Problem

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Answer:

The request has to go up and down, and the response has to go up and down. The total path length traversed is thus 160,000 km. The speed of light in air and vacuum is 300,000 km/sec, so the propagation delay alone is 160,000/300,000 sec or about 533 msec.

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Answer:

With n layers and h bytes added per layer, the total number of header bytes per message is hn, so the space wasted on headers is hn. The total message size is M + nh, so the fraction of bandwidth wasted on headers is hn /(M + hn).

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?

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Answer:

- The image is 1024 × 768 × 3 bytes or 2,359,296 bytes. This is 18,874,368 bits. At 56,000 bits/sec, it takes about 337.042 sec. At 1,000,000 bits/sec, it takes about 18.874 sec. At 10,000,000 bits/sec, it takes about 1.887 sec. At 100,000,000 bits/sec, it takes about 0.189 sec.

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Answer:

No. of cables = n*(n-1)/2 = 15 cables

No. of devices connected per device= n-1=5

No. of ports per device = 5

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- **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.**
- Answer:

  The speed of light in coax is about 200,000 km/sec, which is 200 meters/μsec. At 10 Mbps, it takes 0.1 μsec to transmit a bit. Thus, the bit lasts 0.1 μsec in time, during which it propagates 20 meters. Thus, a bit is 20 meters long here.

- **A factor in the delay of a store-and-forward packet-switching system is how long it takes to store and forward a packet through a switch. If switching time is 10 μsec, is this likely to be a major factor in the response of a client-server system where the client is in New York and the server is in California? Assume the propagation speed in copper and fiber to be 2/3 the speed of light in vacuum.**

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Answer:

- No. The speed of propagation is 200,000 km/sec or 200 meters/µsec. In 10 µsec the signal travels 2 km. Thus, each switch adds the equivalent of 2 km of extra cable. If the client and server are separated by 5000 km, traversing even 50 switches adds only 100 km to the total path, which is only 2%. Thus, switching delay is not a major factor under these circumstances.

- 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?

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- Answer:

  Call the routers A, B, C, D, and E. There are ten potential lines: AB, AC, AD, AE, BC, BD, BE, CD, CE, and DE. Each of these has four possibilities (three speeds or no line), so the total number of topologies is 4 ^10 = 1,048,576. At 100 ms each, it takes 104,857.6 sec, or slightly more than 29 hours to inspect them all.