计算机网络原理 作业2

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Computer Networks, 5th Edition

第一章：1，3，4，9，10，11，12，15，20，33

1. Imagine that you have trained your St. Bernard, Bernie, to carry a box of three 8-mm tapes instead of a flask of brandy. (When your disk fills up, you consider that an emergency.) These tapes each contain 7 gigabytes. The dog can travel to your side wherever you may be, at 18 km/hour. For what range of distances does Bernie have a higher data rate than a transmission line whose data rate (excluding overhead) is 150 Mbps? How does your answer change if (i) Bernie’s speed is doubled; (ii) each tape capacity is doubled; (iii) the data rate of the transmission line is doubled.

【答】The dog can carry 21 gigabytes, or 168 gigabits, and with a speed of 18km/hour, or 0.005 km/sec. He can travel a distance of x km with the time t = x/0.005 = 200x sec, thus resulting in a data rate of 168/200x Gbps or 840/x Mbps. Thus, for 840/x Mbps > 150 Mbps, or x < 5.6 km, the dog has a higher rate of transmission than the communication line.

3. The performance of a client-server system is strongly influenced by two major network characteristics: the bandwidth of the network (that is, how many bit/sec it can transport) and the latency (that is, how many seconds it takes for the first bit to get from the client to the server). Give an example of a network that exhibits high-band width but also high latency. Then give an example of one that has both low bandwidth and low latency.

【答】A transcontinental fiber link may have high bandwidth, supporting many gigabits/sec, but long latency due to the large distance of travel. On the other hand, a modem calling a computer in the same building has low bandwidth and low latency.

4. Beside bandwidth and latency, what other parameter is needed to give a good characterization of the quality of service offered by a network used for (i) digitized voice traffic? (ii) video traffic? (iii) financial transaction traffic?

【答】 For digitalized voice traffic and video traffic, real-time and uniform delivery is important. For financial transaction, confidentiality, integrity, and authentication are extremely important.

9. A disadvantage of a broadcast subnet is the capacity wasted when multiple hosts attempt to access the channel at the same time. As a simplistic example, suppose that time is divided into discrete slots, which each of the n hosts attempting to use the channel with probability p during each slot. What fraction of the slots will be wasted due to collisions?

【答】When there is only one host attempting to connect to communication channel, the probability of each successfully attempting to use the channel without collision, time slot will not be wasted, is , (a binomial probability), those with a total of . When no hosts are using the communication channel, the channel is idle, with a probability of . Thus all other cases will result in collision, by subtracting the above two results from 1, we get the answer

10. What are two reasons for using layered protocols? What is one possible disadvantage of using layered protocols?

【答】By minimizing the amount of information that must be passed between layers, clear cut interfaces between layered protocols make it easier to replace a protocol on one layer with a completely different protocol or implementation. It is often common that different hosts may use different implementations of the same protocol. It also breaks down the network into several, more manageable design problems, thus promoting modularity, simplicity, maintainability, flexibility, scalability, and portability. One possible disadvantage of using it concerns the expansion of the network. One possible disadvantage is the overhead caused by the abstraction barriers between layers, thus resulting in lower throughput.

11. The president of the Specialty Paint Corp. gets the idea to work with a local beer brewer to produce …

【答】In the OSI model, physical communication takes place only in the lowest layer, not in every layer. If we assume the engineering layer is the lowest layer, the lawyers communicating would not follow the OSI model.

12. Two networks each provide reliable connection-oriented service. One of them offers reliable byte stream and the other offers a reliable message stream. Are these identical? If so, why is the distinction made? If not, give an example of how they differ?

【答】These are not exactly the same. In a message stream, the message boundaries are preserved. In a byte stream, those message boundaries are not preserved. For example, a message stream would be useful when sending pages of a book over a network as separate messages. On the other hand, downloading a DVD movie does not require message boundaries, a byte stream would be enough.

15. In some networks, the data link layer handles transmission errors by requesting that damaged frames be retransmitted. If the probability of the frame’s being damaged is p, what is the mean number of transmissions required to send a frame? Assume that acknowledgements are never lost.

【答】The probability, Pk, of a frame requiring exactly k transmissions, is equal to the probability of the first k – 1 attempts failing, p^{k-1} times the probability of the kth transmission succeeding, 1-p. Thus, the mean number of transmission is

20. When a file is transferred between two computers, two acknowledgement strategies are possible. … Discuss these two approaches.

