Homework Chapter 1

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1-1. Five routers are 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?

假设五个路由器分别为 ABCDE，则所有的连接可能为 AB、AC、AD、AE、BC、BD、BE、CD、CE、DE，共 10 个。每条线路有四种选择，则所有可能的拓扑共有 4^10 种，每种需要 100ms，则一共需要约 104857.6s 遍历。

1-2. What are two reasons for using layered protocols? What is one possible disadvantage of using layered protocols?

理由：①使用分层协议意味着各层相互独立，可以独立设计
②各层不会互相影响，一层的修改不会影响到其他层的功能

缺点：信息在传输时需要一层一层向下传再解包，途中会添加许多头文件，这会使传输速率变慢。

1-3. What is the principal difference between connectionless communication and connection-oriented communication? Give one example of a protocol that uses
(i) connectionless communication
(ii) connection-oriented communication

主要区别：无连接通讯可能会出现信息传递错位的情况，面向连接通讯则不会，面向连接通讯的发送接收保持一致。
(i)：数据库查询
(ii)：移动下载

1-4. In some networks, the data link layer handles transmission errors by requesting that damaged frames be retransmitted. If the probability of a frame's being damaged is p, what is the mean number of transmissions required to send a frame? Assume that acknowledgements are never lost.

因为一帧被损坏的概率为 p，则一帧无损坏到达接收方的概率为 1-p；

前 i-1 次都被损坏的概率为 $P_i = (1-p)p^{i-1}$

所以平均发送次数为：

$$E = \sum_{i=1}^{\infty} iP_i = \sum_{i=1}^{\infty} i(1-p)p^{i-1} = (1-p)\sum_{i=1}^{\infty} ip^{i-1} = (1-p)\frac{1}{(1-p)^2} = \frac{1}{1-p}$$

1-5. A system has an n-layer protocol hierarchy. Applications generate messages of length M bytes. At each of the layers, an h-byte header is added. What fraction of the network bandwidth is filled with headers?

报头总字节数：hn；so the fraction is $/frac{hn}{M+hn}$

1-6. What is the main difference between TCP and UDP?

TCP	**UDP**
面向连接的协议	无连接协议
顺序化	不顺序化
注重准确度和流量控制	注重即时交付

1-7. When a file is transferred between two computers, two acknowledgement strategies are possible. In the first one, the file is chopped up into packets, which are individually acknowledged by the receiver, but the file transfer as a whole is not acknowledged. In the second one, the packets are not acknowledged individually, but the entire file is acknowledged when it arrives. Discuss these two approaches.

第一种应该在网络情况不好的时候使用，此时需要逐个确认数据包的传输以保证数据的完整传输；第二种情况应该在网络情况好的情况下使用，此时只许确认整个文件的完整性，可以提高传输效率。

1-8. 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?
Over gigabit Ethernet?

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 18.87 sec.
At 100,000,000 bits/sec, it takes about 0.188 sec.
At 1,000,000,000 bits/sec, it takes about 0.0188 sec.

1-9. Suppose the algorithms used to implement the operations at layer k is changed. How does this impact operations at layers k − 1 and k + 1?

层改变但是接口并未改变，所以无影响。

1-10. Suppose there is a change in the service (set of operations) provided by layer k. How does this impact services at layers k-1 and k+1?

对 k-1 层无影响，但 k+1 层的服务应该会被修改。