[简答题]

Chapter 2 SECTION 2.1 R1. List five nonproprietary Internet applications and the application-layer protocols that they use.

[参考答案]

Web 应用：HTTP 协议。
文件传输：FTP 协议。
远程登录：Telnet 协议。
电子邮件：SMTP 协议。
BitTorrent 文件共享：BitTorrent 协议。

[简答题]

Chapter 2 SECTION 2.1 R2. What is the difference between network architecture and application architecture?

[参考答案]

网络架构是指将通信过程组织成层(例如，五层互联网架构)。而应用程序架构是由应用程序开发人员设计的，并规定了应用程序的广泛结构(例如，C-S 或 P2P)。

[简答题]

Chapter 2 SECTION 2.1 R5. What information is used by a process running on one host to identify a process running on another host?

[参考答案]

需要使用的信息有目标主机的 IP 地址和目标进程的端口号。

[简答题]

Chapter 2 SECTION 2.1 R6. Suppose you wanted to do a transaction from a remote client to a server as fast as possible. Would you use UDP or TCP? Why?

[参考答案]

使用 UDP。因为使用 UDP 不需要建立连接，也没有速率控制，客户端的数据包可以按照应用层的发送速率发送到服务器。如果使用 TCP，则需要建立连接，而且 TCP 会根据网络状态自适应调整速率。

[简答题]

Chapter 2 SECTION 2.2-2.5 R11. Why do HTTP, SMTP, and IMAP run on top of TCP rather than on UDP?

[参考答案]

使用 HTTP、SMTP、IMAP 协议网络应用要求接收端收到的数据可靠，即无丢包、无差错、无乱序，对延迟的要求不高。TCP 提供面向连接的可靠数据传输服务；而 UDP 是无连接的，

不能保证数据传输的可靠性，因此这些应用层协议都使用 TCP。

[简答题]

Chapter 2 SECTION 2.2-2.5 R16. Suppose Alice, with a Web-based e-mail account (such as Hotmail or Gmail), sends a message to Bob, who accesses his mail from his mail server using IMAP. Discuss how the message gets from Alice's host to Bob's host. Be sure to list the series of application-layer protocols that are used to move the message between the two hosts.

[参考答案]

消息首先通过 HTTP 从 Alice 的主机发送到她的邮件服务器，邮件放置到消息队列里。随后 SMTP 客户端打开与 Bob 邮件服务器的 TCP 连接，然后 SMTP 通过 TCP 连接将 Alice 的消息发送给 Bob 的邮件服务器。最后 Bob 通过 IMAP 协议将消息从他的邮件服务器下载到他的主机。

[简答题]

Chapter 2 P6. Obtain the HTTP/1.1 specification (RFC 2616). Answer the following questions:

a. Explain the mechanism used for signaling between the client and server to indicate that a persistent connection is being closed. Can the client, the server, or both signal the close of a connection?

b. What encryption services are provided by HTTP?

c. Can a client open three or more simultaneous connections with a given server?

d. Either a server or a client may close a transport connection between them if either one detects the connection has been idle for some time. Is it possible that one side starts closing a connection while the other side is transmitting data via this connection? Explain.

[参考答案]

a）在 RFC 2616 中，客户机或服务器都可以向另一方发送指示告知将关闭持久连接。是使用在 http 请求/应答包含 connection：close 的头部字段中来实现的。

b） HTTP 不提供任何加密服务。

c）在 RFC 2616 中，使用持久连接的客户机会限制它们与给定服务器同时连接的数量。单个用户客户端与任何服务器或代理服务器的连接不应超过 2 个。

d）连接可能会因为长时间空闲而关闭。客户端可能在服务器决定关闭空闲连接的同时开始发送新请求。从服务器的角度看，连接正在关闭；但从客户端的角度看，请求正在进行中。

[简答题]

Chapter 2 P15. What is the difference between MAIL FROM : in SMTP and From : in the mail message itself?

[参考答案]

MAIL FROM：在 SMTP 中是来自 SMTP 客户端的交互消息，该消息可以标识邮件发送者的的地址。

该邮件本身的发送端:不是 SMTP 消息，是 header lines 中的一部分，属于邮件内容。

[简答题]

Chapter 2 P7. Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP

address from DNS; the successive visits incur an RTT of RTT1,. . .,RTTn. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT0 denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object?

[参考答案]

由题意可知，客户端经过 DNS 查找到包含该网页的服务器 IP 地址使用的时间是：

$$RTT_1 + RTT_2 + \cdots + RTT_n$$

当客户端获取了该 IP 地址之后，要花费一个 RTT0 来建立 TCP 连接。最后进行文件请求和答复，也需要一个 RTT0，故总时长为：

$$2RTT_o + RTT_1 + RTT_2 + \cdots + RTT_n$$

[简答题]

Chapter 2 P8. Referring to Problem P7, suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with

a. Non-persistent HTTP with no parallel TCP connections?

b. Non-persistent HTTP with the browser configured for 6 parallel connections?

c. Persistent HTTP?

