

**Department of Computer Science and Engineering
National Institute of Technology Hamirpur
Computer Networks (CSD-320)**

Home Assignment – 1

1. Survey network of some organization and perform the following tasks:
 - i. Sketch the schematic diagram of the network consisting of hubs, switches bridges, servers and various computers.
 - ii. Describe features of the server machine.
 - iii. List of applications running on the network with their brief description.
 - iv. Describe about the speed of the LAN and the protocols.
 - v. Describe the specification of cables.
 - vi. Describe the networking features of the server operating system.
 - vii. List and describe five examples of WAN application you have seen.

Department of Computer Science and Engineering
National Institute of Technology Hamirpur
Computer Networks (CSD-320)

Home Assignment – 2

1. An alternative to a LAN is simply a big timesharing system with terminals for all users. Give two advantages of a client-server system using a LAN over the timesharing system.
2. What is the principal difference between connectionless communication and connection-oriented communication?
3. What are two reasons for using layered protocols? List two advantages and two disadvantages of having international standards for network protocols.
4. What are differences between TCP and UDP?
5. A noiseless 4-kHz channel is sampled every 1 msec. What is the maximum data rate?
6. If a binary signal is sent over a 3-kHz channel whose signal-to-noise ratio is 20 dB, what is the maximum achievable data rate?
7. Consider the delay of pure ALOHA versus slotted ALOHA at low load. Which one is less? Explain your answer.
8. Sixteen stations are contending for the use of a shared channel using the adaptive tree walk protocol. If all the stations whose addresses are prime numbers suddenly become ready at once, how many bit slots are needed to resolve the contention?
9. Are there any circumstances when a virtual circuit service will (or at least should) deliver packets out of order? Explain.
10. ARP and RARP both map addresses from one space to another. In this respect, they are similar. However, their implementation is fundamentally different. In what major way do they differ?

Department of Computer Science and Engineering
National Institute of Technology Hamirpur
Computer Networks (CSD-320)
Home Assignment – 3

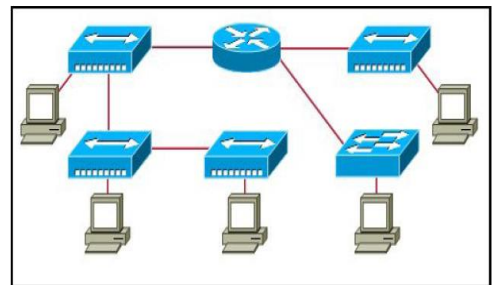
1. What are the common fast Ethernet implementations?
2. What are the advantages of dividing an Ethernet LAN with a bridge?
3. A bridge uses a filter table; a router uses a routing table. Can you explain the difference?
4. How can we distinguish multicast address in IPv4 addressing? How can we do so in IPv6 addressing?
5. An IPv4 fragment has arrived with an offset value of 100. How many bytes of data have already been sent by the source before the data in the fragment?
6. Explain the following application programs used in TCP/IP protocol suite:
 - i. DNS
 - ii. FTP
 - iii. TFTP

Department of Computer Science and Engineering
National Institute of Technology Hamirpur
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Home Assignment – 4

1. Suppose you are assigned the role of Network Coordinator of NIT Hamirpur which has been commissioned few years earlier. Critically analyze the campus wide network and answer the following:
 - i. What are different functionalities supported by the network?
 - ii. What are strong points of the network?
 - iii. What are the weak points of the network?
 - iv. Suppose you want the network to be upgraded to meet out the users requirements of data/voice/video throughout the campus. Propose new design.
 - v. In the proposed design, suggest backplane speed and number of ports (both fibre & copper) of different switches, OFC specs and UTP cable specs.

Department of Computer Science and Engineering
National Institute of Technology Hamirpur
Computer Networks (CSD-320)
Home Assignment - 5

