

# Reserved vs On-Demand/Spot instances :

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Choice of reserved has a lot to do with how certain you are of the expected workload, so are we better (cheaper) of when taking too less or too much reserved instances?

I started by having a look at the example spreadsheet I made where I found the optimal division between reserved and on-demand instances for a specific workload.

Intuitively I'd think that taking too much reserved instances would be worse than taking too less reserved instances, but I found a counterexample for this statement.

I'll now derive the conditions for one less reserved instance than would be optimal to be better (cheaper) than one more reserved instance than the optimal amount. Starting from an example where 2 is the optimal amount of reserved instances.

$$28 * 0.085 * \left(\frac{365}{30} * 24\right) + 30 * 0.03 * \left(\frac{365}{30} * 24\right) + 1 * 227.50 \\ < 0 * 0.085 * \left(\frac{365}{30} * 24\right) + 58 * 0.03 * \left(\frac{365}{30} * 24\right) + 3 * 227.50$$

With the left part of the equation being the price when we'd take 1 reserved instance. 227.50 is the yearly price for the reserved instance, 28 on-demand instances are needed (each has an hourly price of 0.085) and 30 reserved instances are needed (each hour is priced at 0.03). To make the conversion from instances needed in 30 days to hours in a year, we divide by 30 and multiply with 365 and 24.

And the right part of the equation being the price when we'd take 3 reserved instances.

$$(28 - 0) * 24.82 + (30 - 58) * 8.76 + (1 - 3) * 227.50 < 0$$

(28-0)= # on-demand instances needed above (opt<sub>res</sub>- 1) - # on-demand instances needed above (opt<sub>res</sub> + 1)

(30-58) = # reserved instances needed at level (opt<sub>res</sub>- 1) - # reserved instances needed at level (opt<sub>res</sub> + 1)

Notice the total number of instances needed = 58 = 28 + 30 = 58 + 0

$$(28 - 0) * 2.833 + (30 - 58) * 8.76 < \frac{455}{8.76} = 51.9406$$

Set 28 = # on-demand instances needed above (opt<sub>res</sub>- 1) = X, 0 = # on-demand instances needed above (opt<sub>res</sub> + 1) = Y and total number of instances = T

$$2.833 * X + 2.833 * Y + T - X - T + Y < 51.9406$$

$$X - Y < 28.3825$$

So how did we find this constant boundary?

$$28.38 = \frac{opt(res) * yearlyPrice}{(resPrice * (\frac{365}{30}) * 24) * (\frac{onDemandPrice}{resPrice} - 1)}$$

And how do we find this X - Y?



$$Y = \# \text{ opt} + 1$$

$$X = \# \text{ opt} - 1 = \# \text{ opt} + 1 + \text{COUNT}( > \text{opt} - 1) + \text{COUNT}( > \text{opt} )$$

$$\text{COUNT}( > \text{opt} - 1) + \text{COUNT}( > \text{opt} ) < 28.3825$$

See spreadsheet for examples.