【答】 The first, where the file is chopped up into packets which are individually acknowledged by the receiver, is more fit for a network that tends to lose packets, so that the packets can be retransmitted. It is also fit for networks that don’t require the whole file to be sent, such as a web site. The second acknowledgement strategy is more fit for a network that is highly reliable, sending one acknowledgement at the end of the entire transfer saves bandwidth. However, even if one packet fails, the whole file may be sent again. This may be more suitable for FTP.

33. The ping programs allows you to send a test packet to a given location and see how long it takes to get there and back. Try using ping to see how long it takes to get from your location to several known locations. From these data, plot the one-way transit time over the Internet as a function of distance

【答】

测试

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| --- | --- | --- | --- |
| Campus | Address | Average Time | Distance |
| Stanford University | stanford.edu | 183ms |  |
| UC Berkeley | berkley.edu | 309ms |  |
| MIT | mit.edu | 329ms |  |
| Michigan State University | msu.edu | 190ms |  |
| UCLA | ucla.edu | 182ms |  |

The distance information was obtained from Google Maps

第二章：1，3，4，5，9，20，25，37，38，39，40，48

1. Compute the Fourier coefficients for the function .

3. Television channels are 6 MHz wide. How many bits/sec can be sent if four-level digital signals are used? Assume a noiseless channel.

【答】Using the Nyquist theorem, we can sample 12 million times/sec. Four level signals provides 2 bits per sample, thus it can have a total data rate of 24 Mbps.

4. If a binary signal is sent over a 3kHz channel whose signal to noise ratio is 20dB, what is the maximum achievable data rate?

【答】A signal-to-noise ratio of 20db means that S/N is equal to 100. Since is about 6.658. The Shannon limit is about 19.975 kbps. The Nyquist limit is 6kbps. The bottleneck therefore is the Nyquist limit, giving a maximum channel data rate of 6 kbps.

5. What signal-to-noise ratio is needed to put a T1 carrier on a 50-kHz line?

【答】To send a T1 signal, we need with . This gives us , which is about 93 dB.

9. Is the Nyquist theorem for high-quality single-mode optical fiber or only for copper wire?

【答】Nyquist theorem has nothing to do with the material used, it is a mathematical property that states if we have a function whose Fourier spectrum does not contain any sines or cosines above f, by sampling the function at a frequency of 2f, we get to capture all the information of the original signal.

20. Is an oil pipeline a simplex system, a half-duplex system, a full-duplex system, or none of the above? What about a river or a walkie-talkie-style communication?

【答】It is a half-duple system. Oil can flow in either direction, but not both ways at once. A river is an example of a simplex connection, while a walkie-talkie, like the oil pipeline, is a half-duplex system.

25. Ten signals, each requiring 4000 Hz, are multiplexed onto a single channel using FDM. What is the minimum bandwidth required for the multiplexed channel? Assume that the guard bands are 400 Hz wide.

【答】There are 10 4000 Hz signals. We need nine guard bands to avoid any interference. The minimum bandwidth required is 4000 x 10 + 400 x 9 = 43,600 Hz

37. Three packet-switching networks each contain n nodes. The first network has a star topology with a central switch, the second is a (bidirectional) ring, and the third is a fully interconnected, with a wire from every node to every other node. What are the best, average, and worst-case transmission paths in hops?

【答】The star typology has a best case, average case, and worst case of 2. The Ring has a best case of 1, average case of n/4, and worst case of n/2. A full interconnect has a best case of 1, average case of 1, and worst case of 1.

38. Compare the delay in sending an x-bit message over a k-hop path in a circuit-switched network …

【答】With circuit switching, at t = s, the circuit is set up, at t = s + x/b the last bit is sent, and at t = s + x / b + kd, the message arrives. In packet switching, the last bit is sent at t = x/b. To get to the final destination, the last packet must be retransmitted k – 1 times by intermediate routers, with each retransmission taking p / b seconds, so the total delay of retransmission is x / b + (k – 1)p/b + kd. Thus, packet switching is faster if s > (k – 1) p / b. In addition to the faster transmission under these conditions, packet switching is preferable when fault-tolerant transmission in the presence of switch failures is desired.

39. Suppose that x bits of user data are to be transmitted over a k-hop path in a packet-switched network as a series of packets, each containing p data bits and h header bits, with x >> p + h. The bit rate of the lines is b bps and the propagation delay is negligible. What value of p minimizes the total delay?

【答】In order to minimize,

40. In a tpical mobile phone system with hexagonal cells, it is forbidden to reuse a frequency band in an adjacent cell. If 840 frequencies are available, how many can be used in a given cell?

【答】If each cell has 6 neighbors, only 3 unique cells are needed, thus 840/3, each cell can have 280 frequencies.