

1. What are the so called low and high watermarks of reception data buffers?  
They are indexes of input buffer that trigger sending respectively requests for start and stop data transmission.
2. Why PPP (Point-to-Point Protocol) is better than SLIP (Serial Line IP)?  
PPP allows for: connection diagnostic, transmission configuration, control flow, authentication
3. What is the difference between multimode and single mode fibers? The diameter of the fiber. The single mode fibers allow transmission on long distances, but they are more expensive.
4. Which Ethernet versions do work without frame collisions on transmission media? Anyone that is point-to-point full duplex, i.e.: all interfaces 10, 40, 100 Gb/s, most of 1 Gb/s, and some of 100 and 10 Mb/s
5. What is the aim of Spanning-Tree protocols in Ethernet networks? The aim is to break loops in the network, to avoid endless circulation of frames
6. Compare UDP with TCP regarding: connectivity, reliability, speed and data synchronization. UDP is connectionless, unreliable, fast, datagram protocol (the datagram carries a message, thus the message synchronization <discovery of the beginning and the end> is not needed). TCP is connection-oriented, reliable, relatively slow, providing byte stream transmission (thus synchronization of messages / data structures can be needed).
7. What are the advantages of EPON (Ethernet Passive Optical Network)? \* less fibers, \* less optical ports, \* no power supply for a splitter \* easier to manage, \* cheaper to maintain
8. How does Explicit Congestion Notification work on IP networks? A heavily loaded router, before congestion occurs, stamps IP packets with ECN bit. Than addressed computer gets to know that the path is overloaded and it is needed to reduce the transmitted volume of data. In the case of TCP connection, the announced receiver window size is reduced and appropriate flag bit is set in the TCP acknowledgement message that is sent back.
9. What kind of network service should be based on the iterative server schema? Such service that responds for a request with a short message, and a client sends the requests not frequently.
10. Why are there active and passive openings of TCP connection? A server uses passive opening to wait for a client request. The client uses active opening to fix a connection with the server.
11. What are the functions of an SNMP agent? It collects management information about its local environment, and stores control data as defined in the device's MIBs.

12. When a certificate revocation list is updated? Each time a valid private certificate is declared as lost or stolen.
13. What are the main functional difference between POP (Post Office Protocol) and IMAP (Internet Message Access Protocol)? Both are used by local e-mail clients to retrieve e-mail from a remote server. IMAP, unlike POP, allows multiple clients simultaneously connected to the same mailbox. Moreover IMAP allows managing mail folders on the remote server, so a user can access them from different devices. While POP just moves received emails to the local computer.
14. Describe Diffie-Hellman key exchange. The Diffie–Hellman key exchange method allows two parties that have no prior knowledge of each other to jointly establish a shared secret (the key), without sending it via the network. Next, the key can be used for symmetric cyphering. The method relies on the equality  $(gb)^a = (ga)^b$ , the value is the secret key. Via the network are sent:  $g$ ,  $ga$ , and  $gb$
15. What are main advantages of IPv6? Huge address space. No need to use network address translation. Perfect auto-configuration. Built in mobility mechanisms. Routers can work faster.
16. What is the operational principle of MPLS (Multiprotocol Label Switching)? 1) Every packet gets a label on a network border. 2) Label identifies destination point. 3) Internal nodes switch packet using the label. 4) Boarder router restore the original packet.
17. How can be done authentication in PPP (Point-to-Point Protocol)? Using: password exchange, challenge exchange, RADIUS, IPSec
18. Why do a preamble have to start a frame in CSMA and CSMA/CD (Carrier Sense Multiple Access / Collision Detection) protocols? There is no signal in the medium between frames transmitted via CSMA and CSMA/CD protocols. To correctly decode a signal to bits, the receiver clock must be synchronized with incoming signal. For this reason the preamble (a given bit sequence) is added to the start of protocol header.
19. Can one fiber be used to transmit and receive signals? Why? Yes, using two wavelengths.
20. What is the aim of VLANs (Virtual Local Area Network)? Configuration of separated LANs over one physical infrastructure, to raise efficiency and security of the network.
21. What is the reason that a minimal frame length has to be defined in a CSMA/CD protocol? To guarantee that every node in the network segment can hear a collision
22. Why do we need the silence after connection timer? What is the consequence of it when a network application is designed? To guarantee that no one IP packet from previous connection (delayed in a congested

router queue) arrive to the destination during the next connection; which would break reliability of TCP.