[参考答案]

参考 P7，查找到包含该 IP 地址使用的时间是：RTT1+・・・+RTTn。HTML 文件和 objects 长度短，因此文件传输时间可以忽略不计。

a） 非持续 HTTP，一个 TCP 连接。则 HTML 文件和每个 object 都需要 1 个 RTT 建立 TCP 连接，和 1 个 RTT 请求文件传输。所以总时间为：

$$RTT_1 + \cdots + RTT_n + 2RTT_o + 8 \cdot 2RTT_o = 18RTT_o + RTT_1 + \cdots + RTT_n$$ 。

b） 非持续 HTTP，同时开启 6 个 TCP 连接。则 HTML 文件传输到客户端后，其中所含的 8 个 objects 可以每 6 个一批并行传输，因此分成两批传输：第 1 批并行传 6 个 objects，第 2 批并行传 2 个 objects。其中 HTML 的传输时间为 2 RTT_0，每批并行传输各需要 2RTT_0，所以总时间为：

$$RTT_1 + \cdots + RTT_n + 2RTT_o + 2 \cdot 2RTT_o = 6RTT_o + RTT_1 + \cdots + RTT_n$$ 。

c） 采用并行的持久 HTTP，建立 TCP 连接需要 RTT_0，请求 HTML 文件需要 RTT_0，请求 8 个 objects 共需要 RTT_0。所以，

总时间 $= 3RTT_o + RTT_1 + \cdots + RTT_n$ 。

d) 如果采用串行的持久 HTTP，则传输 HTML 文件需要 2 RTT_0，8 个 objects 都各需要 RTT_0。所以，

总时间= $RTT_1 + \cdots + RTT_n + 2RTT_o + 8RTT_o = 10RTT_o + RTT_1 + \cdots + RTT_n$ 。

[简答题]

Chapter 2 P22. Consider distributing a file of F=20 Gbits to N peers. The server has an upload rate of us=30 Mbps, and each peer has a download rate of di=2 Mbps and an upload rate of u. For N=10, 100, and 1,000 and u=300 Kbps, 700 Kbps, and 2 Mbps, prepare a chart giving the minimum distribution time for each of the combinations of N and u for both client-server distribution and P2P distribution.

[参考答案]

client-server 分发模式所需要的最小分发时间为： $D_{c-s} \geq \max\{NF/u_s, F/d_{min}\}$；

而 P2P 分发模式的最小分发时间为： $D_{P2P} \geq \max\{F/u_s, F/d_{min}, NF/(u_s + \sum u_i)\}$；

在本题中，文件大小 F=20Gbit，服务器上传速率 us=30Mbps，d_{min}=2Mbps，代入计算得：

client-server distribution：

		N		
		10	100	1000
u	300 Kbps	10240s	68266.667s	682666.667s
	700 Kbps	10240s	68266.667s	682666.667s
	2 Mbps	10240s	68266.667s	682666.667s

P2P distribution：

		N		
		10	100	1000
u	300 Kbps	10240s	34538.076s	63411.708s
	700 Kbps	10240s	20821.604s	28699.803s
	2 Mbps	10240s	10240s	10240s

[简答题]

Chapter 2 P23. Consider distributing a file of F bits to N peers using a client-server architecture. Assume a fluid model where the server can simultaneously transmit to multiple peers, transmitting to each peer at different rates, as long as the combined rate does not exceed us.

a. Suppose that $u_s/N \leq d_{min}$. Specify a distribution scheme that has a distribution time of NF/u_s.

b. Suppose that $u_s/N \geq d_{min}$. Specify a distribution scheme that has a distribution time of F/d_{min}.

c. Conclude that the minimum distribution time is in general given by max{ NF/u_s, F/d_{min}}.

[参考答案]

分发方案 a：服务器以u_s/N的速率并行地将文件发送给每一个客户端，因为$u_s/N \leq d_{min}$，因此每个客户端可以以u_s/N的速率接收文件，故每个客户端接收整个文件的时间是$F/(u_s/N) = NF/u_s$.。总体分发时间也就是NF/u_s。

分发方案 b：服务器以d_{min}的速率并行地将文件发送到每个客户端，此时总速率为$N * d_{min} \leq u_s$。每个客户机接收整个文件的时间是 F/d_{min}。总体分发时间也就是 F/d_{min}。

c：由 a 可知：当$u_s/N \leq d_{min}$时，只有服务器以u_s/N的速率发送给每个客户端时，$D_{c-s} = NF/u_s$。而其余情况下总有客户端的接收速率小于u_s/N，也即$D_{c-s} \geq NF/u_s$.；同理可由 b 知当$u_s/N \geq d_{min}$时，$D_{c-s} \geq F/d_{min}$。故最小 distribution time 总从 max{NF/u_s, F/d_{min}}中得到。