Modello analitico

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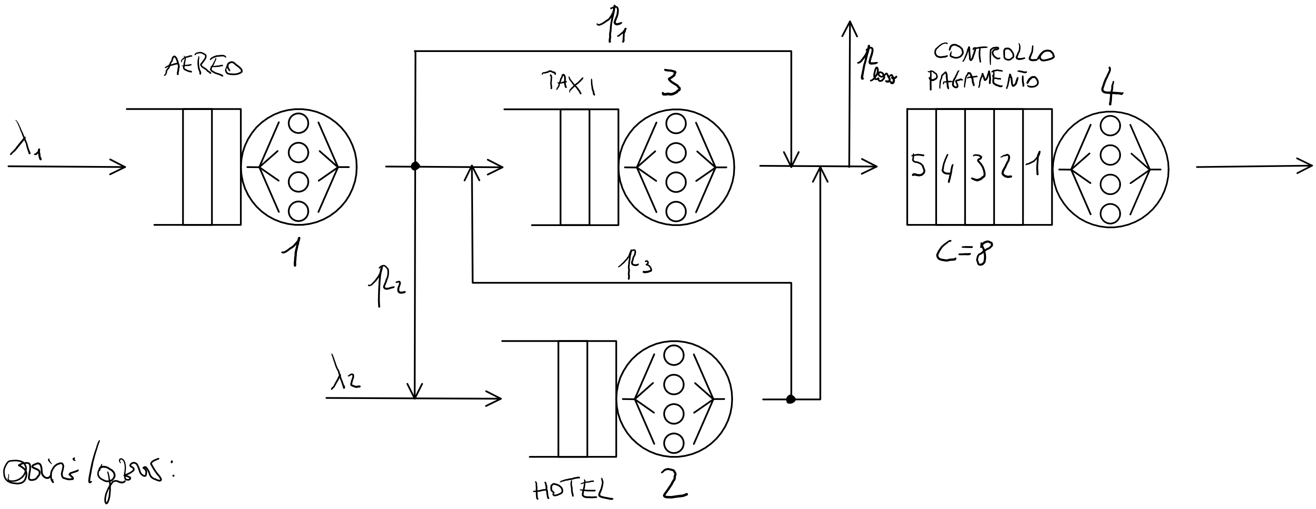

Osservazioni/ipotesi:

$E(S_1) = 2$ s/j $\to \mu_1 \simeq 0{,}5$ j/s $\quad p_1 = 65\%$

$E(S_2) = 3{,}2$ s/j $\to \mu_2 \simeq 0{,}3$ j/s $\quad p_2 = 20\%$

$\lambda_1 = 1{,}9$ j/s $\quad E(S_3) = 2{,}5$ s/j $\to \mu_3 \simeq 0{,}4$ j/s $\quad p_3 = 40\%$

$\lambda_2 = 0{,}8$ j/s $\quad E(S_4) = 1{,}3$ s/j $\to \mu_4 \simeq 0{,}77$ j/s

QoS:

1) $p_{loss} < 1\%$ $\quad T_{sr} = \sum_K E(S_K) = 9$

2) max tempo di risposta (percorso 1-3-2-4) < 12 minimizzando il numero dei serventi

MIGLIORATIVO:

3) QoS di prima con code infinite, senza upgrade di serventi

$f_3 < m_3 \cdot \mu_3$!!! ...

CONFIGURAZIONE INIZIALE: $\rho_K \to 1 \ \forall K \in \{1, \dots, 4\}$

$m_K = \left\lfloor \frac{f_K}{\mu_K} \right\rfloor + 1$, $m_4 = 2$ sempre

$\Rightarrow m_1 = 4 \longrightarrow 4$

$m_2 = 4 \longrightarrow 5$

$m_3 = 2 \longrightarrow 3$

$m_4 = 2 \longrightarrow 5$

$C_4 = 8$

$$\text{max avg wait} = \sum_{K=1}^{4} \text{wait}_K = \sum_{K=1}^{4} \text{delay}_K + \sum_{K=1}^{4} \text{service}_K < 12 \ ;$$

$$\sum^{4} \text{delay} < 3 \ : \ T_Q < 3 - \sum^{3} T_{Q_i} = 0{,}973798976269 \ \dots$$

$$\sum_{k=1}^{4} delay_k < 3 \quad ; \quad T_{Q_4} < 3 - \sum_{k=1}^{3} T_{Q_k} = 0{,}9732989762{,}69 \ s$$

$\lambda = 2{,}7$ $\qquad \lambda_1 = p_1 \lambda \rightarrow \rho_1 = \frac{\lambda_1}{m\mu} = \frac{\lambda_1 E(S)}{m} = p_1 \rho$

$m = 4$ $\qquad \lambda_2 = p_2 \lambda \rightarrow \rho_2 = \qquad = p_2 \rho$

$\mu = \frac{1}{1{,}3}$

$\rho = \frac{\lambda E(S)}{4} = 0{,}8775$

classe 1: $T_Q = \frac{P_Q(\rho)E(S)}{1-\rho_1} < T_{Q_4} \iff \frac{1 - p_1\rho}{P_Q E(S)} > \frac{1}{T_{Q_4}}$

$$1 - p_1 \rho > \frac{P_Q E(S)}{T_{Q_4}} \quad ; \quad p_1 < \left(1 - \frac{P_Q E(S)}{T_{Q_4}}\right) \cdot \frac{1}{\rho} \simeq 85{,}69\%$$

$$\frac{\rho}{1-\rho}\left(\frac{1+C^2}{2}\right)E(S) =$$

$$C^2 = \frac{\sigma^2}{E^2(S)} = \frac{E(S^2) - E^2(S)}{E^2(S)}$$

$$\frac{\rho}{1-\rho}\left(\frac{1+\frac{E(S^2)}{E^2(S)}-1}{2}\right)E(S) = \frac{\rho E(S)}{1-\rho} \cdot \frac{E(S^2)}{E^2(S)} \cdot \frac{1}{2} =$$

$$= \frac{1}{2}\frac{\lambda E^2(S)}{1-\rho} \cdot \frac{E(S^2)}{E^2(S)} = \frac{\frac{\lambda}{2}E(S^2)}{1-\rho}$$

$$E(S^2) = \sigma^2 + E^2(S)$$

exp: $\frac{1}{\lambda^2} + \left(\frac{1}{\lambda}\right)^2 = \frac{2}{\lambda^2}$

uniform: $\frac{(b-a)^2}{12} + \left(\frac{a+b}{2}\right)^2 = \frac{(a+b)^2 - ab}{3}$