23. What are the standard Ethernet transmission speeds? 10 Mb/s, 100 Mb/s, 1 Gb/s, 10 Gb/s, 40 Gb/s, 100 Gb/s.
24. Mention at least 3 other (than UDP and TCP) transport layer protocols. What for do we use them? Real-time Transport Protocol – for multimedia streaming. Datagram Congestion Control Protocol – for fast transfer of datagrams respecting congestion fairness. Wireless Transmission Control Protocol – for efficient TCP connections over wireless links. UDP Lite – to allow a potentially damaged data payload to be delivered to an application rather than being discarded by the receiving station.
25. Can we use TCP for multicast transfer and why? We cannot. TCP support point-to-point double direction reliable data transfer.
26. What are important differences between versions of SNMP (Simple Network Management Protocol)? In ver.1: only one network administrator and no security. In ver. 2: support for many administrators (SNMP views and communities). In ver. 3: complex mechanisms for identification, privacy and control access, for many administrators.
27. How a stream cipher works? It operates on a digit (bit or byte) in the time of data transmission
28. What for HTTP (Hypertext Transfer Protocol) proxies are used? \* Faster response. \* Lower bandwidth consumption. \* Lower server load. \* Security control. \* Captive portal for network/internet access control. \* Different conversions of transported data.
29. What is it anycast address, and for what is it used (example of applications)? It is a group address of receiving nodes, and only one of the nodes is selected by the network for a packet delivery. These addresses are used e.g., by routing protocols and security applications.
30. What does public key infrastructure? Organizational and technical infrastructure for providing for third party vetting of, and vouching for, user identities. The infrastructure consists in Registration Center, Certification Center, and Public Repository.
31. What are main disadvantages of NAT (Network Address Translation)? Main Internet concept is broken – no peer-to-peer visibility disturbs many applications. NAT server is a bottleneck for network throughput. Battery save terminals cannot be placed behind a NAT. Disable integrity verification of IP headers (IPSec)
32. What are the advantages of MPLS (Multiprotocol Label Switching)? \* Well suited to service VPNs supporting Class of Services. \* Efficient traffic engineering mechanisms.

33. What is the principle of asynchronous serial communication? The transmitted signal carries only data and no clock for receiver synchronization.
34. Give an example of the SLIP (Serial Line IP) protocol usage. For temporal and local connection between two devices located in the same room.
35. What are the functions of Logical Link Control layer? \* common programming interface independent from different MAC protocols, \* data streams multiplexing, \* control flow for every Service Access Point, \* duplicated and lost frames treatment.
36. What are the distance ranges of Ethernet interfaces? e.g.: 15 m, 100 m, 300 m, 500 m, 10 km.
37. What is the principle of CSMA/CD mechanism? CSMA/CD means carrier sense multiple access with collision detection. A transmitter obtaining a frame to send senses the carrier (a medium), and if there is no signal it starts transmission. Next it senses the carrier to discover a collision. If there is no collision to the end of frame, a successful transmission is assumed. If a collision happens the transmission is interrupted and short Collision-Detected signal is transmitted. After silence detection a random delay is taken before a transmission attempt.
38. Can network switches prioritize Ethernet frames? Why? Yes, there is an Ethernet extension header which carries 3-bit priority field.
39. When TCP is a good choice for an application? When a reliable transfer is needed for big data chunks.
40. What for is the “urgent pointer” field of TCP PDU? For enabling transfer of interruption or urgent messages during a connection.
41. What is the purpose of the TCP live / inactivity timers? For discovering a connection lost.
42. Why SNMP ver.1 is widely used, even though it is unsecure? Because network owners often deploy a management network which is isolated from the users traffic and access. Moreover, if the SNMP default agent configuration allows for read-only-access, which cannot be harmful for the network.
43. What is the difference between Qualified Certificate and Nonqualified Certificate? A qualified certificate is issued by an approved authority.
44. What is the principle of synchronous serial communication? The transmitted signal carries data and clock for receiver synchronization.
45. Give an example of PPP (Point-to-Point Protocol) usage. Today the main PPP application is to create private networks over open Internet. In the past it was widely used for dial-up access to the Internet.

46. What data are carried by the LLC (Logical Link Control) header? The Source Service Access Point and the Destination Service Access Point fields allow recognizing the upper layer protocol that is processing the frame (thus data streams multiplexing). The control field allows for flow control and duplicated / lost frames treatment.
47. Does the full-duplex point-to-point Ethernet use the CSMA/CD mechanism? Why? No. There are separate mediums for each direction and only one transmitter on each medium in that case.
48. What is the reason for minimum length of Ethernet frame? The collision detection mechanism requires that the time of frame transmission is longer than time of signal propagation forward and backward via the full medium length. Otherwise a transmitter situated on the end of the medium could not detect a collision.
49. What are the pros for Industrial Ethernet deployment? \* increased transfer speed, \* increased distance range, \* ability to use standard Ethernet devices, \* cheaper deployment.
50. What for is the “window size” field of TCP PDU? This field tells how many bytes the transmitter is allowed to send in subsequent packets. It is used for flow control and congestion avoidance.
51. Why does the standard TCP configuration work inefficiently over radio links? For the reason that the standard TCP takes to mean every lost segment as result of a router congestion and slows down transmission speed.
52. What is a representation of an OBJECT IDENTIFIER (used by SNMP)? An ordered list of positive integers. The numbers from the list form a path in the name tree from the root to the object.
53. How authentication is performed using asymmetric ciphers? The sender uses its private key to cipher a message. The recipient deciphers the message using corresponding public key. Successful decipherment proves authenticity of the sender. A certificate containing the public key contains a description of the key owner and signature of the entity who vouches for the authenticity.