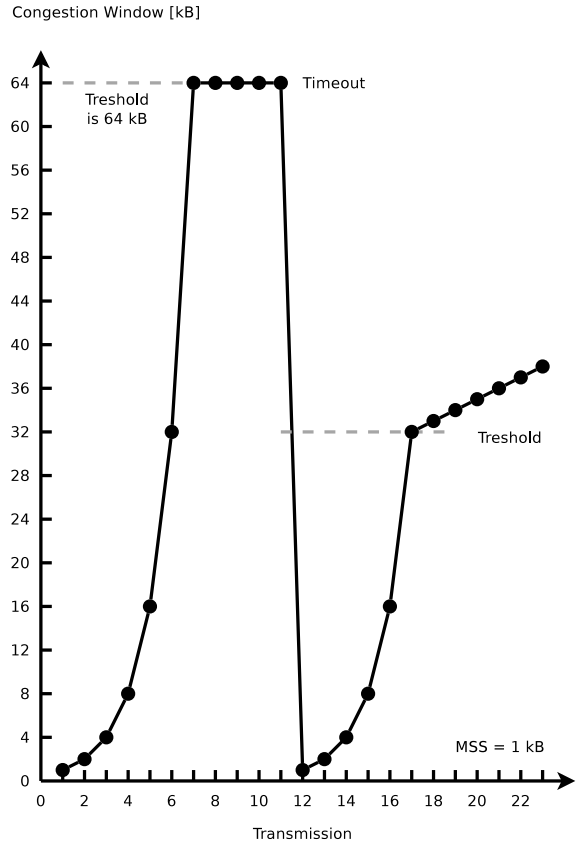
Exercise Sheet 5

Exercise 1 (Transport Protocols)

1. Explain the **differences** between TCP and UDP.
2. Describe **two examples**, where using the Transport Layer protocol TCP makes sense.
3. Describe **two examples**, where using the Transport Layer protocol UDP makes sense.
4. Describe what a socket is.
5. Describe what the Seq number in a TCP segment specifies.
6. Describe what the Ack number in a TCP segment specifies
7. Describe the **silly window syndrome** and its effect.
8. Describe the functioning of **silly window syndrome avoidance**.
9. Name the two possible **reasons** for the occurrence of congestion in computer networks.
10. Explain why the sender does maintain **two windows** when using TCP and not just a single one.
11. Describe what the slow-start phase is.
12. Describe what the congestion avoidance phase is.
13. Mark in the figure both the slow-start phase and the congestion avoidance phase.



14. Describe what fast retransmit is.

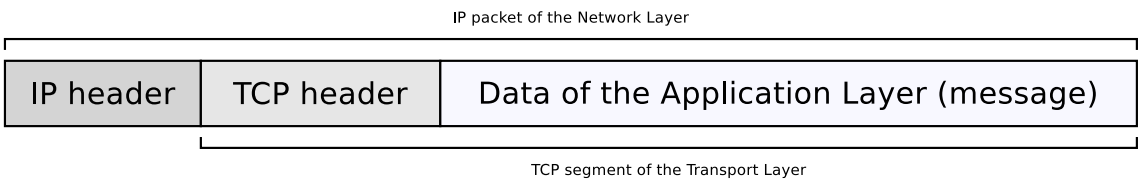
15. Describe what fast recovery is.

16. The concept of TCP congestion control is called **AIMD** (= Additive Increase / Multiplicative Decrease). **Describe the reason** for the aggressive reduction and conservative increase of the congestion window.

17. Describe how a Denial-of-Service attack via **SYN flood** works.

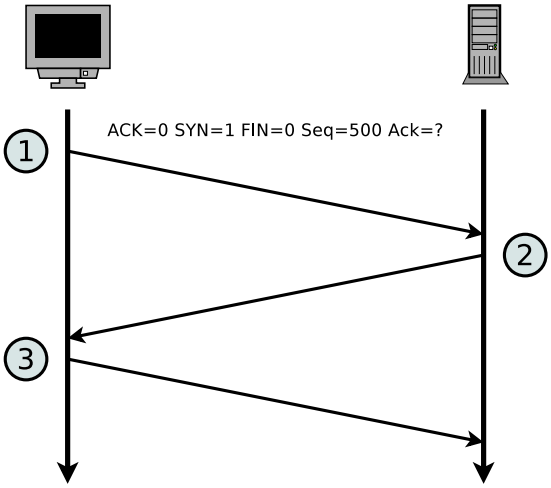
Exercise 2 (Header and Payload)

An application generates 40 bytes payload which is first packed into a single TCP segment, and then packed into a single IP packet. What is the percentage of header data in the IP packet and what is the percentage of application generated payload?



