PARAMS

- k_i instance performance indicator
- K_s average service performance indicator
- z_i k_i / k_s instance performance ratio
- S instance shutdown threshold
- I_a set of active instances (not booting)
- n $|I_a|$
- P_i previous weight of instance i

VARIABLES

- W_i weight of instance i $(W_i \in [0, 1])$
- Q_i $\begin{cases} 0 & \text{if instance } i \text{ must be shutdown} \\ 1 & \text{otherwise} \end{cases}$

OBJ FUNC

$$\min \sum_{i \in I_0} \frac{1}{z_i} W_i - z_i Q_i$$

Se i è buona $z_i > 1$ quindi conviene avere W_i alto

Se l'istanza resta accesa conviene, scalato per z_i

CONSTRAINT

1 $W_i \leq Q_i$

2 $W_i \geq \frac{S}{M} Q_i$

3 $\sum_{i \in I_0} W_i = 1$

4 $W_i \leq \frac{k_i}{k_j} W_j + (1 - Q_j) \quad k_i \geq k_j$

5 $W_i \leq z_i P_i + z_i \sum_{i \neq j} P_j (1 - Q_j)$

(1) To impose that an instance to shutdown has $W_i = 0$

(2) To impose that an active instance should have a W_i higher than a certain threshold S.

S is the ratio between the # of requests processed by the instance and the # of requests that an instance should process in an ideal case (when the load is distributed equally)

L'idea è "spegni le istanze che si allontanano molto dal caso ideale. Se è così, è perché hanno performance molto basse".

Quindi ($r_i \rightarrow$ # richieste istanza i)

$$S = \frac{r_i}{\sum r_i / n} \rightarrow \text{caso ideale}$$

Ma S non va calcolato, va visto come percentuale

Tipo, $S = 0{,}8$ indica che l'istanza i è lontana dal caso ideale del 20%

Ma $\frac{r_i}{\sum r_i} = W_i$, quindi il W_i soglia è $= S \cdot n$

Quindi vogliamo $W_i \geq S/n$

(3) The weights should have unitary sum

(4) We want that instance weights are proportional to their performances, i.e. that $W_i = \frac{k_i}{k_j} W_j$.
However, if $W_j = 0$, it doesn't mean that W_i must be $= 0$ if $k_i > k_j$
Hence, we want
$W_i \leq \frac{k_i}{k_j} W_j + (1 - \alpha_j)$ if $k_i \geq k_j$, so that if $\alpha_j = 0$, W_i can be for sure ≤ 1

(5) We want that a weight should not grow too much with respect to its previous weight if there are no instances to shut down. If there are, constraint (4) will take care of splitting the load fairly