

```
telnet whu.edu.cn 25
Trying 202.114.64.84...
Connected to whu.edu.cn.
Escape character is '^]'.
220 whu.edu.cn Anti-spam GT for Coremail System (whu[20171226])
hello,world
502 Error: command not implemented
exit
502 Error: command not implemented
quit
221 Bye
Connection closed by foreign host.
```

P7 获得 IP 地址的时间: $RTT_1 + RTT_2 + \dots + RTT_n$

主机与服务器建立 TCP 连接的耗时: RTT

请求和服务器一个对象的耗时: RTT_0

总耗时: $2RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n$

P8 a. $8 \times 2RTT_0 + 2RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n$

$$= 18RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n$$

b. $2 \times 2RTT_0 + 2RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n$

$$= 6RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n$$

c. $RTT_0 + 2RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n$

$$= 3RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n$$

P9 a. $\Delta = \frac{4}{R} = \frac{850,000}{15,000,000} = 0.0567 (s)$

$$\frac{0}{1-0.9} = \frac{0.0567}{1 - 0.0567 \times 1.6} = \frac{0.0567}{0.09} = 0.63 (s)$$

$$0.63 + 3 = 3.63 (s)$$

b. $0.0567 / (1 - 0.6 \times 0.9) = \frac{0.0567}{0.458} = 0.124 (s)$

$$0.4 \times 0 + 0.6 \times 3.63 = 1.87 (s)$$

P10 传播延迟 $T_p = \frac{10m}{3 \times 10^8 m/s} = 3.3 \times 10^{-8} (s)$

初始下载对象: $200/150 + T_p + 200/150 + T_p + 200/150 + T_p + 100,000/150 + T_p$

105 引用对象: $200/15 + T_p + 200/15 + T_p + 200/15 + T_p + 100,000/15 + T_p$

$$T_{\text{非持续}} = 44 + 7333 + 8T_p = 7377 + 8T_p$$

$$T_{\text{持续}} = 4 + 4T_p + 666.67 + 10 \times (200/150 + T_p + 100,000/150 + T_p)$$

$$= 24T_p + 17.33 + 7333.33 \approx 7351 + 24T_p$$

T_p 特别小, 可忽略, 所以持续 HTTP 比非持续 HTTP 有很大增益

P11 a. 能, 因为 Bob 能同时建立多个连接, 他可以获得较大的链路带宽份额。

b. Bob 的并行连接仍有好处, 否则他获得的带宽将少于其它用户