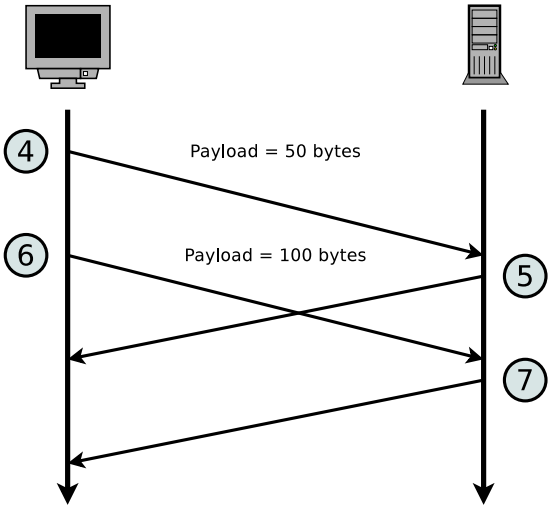
Exercise 3 (Transmission Control Protocol)

1. The diagram shows the establishment of a TCP connection. Complete the information in the table for TCP messages 2 and 3 according to TCP messages 1.



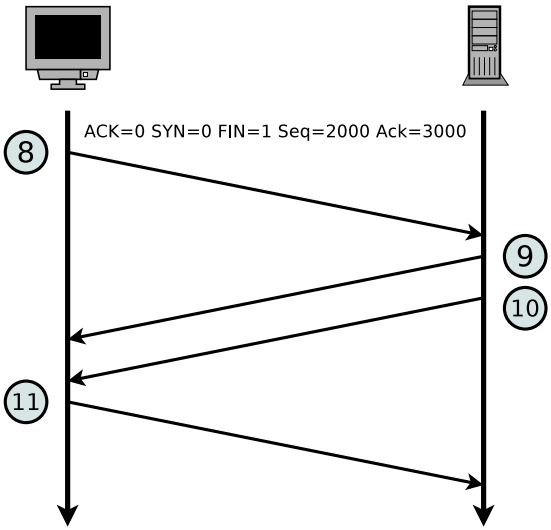
Message	ACK	SYN	FIN	Payload length	Seq number	Ack number
1	0	1	0	0	500	
2					1000	
3						

2. The diagram shows an excerpt of the transmission phase of a TCP connection. Complete the table.



Message	ACK	SYN	FIN	Payload length	Seq number	Ack number
4	0			50	501	1001
5	1			0		
6	0			100		
7	1			0		

3. The diagram shows the termination of a TCP connection. Complete the table.



Message	ACK	SYN	FIN	Payload length	Seq number	Ack number
8	0	0	1	0	2000	3000
9				0		
10				0		
11				0		

Exercise 4 (Devices in Computer Networks)

1. Name the network devices that were discussed in this module in this semester.
2. Assign the devices to the layers of the hybrid reference model.

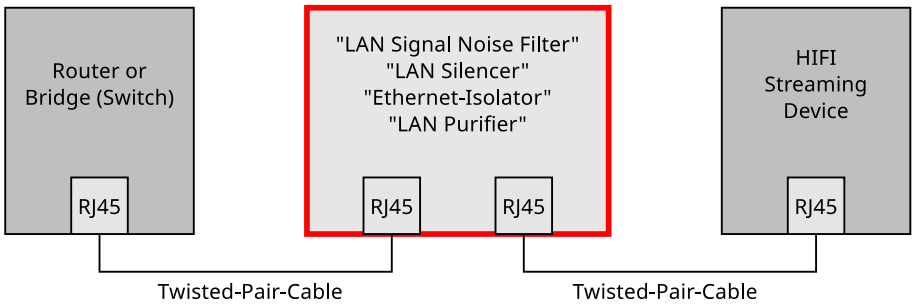
Exercise 5 (Devices in Computer Networks)

What network device(s) is (are) used to...

1. connect networks with different logical address ranges?
2. transmit signals over long distances by modulating them to a carrier frequency in the ultra low frequency band?
3. connect physical networks?
4. extend the range of LANs?
5. connect wireless network devices in the infrastructure mode?
6. enable communication between networks, which use different protocols?

Exercise 6 (A difficult decision)

Some vendors sell so-called „LAN Signal Noise Filters“ (sometimes called „Ethernet Filter“, „LAN Silencer“, „LAN Purifier“, or „Ethernet-Isolator“) that are supposed to remove Electrical interference (noise signals) from Ethernet connections (twisted-pair cables with RJ45 connectors) between a Router/Switch and a streaming device, aiming to improve the music quality in HIFI applications. The figure demonstrates the concept of using such a device.