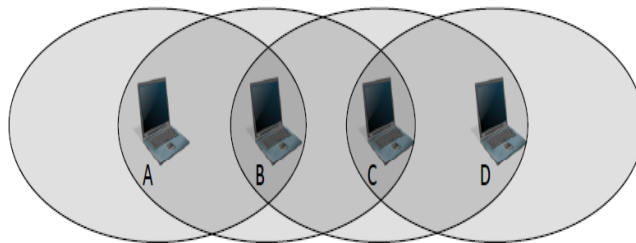
1. (a) What transport layer protocol (TCP or UDP) you would use if your application needed one of the properties: (i) speed (ii) long messages. Give one succinct reason for each.
(b) Suppose two Ethernet LANs are interconnected by a box that operates as follows. The box has a table that tells it the physical addresses of the machines in each LAN. The box listens to frame transmissions on each LAN. If a frame is destined to a station at the other LAN, the box retransmits the frame onto the other LAN, otherwise the box does nothing.
Is the resulting network still a LAN? Does it belong to the data link layer or the network layer? Explain.
2. (a) Consider a 100 meter 100 Mb/s Ethernet link transporting 1500 byte frames. What is the transmission delay for a frame? What is the approximate propagation delay of this link? Which delay dominates for this link? Assume that signal propagates about 1 foot in 1 nanosecond.
(b) What are ping and traceroute used for? Describe the output from each program.
3. (a) What is DNS and what is it used for? If all DNS servers could be crashed (or become offline), what would happen to the Internet?
(b) In the ARP protocol the ARP request is broadcast and the ARP response is unicast. What might the advantages and disadvantages be of broadcasting the ARP response?
4. (a) Why are IP addresses hierarchal with netid and hostid?
(b) You have been hired by a local company to set up a router that both serves as the network's bidirectional firewall and also NATs hosts in the corporate network. The corporate network consists of about 100000 machines that simultaneously access the Internet using port-based NAT. What problem could arise if the corporate network only has a single public IP address? Explain in detail.
5. (a) Give reasons that DNS lookups are run over UDP rather than TCP.
(b) Refer to the exhibit. Assume that all devices are using default configurations. How many subnets are required to address the topology shown? Explain.



Department of Computer Science and Engineering
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Computer Networks (CSD-320)

Home Assignment - 6

1. (a) A process on host 1 has been assigned port p, and a process on host 2 has been assigned port q. Is it possible for there to be two or more TCP connections between these two ports at the same time? Explain.
- (b) Present a location-aware mobile application, stressing the way location can be provided.
2. (a) Why is conventional routing in wired networks not suitable for wireless networks?
- (b) Consider the following IEEE 802.11 network.



The shaded oval around a node represent the communication and interference range of that node. Assume that nodes do not use RTS/CTS. For each of the following traffic patterns, indicate at which (if any) nodes can data frames be lost due to a collision? Explain.

- i. A sends data to B, C sends data to B.
 - ii. B sends data to A, C sends data to D.
3. (a) Why was IPv6 created? Describe two most significant changes of IPv6 compared to IPv4.
 - (b) Can collision detection be feasibly implemented for a wireless channel? Why or why not?
 4. (a) What does TCP do when it detects congestion? What problems may this cause in wireless networks?
 - (b) Suppose that a 100Mbps link is being set up between earth and a communication satellite at an altitude of 36,000 km. An image file of 20 MB should be transferred from station A to station B on earth. Assume the speed of light is 300,000,000 m/s. Calculate the minimum RTT for the link.
 5. (a) What does "reverse path forwarding" mean in IP multicast?
 - (b) A router is connected to the 202.33.44.128/25 subnet, using the address 202.33.44.129. It sends a multicast packets destined to all hosts on this network. What are the source and destination IP addresses of the packet?

Department of Computer Science and Engineering
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Computer Networks (CSD-320)

Home Assignment - 7

1. What is meant by the term “IP spoofing”? Provide an example of a countermeasure that can be used to help stop it.
2. Suppose that an interactive video game is accessed over a communication network. What requirements are imposed on the network if the network is connection-oriented? connectionless?
3. Two musicians located in different cities wish to have a jam session over a communications network. Find the maximum possible distance between the musicians if they are to interact in real-time, in the sense of experiencing the same delay in hearing each other as if they were 10 meters apart. The speed of sound is approximately 330 meters/second. Assume that the network transmits the sound at the speed of light in cable, 2.3×10^8 meters/second.
4. Suppose all laptops in a large city are to communicate using radio transmissions from a high antenna tower. Is the data link layer or network layer more appropriate for this situation?
5. What is VPN and why is it needed?
6. Compare and contrast the following multicast routing protocols:
 - (a) Flooding
 - (b) Spanning Trees
 - (c) Reverse Path Broadcasting (RPB)
 - (d) Truncated Reverse Path Broadcasting (TRPB)
 - (e) Reverse Path Multicasting (RPM)
 - (f) Core-Based Trees

Department of Computer Science and Engineering
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Computer Networks (CSD-320)
Home Assignment – 8

1. (a) Why may delay and jitter in an IP network be problems for real-time applications, such as VoIP?

