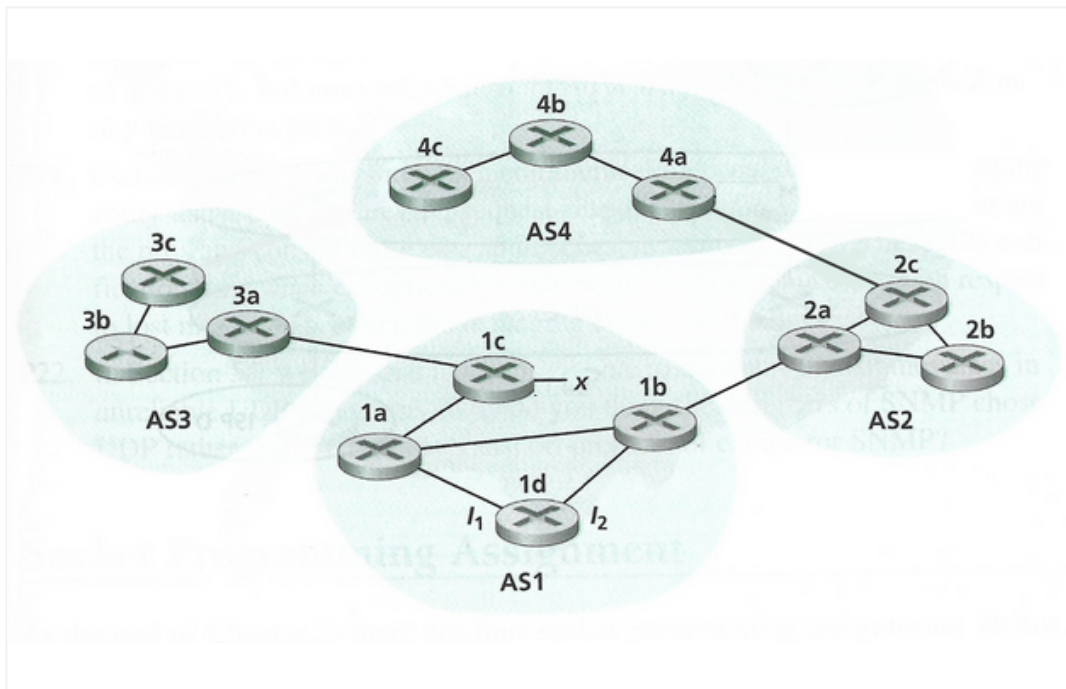
(BGP, OSPF, IGMP, RIP) exchanges information about changed routing tables with neighbour routers.

(RIP, IGMP, OSPF, BGP) announces a subnet to all autonomous systems on the Internet.

(BGP, IGMP, OSPF, RIP) exchanges information about neighbour routers with all routers in the network.

Maks poeng: 5

15 AS Routing



Consider the network shown above. Suppose AS1 and AS2 are running RIP as their intra-AS routing protocol. Suppose AS3 and AS4 are running OSPF as their intra-AS routing protocol. Suppose eBGP and iBGP are used as inter-AS routing protocol. (4 points)

Select the correct protocol:

- a) Router 3a learns about prefix x from which routing protocol? ▼
(RIP, OSPF, eBGP, iBGP)
- b) Router 4b learns about prefix x from which routing protocol? ▼
(RIP, OSPF, eBGP, iBGP)
- c) Router 2b learns about prefix x from which routing protocol? ▼
(RIP, OSPF, eBGP, iBGP)
- d) Router 2a learns about prefix x from which routing protocol? ▼
(RIP, OSPF, eBGP, iBGP)

Maks poeng: 4

16 Binary to IP

The IP address 10011000.01011010.01011110.00001001 can be written on dotted decimal form as: (2 points)

 . . .

Maks poeng: 2

17 IP og subnetting

Suppose an ISP owns the block of addresses of the form 192.258.56.0/22. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. (4 points)

What are the prefixes (of the form a.b.c.d/x) for the four subnets?

Subnet 1: 192.168. .0/

Subnet 2: 192.168. .0/

Subnet 3: 192.168. .0/

Subnet 4: 192.168. .0/

Maks poeng: 4

18 Routing tables

In this assignment, the objective is to determine the correct forwarding link given the routing table below (5 points).

A router has the following routes in its forwarding table:

00001010.10101000.00000100.00000000/22	link 1
00001010.10101000.00000010.00000000/23	link 2
00001010.10101000.00000100.00000000/24	link 3
00001010.10101000.00000000.00000000/16	link 4
All other addresses	link 5

Assume the router receives datagrams destined to the following addresses and decide which link they are forwarded to.

