

$$P_{15} \quad t_1 = \frac{1500 \cdot 8}{10^5} = 0.012 \text{ ms}$$

由題 $0.98 = \frac{0.012n}{30 + 0.012}$ 得 $n = 2451$

P₃₁

$$\text{由題 } 0.98 = \frac{0.012n}{30+0.01n} \quad \text{得 } n = 2451$$

P₃₁

$$\text{DevRTT} = (1-\beta) \cdot \text{DevRTT} + \beta \cdot |\text{Sample} - \bar{\text{Est}}|$$

$$\bar{\text{EstRTT}} = (1-\alpha) \cdot \bar{\text{EstRTT}} + \alpha \cdot \text{Sample}$$

$$\therefore \textcircled{1} 106\text{ms: Dev} = 0.75 \times 5 + 0.25 \times 6 = 5.25\text{ms}$$

$$\bar{\text{Est}} = 0.875 \times 100 + 0.125 \times 106 = 100.75\text{ms}$$

$$\text{TI} = 100.75 + 4 \times 5.25 = 124.75\text{ms}$$

$$\textcircled{2} 120\text{ms: Dev} = 0.75 \times 5.25 + 0.25 \times (120 - 100.75) = 8.75\text{ms}$$

$$\bar{\text{Est}} = 0.875 \times 100.75 + 0.125 \times 120 = 103.16\text{ms}$$

$$\text{TI} = 103.16 + 4 \times 8.75 = 138.16\text{ms}$$

$$\text{同理得} \quad \textcircled{3} 140\text{ms} \left\{ \begin{array}{l} \text{Dev: } 15.77\text{ms} \\ \bar{\text{Est: }} 107.76\text{ms} \\ \text{TI: } 170.84\text{ms} \end{array} \right. \quad \textcircled{4} 50\text{ms} \left\{ \begin{array}{l} \text{Dev: } 16.27\text{ms} \\ \bar{\text{Est: }} 105.54\text{ms} \\ \text{TI: } 170.62\text{ms} \end{array} \right.$$

$$\textcircled{5} 115\text{ms} \left\{ \begin{array}{l} \text{Dev: } 14.57\text{ms} \\ \bar{\text{Est: }} 106.72\text{ms} \\ \text{TI: } 165\text{ms} \end{array} \right.$$

P₄₀.

传输轮回

- (a) TCP在区间[1, 6] ∪ [23, 26] 慢启动
- (b) 在[6, 16] ∪ [17, 22] 拥塞避免运行
- (c) 见余ACK(因为没降到1)
- (d) 超时(因为窗口长度回到1)

P₄₄ (a) 往返时间恒定

$$\therefore \Delta ns = 12 - 6 = 6 RTT s$$

(b) 到 T = 6RTT , cwnd = 11 MSS

$$\begin{aligned}\therefore avg &= \frac{1}{6}(6+7+8+9+10+11) \\ &= 8.5 \text{ MSS/RTT}\end{aligned}$$