JMT ۹۳۷۲۵۱۰۲ حسام تاج‌بخش

One CPU $\lambda = 5\,tps$ $V_{d_1} = 3$ $V_{d_2} = 6$ → $V_{cpu} = 10$

2 Disks $S_{cpu} = 0.002\,s$ $S_{d_1} = S_{d_2} = 0.01\,s$

a) $D_i = S_i \times V_i$ ⇒

$$\begin{cases} D_{cpu} = 10 \times 0.002 = 0.02\,s \\ D_1 = 3 \times 0.01 = 0.03\,s \\ D_2 = 6 \times 0.01 = 0.06\,s \end{cases}$$

$$\begin{cases} X_0 = 5\,tps \\ X_{cpu} = 50\,tps \\ X_{d_1} = 15\,tps \quad X_{d_2} = 30\,tps \end{cases}$$

$$U = \begin{cases} U_{cpu} = 0.1 \\ U_{d_1} = 0.15 \\ U_{d_2} = 0.3 \end{cases}$$

Residence Time

$$\begin{cases} R_{aggregate} = 0.143\,s = \text{Response of System} \\ R_{cpu} = 0.022\,s \\ R_{d_1} = 0.035\,s \\ R_{d_2} = 0.085\,s \end{cases}$$

→

$$\begin{cases} N_{cpu} = 0.111 \\ N_{D_1} = 0.176 \\ N_{D_2} = 0.428 \end{cases}$$

Number of trans. in sys. = 0.716

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b) N': Number of transaction is being served

$N' = S_i X_i = U_i$ →

$$\begin{cases} N'_{cpu} = 0.1 \\ N'_{d_1} = 0.15 \\ N'_{d_2} = 0.3 \end{cases}$$

→ $N'_{aggregate} = 0.1 + 0.15 + 0.3 = 0.55$

Queue Length = $N - N'$ →

$$\begin{cases} Q.L._{cpu} = 0.011 \\ Q.L_{d_1} = 0.026 \\ Q.L_{d_2} = 0.228 \end{cases}$$

→ $N_{waiting} = 0.265$

Waiting Time = Residence Time − Demand ⇒

$$\begin{cases} W.T_{cpu} = 0.022 - 0.02 = 0.002\,s \\ W.T_{d_1} = 0.035 - 0.03 = 0.005\,s \\ W.T_{d_2} = 0.085 - 0.06 = 0.025\,s \end{cases}$$

waiting Time of System = $R_{\checkmark} - D_{\checkmark} = 0.143 - (0.02 + 0.03 + 0.06)$

$= 0.033\,(s)$

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c) Doubling the arrival rate → $\lambda = 10\,tps$

Demand →

$$\begin{cases} D_{cpu} = 0.02 \\ D_1 = 0.03 \\ D_2 = 0.06 \end{cases}$$

→ No Change

$$X = \begin{cases} X_0 = 10\,tps \\ X_{cpu} = 100\,tps \\ X_{d_1} = 30\,t \quad X_{d_2} = 60\,tps \end{cases}$$

→ 2 time greater

$$U = \begin{cases} U_{cpu} = 0.2 \\ U_{D_1} = 0.3 \\ U_{D_2} = 0.6 \end{cases} \rightarrow \text{دو برابر شده است}$$

$$\text{Residence} = \begin{cases} R_{aggregate} = 0.217 \rightarrow \frac{0.217 - 0.143}{0.143} \times 100 = 51\% \\ R_{cpu} = 0.025 \rightarrow \frac{0.025 - 0.022}{0.026} \times 100 = 12\% \\ R_{d_1} = 0.042 \rightarrow \frac{0.042 - 0.035}{0.035} \times 100 = 20\% \\ R_{d_2} = 0.15 \rightarrow \frac{0.15 - 0.085}{0.085} \times 100 = 76\% \end{cases}$$

افزایش "

$$N = \begin{cases} N_{aggregate} = 2.178 \rightarrow \frac{2.178 - 0.716}{0.716} \times 100 = 204\% \\ N_{cpu} = 0.250 \rightarrow \frac{0.250 - 0.111}{0.111} \times 100 = 125\% \\ N_{d_1} = 0.428 \rightarrow \frac{0.428 - 0.176}{0.176} \times 100 = 143\% \\ N_{d_2} = 1.500 \rightarrow \frac{1.5 - 0.428}{0.428} \times 100 = 250\% \end{cases}$$

Scenario 2 Using faster resource → 3 times faster

Bottleneck: Disk2 ($U = 0.3$) → زمان سرویس (S) را $\frac{1}{3}$ می‌کنیم

$S'_{d_2} = \frac{0.01}{3} = 0.0033 \rightarrow D_2 = 0.019 \simeq 0.02$ ← حالا Demand را محاسبه می‌کنیم

$\text{Residence-Time}^{new}_{aggregate} = 0.079 \rightarrow \frac{\Delta R}{R^{old}} = \frac{0.143 - 0.079}{0.143} \times 100 \simeq 44\%$ کاهش

Scenario 3: New Disk $\quad S_{d_3} = 0.01(s) \quad V_1 = V_2 = V_3 = 3$

$$\begin{cases} D_{cpu} = 0.02\,(s) \\ D_{d_1} = D_{d_2} = D_{d_3} = 0.03\,(s) \end{cases}$$

← هم balanced و هم equivalent

$\text{Residence-Time}^{new}_{aggregate} = 0.128(s) \rightarrow \frac{\Delta R}{R^{old}} = \frac{0.143 - 0.128}{0.143} \times 100 \simeq 10\%$ کاهش