1. Has such a device the potential to improve the music quality?

   ☐ yes ☐ no ☐ maybe

2. Explain your opinion on the effectiveness in detail.

Exercise 7 (Reference Models)

For the network devices, protocols, transmission units, line codes and addressing schemes in the table, mark the corresponding layer of the **hybrid reference model**.

1 stands for the bottom layer and 5 for the top layer in the hybrid reference model. If more than just <u>one</u> layer are a correct answer, it is sufficient to select at least a single correct layer.

	Hybrid reference model layer				
	1	2	3	4	5
4B5B					
Address Resolution Protocol (ARP)					
Alternate Mark Inversion (AMI)					
Autonomous Systems					
Border Gateway Protocol (BGP)					
Bridge					
Congestion control					
CSMA/CA					
CSMA/CD					
Cyclic Redundancy Check (CRC)					
Distance vector routing protocols					
Dynamic Host Configuration Protocol (DHCP)					
Ethernet					
File Transfer Protocol (FTP)					
Flow control					
Gateway					
Hub					
Hypertext Transfer Protocol (HTTP)					
ICMP					
Internet Protocol (IP)					
Link state routing protocols					
Logical addresses					
Manchester-Code					
Media access control					
Modem					
Multilevel Transmission Encoding - 3 Levels					
Multiport Bridge					
Non-Return to Zero					
Open Shortest Path First (OSPF)					
Physical addresses					
Port numbers					

	Hybrid reference model layer				
	1	2	3	4	5
Reliable end-to-end data connection					
Repeater					
Router					
Routing Information Protocol (RIP)					
Security					
Spanning Tree Protocol (STP)					
Switch					
Telnet					
Transmission Control Protocol (TCP)					
User Datagram Protocol (UDP)					
Wireless LAN					

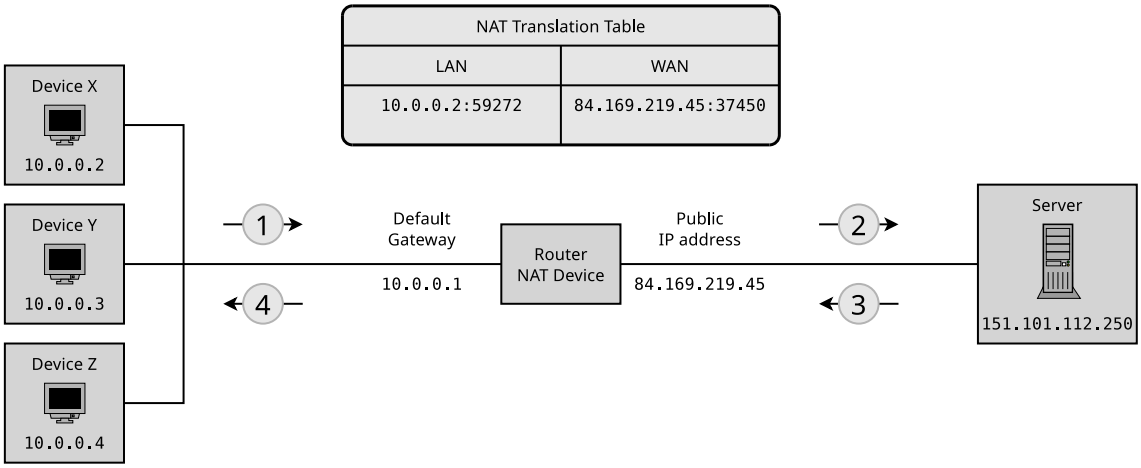
Exercise 8 (Protocols in Computer Networks)

Name the protocol that is used to...

1. provide congestion control and flow control.
2. resolve logical addresses into physical addresses.
3. avoid collisions inside physical networks.
4. provide routing within autonomous systems via the Bellman-Ford algorithm.
5. remote control computers in an encrypted way.
6. provide routing within autonomous systems via the Dijkstra algorithm.
7. assign the network configuration to network devices.
8. remote control computers in a unencrypted way.
9. realize connectionless inter-process communication.
10. resolve domain names into logical addresses.
11. detect collisions inside physical networks.
12. download and upload files in a unencrypted way.
13. exchange (deliver) emails.
14. exchange diagnostic and control messages.
15. reduce a computer network to a loop-free tree.

Exercise 9 (Network Address Translation – NAT)

Fill the missing IP addresses and port numbers into the figure that describes a NAT scenario where device X sends a request for a web page to a web server process that runs on the server and can be accessed via port number 80.



	Source		Destination
(Message 1)	___.___.___.___:_____	-->	___.___.___.___:_____
(Message 2)	___.___.___.___:_____	-->	___.___.___.___:_____
(Message 3)	___.___.___.___:_____	-->	___.___.___.___:_____
(Message 4)	___.___.___.___:_____	-->	___.___.___.___:_____