 (b) Compute the effective data rate of a communication channel with signal to noise ratio of 30dB and bandwidth 5000 Hz.
2. (a) Why do IP packets carry a time-to-live (TTL) field? How do routers handle the TTL field when forwarding a datagram?

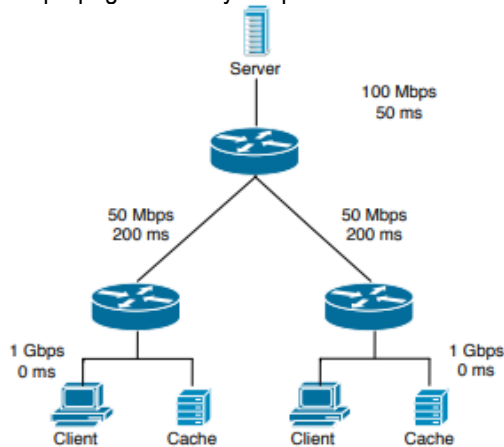
 (b) Explain the hidden terminal problem. How does the 802.11 protocol deal with the hidden terminal problem?
3. (a) Consider the following IP addresses in the context of classless addressing. Identify whether the following is a subnet/network address, broadcast IP address or a unicast IP address:
 i. 212.40.90.63 /26
 ii. 156.23.80.0 /20
4. (a) What is the major enhancement with DHCP compared to BOOTP?

 (b) The DNS service in the Internet is distributed by design. Alternatively, DNS could have a centralized design instead. List two disadvantages of a centralized design. Justify your answer.
5. (a) We know that www.google.com is a very popular web site and the many client requests cannot be handled by a single server but rather by a cluster of web servers (each having a different IP address). Describe the process that DNS offers for load balancing.

 (b) A diskless client requesting an IP address sends an IP packet to the limited broadcast address. What are the source and destination IP addresses of this packet?

Department of Computer Science and Engineering
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Computer Networks (CSD-320)
Home Assignment – 9

1. Suppose a computer is moved from one building to another within a campus. Does the physical address need to change? Does the IP address need to change?
2. Suppose a user has two browser applications active at the same time, and suppose that the two applications are accessing the same server to retrieve HTTP documents at the same time. How does the server tell the difference between the two applications?
3. What is ARP? How does a computer know whether an arriving frame contains an ARP message? In the ARP protocol the ARP request is broadcast and the ARP response is unicast. Why?
4. An IP subnet is specified by 220.1.1.0/24. What is the subnet address? What is the maximum number of nodes that can be located in this subnet? To what value would you change the subnet mask if a maximum of 20 nodes were located in this subnet?
5. Consider the scenario shown in following figure in which a server is connected to a router by a 100Mbps link with a 50ms propagation delay. Initially this router is also connected to two routers, each over a 50Mbps link with a 200ms propagation delay. A 1Gbps link connects a host and a cache (if present) to each of these routers and we assume that this link has 0 propagation delay. All packets in the network are 20,000 bits long.



- i. What is the end-to-end delay from when a packet is transmitted by the server to when it is received by the client? Assume that there are no caches, there is no queuing delay at the routers, and the packet processing delays at routers and nodes are all 0.
 - ii. Assume that client hosts send requests for files directly to the server (caches are not used). What is the maximum rate at which the server can deliver data to a single client if we assume no other clients are making requests?
6. Why is an IP datagram fragmented? Explain with suitable examples. An IP datagram carrying 10000 bytes of data must be sent over a link that has an MTU of 2468 bytes. How many fragments will be generated?

Department of Computer Science and Engineering
National Institute of Technology Hamirpur
Computer Networks (CSD-320)
Home Assignment – 10

1. What is the difference between congestion control and flow control?
2. What is the difference between the bit rate and baud rate of a signal?
3. Why does distance-vector routing scale better than link-state routing?
4. What is IP? Discuss the different classes of IP addressing? Explain classful and classless routing.
5. Explain distance vector routing algorithm. What are its advantages and disadvantages?
6. Explain functionalities of DHCP Server, Proxy Server, File server and Web Server.
7. Draw and Explain Three Way Handshake process of TCP.
8. Explain and compare all versions of IEEE 802.11 standard.
9. Explain VANET architecture. What are the challenges in vehicular network?