A: 00001010.10101000.00000100.10000000

B: 00001010.10101000.00001001.00000000

C: 00001010.10101010.00000101.00000000

D: 00001010.10101000.00000011.00000000

E: 00001010.10101000.00000111.00000000

On which link will they be forwarded? (5 points)

A: link B: link C: link D: link E: link

Maks poeng: 5

19 TCP/IP switch layers

Which layers in the TCP/IP model are involved when an Ethernet switch forwards packets? (2 points)

Select one or more alternatives

- ☐ Application layer
- ☐ Transport layer
- ☐ Network layer
- ☐ Link layer
- ☐ Physical layer

Maks poeng: 2

20 Link layer

Below are some general statements about how the link layer works. Select the correct alternative(s). (2 points)

Select one or more alternatives

- ☐ The link layer is the place in the protocol stack where software meets hardware.
- ☐ The link layer is implemented only in hardware.
- ☐ The link layer cannot offer any form of reliable delivery.
- ☐ The link layer performs error detection.
- ☐ The link layer is implemented only in software.

Maks poeng: 2

21 Wireless concepts

Below are some general statements about wireless transmission as well as some more specific statements about how IEEE 802.11 wireless LANs function. (6 points)

Fill in the correct term in each sentence.

In (rate adaptation, interference, path loss, ad-hoc mode, multipath propagation, infrastructure mode, beacon frames) each wireless host is connected to the Internet via an access point.

In (interference, ad-hoc mode, path loss, infrastructure mode, rate adaptation, multipath propagation, beacon frames) wireless hosts themselves provide routing, address assignment and DNS.

Wireless stations discover and identify the access point using

(multipath propagation, infrastructure mode, path loss, ad-hoc mode, rate adaptation, interference, beacon frames).

Attenuation of the wireless signal when travelling through matter is called

(interference, rate adaptation, beacon frames, ad-hoc mode, multipath propagation, path loss, infrastructure mode).

When two or more sources within a basic service set transmit at the same time on the same frequency then

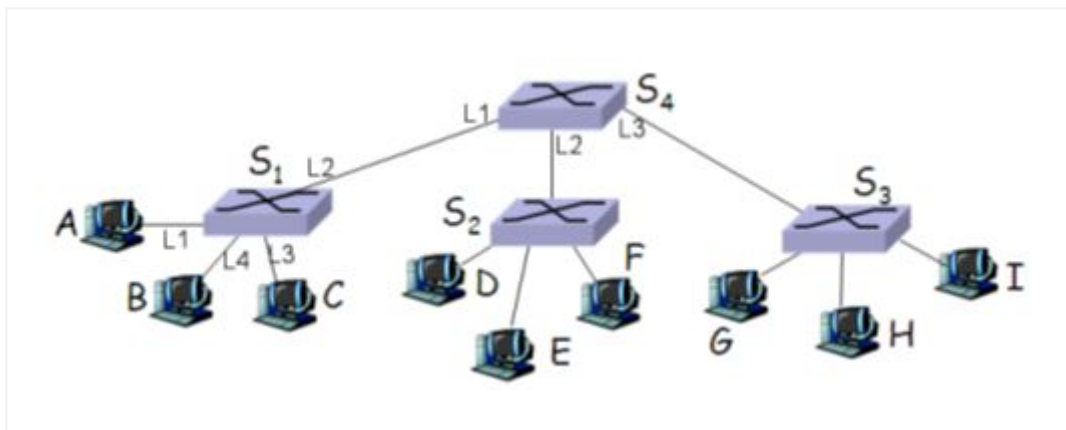
(ad-hoc mode, infrastructure mode, rate adaptation, multipath propagation, beacon frames, path loss, interference) may occur.

Blurring of the received signal due to several reflections of the electromagnetic wave from objects and ground is called

(infrastructure mode, ad-hoc mode, rate adaptation, path loss, interference, beacon frames, multipath propagation).

Maks poeng: 6

22 Self-learning switches



The figure above shows a network with four self-learning Ethernet switches and nine hosts. The switches have just been started, and the switch table is empty. (6 points)

Assume the following frames are being sent:

A to B

E to I
I to A
Then D to B.

How will the switch table in S_4 be after this sequence?

