1. Which of the OSI layers handlers each of the following:
2. Dividing the transmitted bit stream into frames ⎯ Data Link Layer
3. Determining which route through the subnet to use ⎯ Network Layer
4. A system has a 7-layer protocol hierarchy. Applications generate messages of length 1000 bytes. At each of the layers, a 20 byte header is added. What fraction of the network bandwidth is filled with headers?

Except the application layer, the each layer below the application layer will add a 20 bytes header to the message, so totally there are 20×6 = 120 bytes control header will be added.

120 bytes/1000 bytes = 12%.

1. How long was a bit on the original 802.3 standard in meters? Use a transmission speed of 10 Mbps and assume the propagation speed in coax is 2/3 the speed of light in vacuum.

The propagation speed in coax is 2/3 the speed of light in vacuum 2/3 × 3 × 108 = 2 × 108 m/s.

The data rate is 10 × 106 bits/s.

So duration of one bit is 20 m.

1. A client-server system uses a satellite network, with the satellite at a height of 40000 km. What is the best-case delay in response to a request?

In this problem, the satellite plays a role of “router” between the client and the server. To complete a request from the client to server, firstly a request is sent from the client to the satellite, and then the satellite to the server; when the server receive the request, it sends back an answer to the satellite, and then from the satellite to the client. So, the total distance is 4×40000 km = 160 Mkm. Because here we use the light as the communication median, and the light speed is 3 × 108, do not consider any processing time and relay time, the best case delay is

160 × 106/ 3 × 108 = 533 msec.

1. An image is 1024 x 768 pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it over a 56-kbps modem channel? Over a 1-Mbps cable modem? Over a 10-Mbps Ethernet? Over 100-Mbps Ethernet? (round to three decimal place)

The size of the image is 1024 × 768 × 3 × 8 = 18874368 bits.

18874368 / 56 × 103 = 337.042 sec.

18874368 / 1 × 106 = 18.874 sec

18874368 / 10 × 106 = 1.887 sec

18874368 / 100 × 106 = 0.189 sec

1. A collection of five routers is to be connected in a point-to-point subnet. Between each pair of routers, the designers may put a high-speed line, a medium-speed line, a low-speed line, or no line. If it takes 100 ms of computer time to generate and inspect each topology, how long will it take to inspect all of them? (give your answer as xxx.xx)

If we name the five routers as A, B, C, D and E, so there are totally 10 different paths: AB, AC, AD, AE, BC, BD, BE, CD, CE,和DE. For each path, the designers have four choices (a high-speed line, a medium-speed line, a low-speed line, or no line), so the number of different topologies is 410 = 1048576. If it takes 100 ms of computer time to generate and inspect each topology, the total time to inspect all of them is 1048576 × 100 × 10−3 = 104857.6 sec > 29 hours.

1. Which of the following description about OSI layers is incorrect?
2. The physical layer is concerned with transmitting raw bits over a communication channel
3. The data link layer is a true end-to-end layer, all the way from the source to the destination √ only above the transportation layer is end-to-end layer
4. The network layer controls the operation of the subnet and determines how packets are routed from source to destination
5. The application layer contains a variety of protocols that are commonly needed by users
6. Which service model is connection-oriented service?
7. virtual circuit service √
8. acknowledged datagram service (a reliable connectionless scheme)
9. client-server service
10. datagram service
11. What is the name of PDU at the network layer of the OSI reference model?
12. Message
13. Frame
14. Packet √
15. Segment
16. Some network systems support transmission to a subset of the machines. This mode of operation is called:
17. flow control
18. congestion control
19. multicasting √
20. broadcasting