计算机网络作业 第四章

09021227 金桥

2023 年 12 月 22 日

1. R17. 假定主机 A 向主机 B 发送封装在一个 IP 数据报中的 TCP 报文段. 当主机 B 接受到该数据报时, 主机 B 中的网络层怎样知道它应当将该报文段 (即数据报的有效载荷) 交给 TCP 而不是 UDP 或某个其他东西呢?

通过 IP 数据报的协议字段来区分是交给 TCP 还是 UDP. 例如，值为 6 时交给 TCP, 值为 17 时交给 UDP.

2. R18. 在 IP 首部中, 哪个字段能用来确保一个分组的转发不超过 N 台路由器.

寿命 (Time-To-Live).

3. R19. 前面讲过因特网检验和被用于运输层报文段以及网络层数据报. 现在考虑一个运输层报文段封装在一个 IP 数据报中. 在报文段首部和数据报首部中的检验和要遍及 IP 数据报中的任何共同字节进行计算吗?

不需要。因为 IP 数据报的首部校验和字段只计算 IP 数据报的首部校验和，与运输层报文无关。

4. P2. 假设两个分组在完全相同的时刻到达一台路由器的两个不同输入端口。同时假设在该路由器中没有其他分组。

a. 假设这两个分组朝着两个不同的输入端口转发。当交换结构使用一条共享总线时，这两个分组可能在相同时刻通过该交换结构转发吗?

不可能。共享总线同一时间只能传输一个分组。

b. 假设这两个分组朝着两个不同的输出端口转发。当交换结构使用经内存交换时，这两个分组可能在相同时刻通过该交换结构转发吗?

不可能。因为经过共享系统总线一次仅能执行一个内存读/写。

c. 假设这两个分组朝着相同的输出端口转发。当交换结构使用纵横式时，这两个分组可能在相同时刻通过该交换结构转发吗?

不可能。因为这会导致同时有两个分组从一个输出端口转发，而这是不可能的。

5. P8. 考虑互联 3 个子网（子网 1，子网 2 和子网 3）的一台路由器：假定这 3 个子网的所有接口要求具有前缀 223.1.17/24。还假定子网 1 要求支持多达 60 个接口，子网 2 要求支持多达 90 个接口，子网 3 要求支持多达 12 个接口。提供三个满足这些限制的网络地址（形式为 a.b.e.d/x）。

分别是：

- 223.1.17.0/26
- 223.1.17.128/25
- 223.1.17.64/28

7. P14. 考虑向具有 700 字节 MTU 的一条链路发送一个 2400 字节的数据报。假定初始数据报标有标识号 422。将会生成多少个分片？在生成相关分片的数据报中各个字段的值是多少？

分片数量为 $\lceil \frac{2400-20}{700-20} \rceil = 4$.

- 对于每个分片，标识字段均为 422.
- 除了最后一个分片，其他分片的数据报长度字段均为 700. 最后一个分片的数据报长度字段为 360.
- 四个分片的偏移字段分别为 0, 85, 170, 255.
- 前三个分片的标志字段为 1，最后一个分片的标志字段为 0.

8. P15. Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 5 million bytes? Explain how you computed your answer.

假设使用 TCP 传输。每个 TCP 报文段需要 20 字节的首部，每个 IP 数据报可以携带 $1500-40=1460$ 字节的数据。

因此，需要的数据报数量为 $\lceil \frac{5\times 10^6}{1460} \rceil = 3425$ 个。

9. P16. Consider the network setup in Figure 4.25 . Suppose that the ISP instead assigns the router the address 24.34.112.235 and that the network address of the home network is 192.168.1/24.

a. Assign addresses to all interfaces in the home network.

三台主机: 192.168.1.1, 192.168.1.2, 192.168.1.3.

路由器接口：192.168.1.4

b. Suppose each host has two ongoing TCP connections, all to port 80 at host 128.119.40.86. Provide the six corresponding entries in the NAT translation table.

WAN 端	LAN 端
24.34.112.235, 4000	192.168.1.1, 3345
24.34.112.235, 4001	192.168.1.1, 3346
24.34.112.235, 4002	192.168.1.2, 3345
24.34.112.235, 4003	192.168.1.2, 3346
24.34.112.235, 4004	192.168.1.3, 3345
24.34.112.235, 4005	192.168.1.3, 3346

复习第三章

P40. Consider Figure 3.61. Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

a. Identify the intervals of time when TCP slow start is operating.

$[1, 6]$ and $[23, 26]$

b. Identify the intervals of time when TCP congestion avoidance is operating.

$[6, 16]$ and $[17, 22]$

c. After the 16^{th} transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

Triple duplicate ACK. Otherwise, the congestion window size would have dropped to 1.

d. After the 22^{nd} transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

Timeout. Because the congestion window size has dropped to 1.

e. What is the initial value of ssthresh at the first transmission round?

32. Because at this window size the slow start stops and congestion avoidance begins.

f. What is the value of *ssthresh* at the 18^{th} transmission round?

21. When the loss is detected during transmission round 16, the congestion window size is 42, and the threshold is set to half when packet loss is detected. Therefore, the value is 21.

g. What is the value of *ssthresh* at the 24^{th} transmission round?

14. When the loss is detected during transmission round 22, the congestion window size is 29, and the threshold is set to half when packet loss is detected. Therefore, the value is $\lfloor 14.5 \rfloor = 14$.

h. During what transmission round is the 70^{th} segment sent?

7^{th}. Because:

- In 1^{st} transmission round, packet 1 is sent.
- In 2^{nd} transmission round, packet 2-3 is sent.
- In 3^{rd} transmission round, packet 4-7 is sent.
- In 4^{th} transmission round, packet 8-15 is sent.
- In 5^{th} transmission round, packet 16-31 is sent.
- In 6^{th} transmission round, packet 32-63 is sent.
- In 7^{th} transmission round, packet 64-96 is sent.

i. Assuming a packet loss is detected after the 26^{th} round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of *ssthresh*?

The new value of the congestion window size will be 7 and *sshthres* will be 4. This is because the threshold will be set to half the congestion window when the loss occurred and congestion window will be set to the new threshold value + 3MSS.

j. Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 16^{th} round. What are the *ssthresh* and the congestion window size at the 19^{th} round?

The *sshthres* is 21 and congestion window size is 1.

k. Again suppose TCP Tahoe is used, and there is a timeout event at 22^{nd} round. How many packets have been sent out from 17^{th} round till 22^{nd} round, inclusive?

52. Because:

- Round 17: 1 packet.
- Round 18: 2 packets.
- Round 19: 4 packets.
- Round 20: 8 packets.
- Round 21: 16 packets.
- Round 22: 21 packets.