Switch table for S_4

Address	Interface
A	▼ (L1, L4, L2, L3)
E	▼ (L3, L4, L1, L2)
I	▼ (L1, L4, L2, L3)
▼ (E, A, I, C, H, B, D)	▼ (L4, L1, L2, L3)

Which hosts receive the last frame? ▼ (All except D, D and E, Only E, D, E and F)

Maks poeng: 6

23 E-mail encryption

What is the de-facto e-mail encryption scheme described in the textbook?
 (2 points)

Select one alternative

- ☐ DSA (Digital Signature Algorithm)
- ☐ TLS (Transport Layer Security)
- ☐ RSA (Rivest-Shamir-Adleman)
- ☐ PGP (Pretty Good Privacy)
- ☐ MIME (Multipurpose Internet Mail Extensions)

Maks poeng: 2

24 SSL statements

Below are some clauses about the SSL protocol. What is the correct statement about SSL? (2 points)

Select one alternative

- ☐ SSL connections are closed by terminating the TCP connection.
- ☐ SSL allows agreeing on cryptographic algorithms during the handshake phase.
- ☐ SSL implements sequence numbers in cleartext in the SSL record.
- ☐ SSL always uses AES after the handshake phase.

Maks poeng: 2

25 SSL certificate

What is the digital certificate used for in the TLS/SSL protocol? (2 points)

Select one or more alternatives

- ☐ Licence for legal sending of SSL messages.
- ☐ Authorise the client to communicate with the server.
- ☐ Authenticate the server.
- ☐ Create a signature for SSL messages.
- ☐ Use public key to encrypt master secret.

Maks poeng: 2

26 SSL Quality of Service

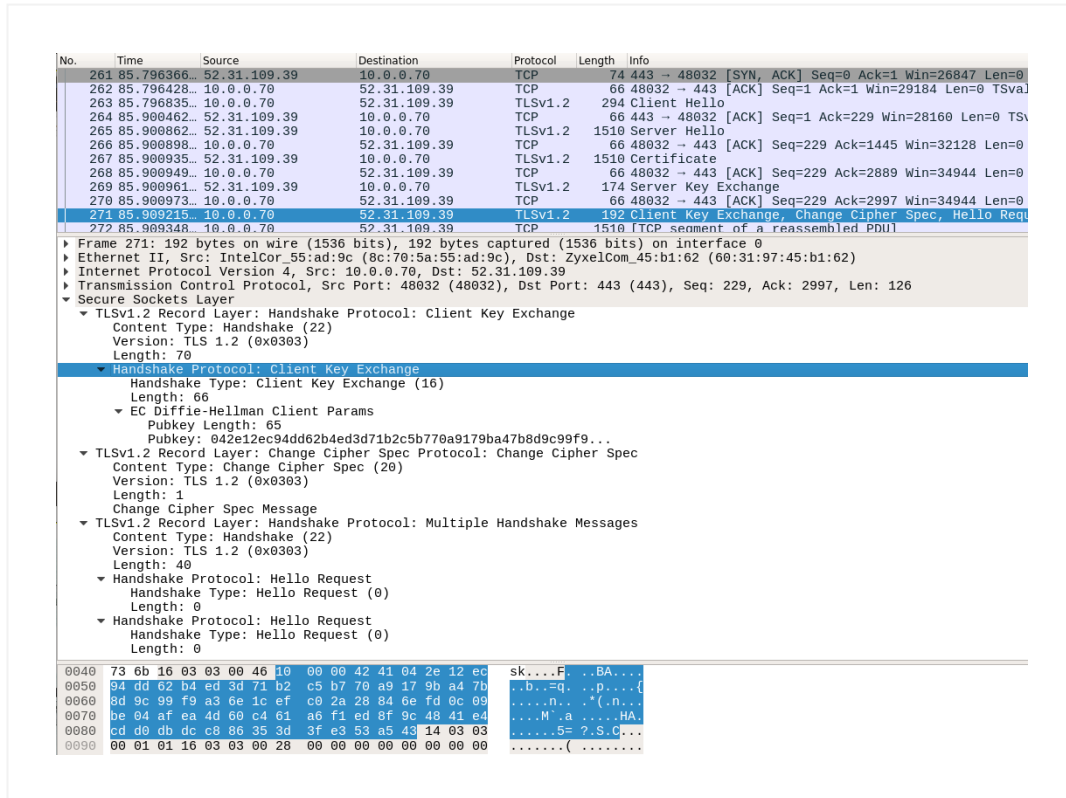
Which service quality guarantees does SSL give? (3 points)

Select correct answer(s)

- ☐ Bounded delay
- ☐ Data integrity
- ☐ Data confidentiality
- ☐ Guaranteed bandwidth
- ☐ Server authentication

Maks poeng: 3

27 Wireshark SSL



The figure above shows a TCP sequence from Wireshark. Answer the following questions: (11 points)

Which link layer protocol is used here? (ARP, DHCP, Ethernet, IEEE 802.11, HTTP, IP)

Which protocol is encapsulated in the link layer frame?
(ARP, DHCP, Ethernet, IEEE 802.11, HTTP, IP, SNMP, SMTP, TCP, UDP)

Packet 270 shows "Win=34944". What type of window is this?

