Soluzione Esame 16-06-2021

```
matricola =  879236
variabili =  ['8', '7', '9', '2', '3', '6']
x       y       z       u       v       w
8       7       9       2       3       6
```

DATI:

$R1 = 7.0\ \frac{\text{Mbit}}{\text{s}} = 7.00 \times 10^{6}\ \frac{\text{bit}}{\text{s}}$

$R2 = 16.0\ \frac{\text{Mbit}}{\text{s}} = 1.60 \times 10^{7}\ \frac{\text{bit}}{\text{s}}$

$R3 = 6.0\ \frac{\text{Mbit}}{\text{s}} = 6.00 \times 10^{6}\ \frac{\text{bit}}{\text{s}}$

$D1 = 1600\ \text{m} = 1.60 \times 10^{3}\ \text{m}$

$D2 = 63\ \text{km} = 6.30 \times 10^{4}\ \text{m}$

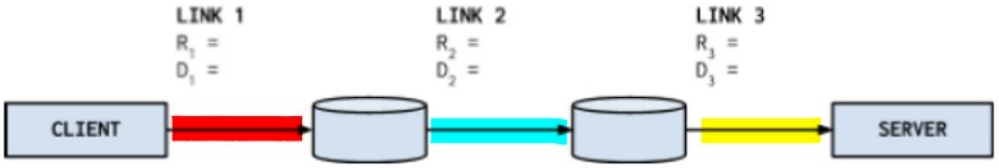
$D3 = 450\ \text{m} = 4.50 \times 10^{2}\ \text{m}$

$L = 1.8\ \text{kB} = 1.44 \times 10^{4}\ \text{bit}$

$Q = 9$

$d_{elab} = 6\ \text{ms} = 6.00 \times 10^{-3}\ \text{s}$

$vel = 2.50 \times 10^{8}\ \frac{\text{m}}{\text{s}}$



---LINK 1

1) $d_{prop} = \frac{D_1}{vel} = \frac{1.60 \times 10^{3}\ \text{m}}{2.50 \times 10^{8}\ \frac{\text{m}}{\text{s}}} = 6.40 \times 10^{-6}\ \text{s}$

2) $d_{trasm} == \frac{L}{R_1} = \frac{1.44 \times 10^{4}\ \text{bit}}{7.00 \times 10^{6}\ \frac{\text{bit}}{\text{s}}} = 2.06 \times 10^{-3}\ \text{s}$

3) $d_{acc} = Q \cdot d_{trasm} = 9.00 \times 10^{0}\ \cdot 2.06 \times 10^{-3}\ \text{s} = 1.85 \times 10^{-2}\ \text{s}$

4) $d_{link1} = d_{prop} + d_{trasm} + d_{elab} + d_{acc} = 6.40 \times 10^{-6}\ \text{s} + 2.06 \times 10^{-3}\ \text{s} + 6.00 \times 10^{-3}\ \text{s} + 1.85 \times 10^{-2}\ \text{s} = 2.6578 \times 10^{-2}\ \text{s}$

---LINK 2

5) $d_{prop} = \frac{D_2}{vel} = \frac{6.30 \times 10^{4}\ \text{m}}{2.50 \times 10^{8}\ \frac{\text{m}}{\text{s}}} = 2.52 \times 10^{-4}\ \text{s}$

6) $d_{trasm} == \frac{L}{R_2} = \frac{1.44 \times 10^{4}\ \text{bit}}{1.60 \times 10^{7}\ \frac{\text{bit}}{\text{s}}} = 9.00 \times 10^{-4}\ \text{s}$

7) $d_{acc} = Q \cdot d_{trasm} = 9.00 \times 10^{0}\ \cdot 9.00 \times 10^{-4}\ \text{s} = 8.10 \times 10^{-3}\ \text{s}$

8) $d_{link2} = d_{prop} + d_{trasm} + d_{elab} + d_{acc} = 2.52 \times 10^{-4}\ \text{s} + 9.00 \times 10^{-4}\ \text{s} + 6.00 \times 10^{-3}\ \text{s} + 8.10 \times 10^{-3}\ \text{s} = 1.5252 \times 10^{-2}\ \text{s}$

---LINK 3

9) $d_{prop} = \frac{D_3}{vel} = \frac{4.50 \times 10^2 \text{ m}}{2.50 \times 10^8 \frac{\text{m}}{\text{s}}} = 1.80 \times 10^{-6} \text{ s}$

10) $d_{trasm} == \frac{L}{R_3} = \frac{1.44 \times 10^4 \text{ bit}}{6.00 \times 10^6 \frac{\text{bit}}{\text{s}}} = 2.40 \times 10^{-3} \text{ s}$

11) $d_{acc} = Q \cdot d_{trasm} = 9.00 \times 10^0 \cdot 2.40 \times 10^{-3} \text{ s} = 2.16 \times 10^{-2} \text{ s}$

12) $d_{link3} = d_{prop} + d_{trasm} + d_{elab} + d_{acc} = 1.80 \times 10^{-6} \text{ s} + 2.40 \times 10^{-3} \text{ s} + 6.00 \times 10^{-3} \text{ s} + 2.16 \times 10^{-2} \text{ s} = 3.0002 \times 10^{-2} \text{ s}$

---DELAY E2E

13) $d_{e2e} = d_{link1} + d_{link2} + d_{link3} = 2.66 \times 10^{-2} \text{ s} + 1.53 \times 10^{-2} \text{ s} + 3.00 \times 10^{-2} \text{ s} = 7.1832 \times 10^{-2} \text{ s}$

6 8 12

---FILE

14) $T = \frac{F}{R_{min}} = \frac{5.60 \times 10^{10} \text{ bit}}{6.00 \times 10^6 \frac{\text{bit}}{\text{s}}} = 9.3333 \times 10^3 \text{ s}$

15) $THR_{medio} = R_{min} = 6.00 \times 10^6 \frac{\text{bit}}{\text{s}}$

nel caso di collegamenti multipli il collegamento con la banda minore fa da collo di bottiglia e viene usato per determinare, semplificando, il tempo di scaricamento e il throughput