

1.
  - a. Unreachable(Type 3), Time Exceeded(Type 11)
  - b. A mapping from ip to mac address
  - c. TTL, Checksum. If df is zero, MF and Fragmentation may change.
  - d. To merge different entry in the route table with same prefix and same destination into one entry.

By mergeing, the route table can shrink.

16.17.24.0/24

2.

$$a. R_{s1} = 340 - 220 = 120$$

$$R_{s2} = X$$

$$R_{s3} = 400 - 240 = 160$$

$$R_{s4} = 450 - 250 = 200$$

$$RTT_{t5} = \frac{3}{4} \times 50 + \frac{1}{4} \times |160 - 120| = 47.5$$

$$SRTT_{t5} = \frac{7}{8} \times 160 + \frac{1}{8} \times 120 = 140 + 15 = 155$$

$$RTT_{t6} = \frac{3}{4} \times 47.5 + \frac{1}{4} \times |155 - 160| = 36.875$$

$$SRTT_{t6} = \frac{7}{8} \times 155 + \frac{1}{8} \times 160 = 155.625$$

$$b. RTOS_5 = 155 + 4 \times 47.5 = 345$$

$$RTOS_6 = 155.625 + 4 \times 36.875 = 303.125$$

Table 1: The flow number, arrival time, packet length (byte), virtual finish time, packet output order and departure time for each of packets A, B, ...and H arriving at input queues for service.

Packet	Flow No.	Arrival time (sec)	Length (Bytes)	Virtual finish time (sec)	Output order	Departure time
A	1 <b>600</b>	0	2400 <b>4</b>	4	1	2
B	2 <b>400</b>	1	3000 <b>1.5</b>	8.5	3	5.5
C	3 <b>200</b>	1.5	1200 <b>6</b>	7.5	2	3
D	2 <b>600</b>	3.5	2400 <b>6</b>	$x_1$ <b>14.5</b>	$y_1$ <b>7</b>	$z_1$ <b>12</b>
E	3 <b>200</b>	4	1200 <b>6</b>	$x_2$ <b>13.5</b>	$y_2$ <b>6</b>	$z_2$ <b>10</b>
F	1 <b>600</b>	5	2400 <b>4</b>	$x_3$ <b>9</b>	$y_3$ <b>4</b>	$z_3$ <b>11.5</b>
G	3 <b>200</b>	6	1200 <b>6</b>	$x_4$ <b>19.5</b>	$y_4$ <b>8</b>	$z_4$ <b>13</b>
H	1 <b>600</b>	7	1800 <b>3</b>	$x_5$ <b>12</b>	$y_5$ <b>5</b>	$z_5$ <b>9</b>

4. a.  $\frac{10 \times 10^6 \times 168 \times 10^{-3}}{8 \times 1200} = 175$

b. 1.  $\frac{1 + \frac{1}{2}}{2} = 0.75$ ,  $0.75 \times 175 = 131.25$ , 2.  $\frac{131.25 \times 1200 \times 8}{168 \times 10^{-3}} = 7500000bp$

c.  $\frac{175}{2} \times 168 \times 10^{-3} = 14.7sec$

5. 0:  $2^6 = 64$ , 1:  $2^5 = 32$ , 2:  $2^5 = 32$ , 3.  $2^8 - 64 - 32 - 32 = 128$

6.

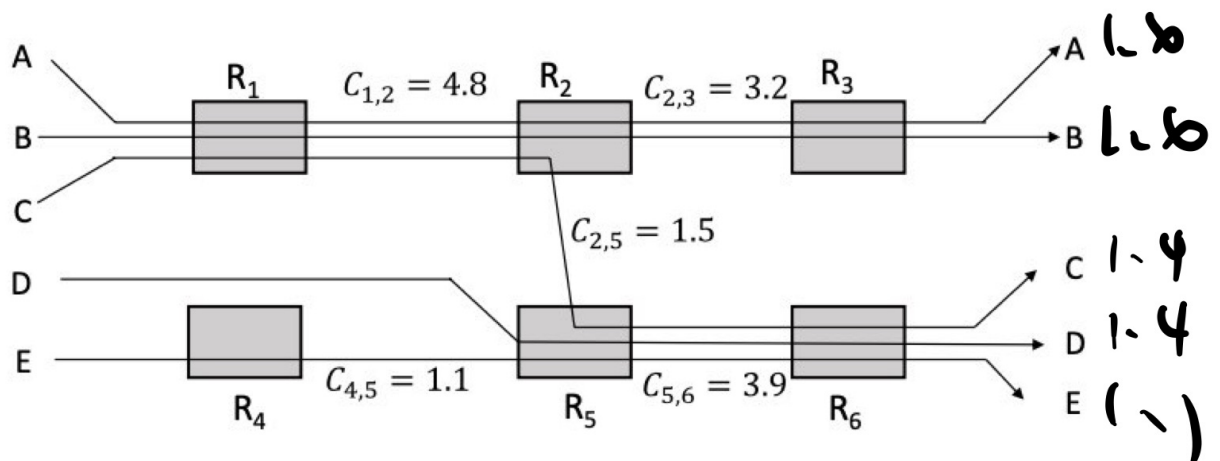


Figure 3: Max-min bandwidth allocation for five flows

7. a. Iterative代表local會做每次的過程，要是現在的query沒有拿到結果或者產生錯誤，那會由本機繼續做下去

Recursive代表當我發送DNS請求的時候，我不經手中間的過程，要是中間沒拿到結果就由DNS Server繼續幫我Query下去,只拿到結果

b. 可以，可以用多個A紀錄，對應到的每個不同IP做Round Robin輪詢

c. how: Fast retransmission 代表當timeout產生的時候，會把threshold減半，window size初始化，當碰到threshold就線性成長

Why: 由於初始化，便不再congestion, 由於碰到threshold之後就會線性成長，因此就可以精確找到congestion的點

d. 1, 2, 4, 8, 10, 11, 12

e. URGENT packet and probe packet from persistent timer