(Congestion window, Receiver window, Sliding window in number of packets, Window size of the user interface)

Which phase of a TCP connection does packet 261 belong to?

(Connection, Data transfer, Disconnection, Three-way handshake, Listen for new connections (LISTEN))

Who sends packet 261? (None, Client, Server, Do not know)

How many bytes payload are sent in packet 271?

How many bytes payload have been sent (from client to server) and received in total from the start of the session and until inclusive packet 271?

Sent: Received:

Which application layer protocol is used here? (ARP, DHCP, DNS, Ethernet, FTP, HTTP, SNMP, SMTP, TLS/SSL)

Packets 263 and 265 contain nonces. What is the purpose of these nonces? (Data authentication,

Protect against chosen plaintext attacks, Protect against replay attacks, Protect against man-in-the-middle attacks, Protect against denial-of-service attacks, Protect against known plaintext attacks)

For SSL, how can the client securely send the Master Secret (MS) to the server? (Encrypt MS with the private key of the server., Encrypt MS with the public key of the server., Encrypt MS with the common session key., Use the signed hash value of MS as key.)

Maks poeng: 11

28 Link utilisation

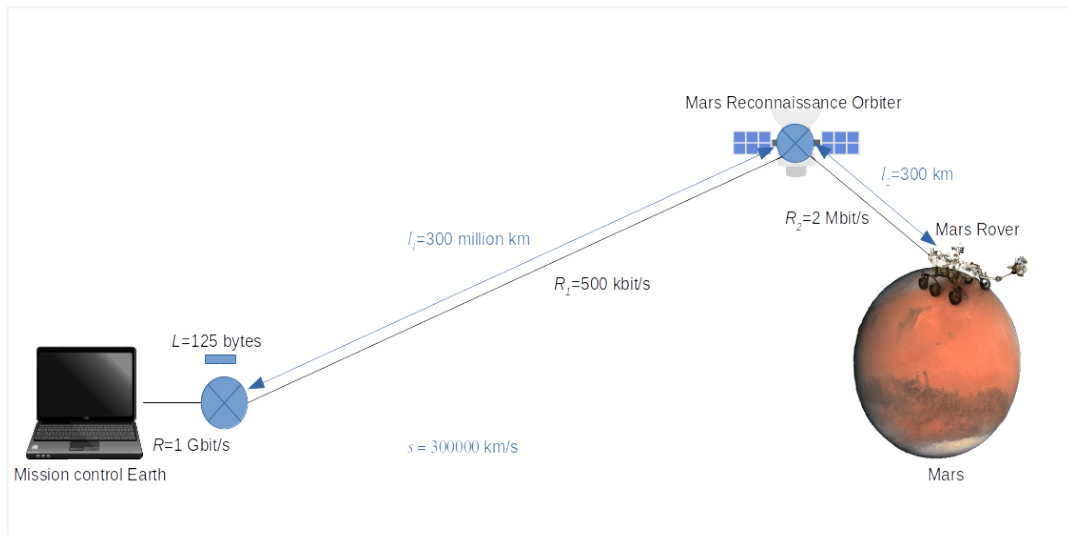
Consider a long fibre link between two hosts, where the round-trip propagation delay between these two end systems, RTT, is 30 ms. Suppose that the size of a packet is 1250 bytes, including both header fields and data, and that the transmission rate is 1 Gbit/s. (4 points)

What is the transmission delay in μs ?

How big would the window size have to be (in number of packets) for the channel utilisation to be greater than 97 percent? Round up your answer

Maks poeng: 4

29 Transmission and Propagation delay



The Mars Rover is connected to Earth via the Mars Reconnaissance Orbiter satellite as shown in the figure. The bandwidth from Earth to the satellite is 500 kbit/s and the bandwidth from the satellite to the Rover is 2 Mbit/s. The satellite is 300 km from the surface of Mars and 300 million km from Earth, and works like a router (store and forward). The speed of light is 300 000 km/s. Routers and switches before the satellite link are not overloaded and use a 1 Gbit/s network. (10 points)

How large is the propagation delay between the Earth and the satellite in seconds?

A 125 bytes control frame is sent from Earth to the Mars Rover. How large is the total transmission delay in milliseconds through all routers?

What is the minimal round-trip-time (RTT) in seconds for the control frames?

Assuming that a continuous sequence of control frames is sent to the Rover, what is the maximum end-to-end bandwidth in Mbit/s that is attainable from Mission control and to the Rover?

Assuming the Mars Rover has a speed of 5 km/h, is it then possible to successfully perform controlled navigation of the Rover on Mars from Earth interactively in a terrain full of craters and boulders?

Select one

- ☐ Yes
- ☐ No

Maks poeng: 10

Comments

Write assumptions and comments to the assignments here.

Maks poeng: 0