

Problem 1. VPS Calculations

$$\text{Demand High} = 250 \text{ servers} = D_H = 250S$$

$$\text{Avg Daily Use} = 150 \text{ servers} = \overline{D_D} = 150S/\text{day}$$

$$\text{Data center Server Hour Cost} = \$5 \text{ per hour} = C_D = 5\$/\text{hr}$$

$$\text{Cloud Provider Server Hour Cost} = \$4.20 \text{ per hour} = C_C = 4.2\$/\text{hr}$$

- (a) How many server hours per day do we actually need?

$$\begin{aligned} \text{Average server hours per day} &= \overline{D_D} \times 24 = 150S/\text{day} \times 24H/\text{day} \\ SH_C &= 3600SH/\text{day} \end{aligned}$$

The organization requires 3600 server hours per day, on average.

- (b) How many server hours per day must we actually provision?

$$\begin{aligned} \text{Provisioned server hours per day} &= D_H \times 24 = 250S/\text{day} \times 24H/\text{day} \\ SH_D &= 6000SH/\text{day} \end{aligned}$$

Because of the peak load, the organization must provision 6000 server hours per day.

- (c) What is the annual cost difference, in dollars, between hosting the application in our own data center versus hosting it with the cloud provider?

Assuming:

- *data center provisioning is daily and cloud is flexible; ie: a and b give cloud and data center usage respectively.*
- *a year is precisely 365 days.*

$$\begin{aligned} \text{Cost difference} &= (SH_D \times C_D) - (SH_C \times C_C) \\ &= (6000SH/\text{day} \times 5\$/\text{hr}) - (3600SH/\text{day} \times 4.2\$/\text{hr}) \\ &= (30,000\$/\text{day}) - (15,120\$/\text{day}) \\ &= 14,880\$/\text{day} \\ &= 5,431,200\$/\text{yr} \end{aligned}$$

Hosting the application in our own data center will cost \$5,431,200 more annually instead of hosting it in a cloud provider.

Problem 2. Data Processing Time Calculations

$$1GB = 1000MB$$

$$1MB = 8Mb$$

$$\text{Server Hour} = \text{Shr}$$

$$\text{Data Created} = 250 \text{ GB} / \text{wk} = D$$

$$\text{Local servers} = 8 = S_L$$

$$\text{Server speed} = 2 \text{ hr} / \text{GB} = C$$

Assuming the process scales linearly across compute nodes.

- (a) How long will it take us to process each week's data locally?

$$\begin{aligned} \text{Local processing time} &= 250 \text{ GB} / \text{wk} \times C / S_L \\ &= \frac{(250 \times 2) \text{ Shr} / \text{wk}}{8S} \\ &= (500/8) \text{ hr} / \text{wk} \\ &= 40 \text{ hr} / \text{wk} \end{aligned}$$

The processing on local servers will be complete after 40 wall-clock hours each week.

- (b) How much would it cost to process the data locally assuming each server hour costs \$4.50?

$$\begin{aligned} \text{Total local processing cost} &= 500 \text{ Shr} / \text{wk} \times 4.5\$ / \text{Shr} \\ &= \$1800 \end{aligned}$$

Running the processing on local servers will cost \$1800 per week.

- (c) How many cloud compute instances would we need to complete the analysis in one hour?

Since it takes 500 server hours per week to perform the computation, provisioning 500 cloud compute instances will perform the computation in 1 hour each week.

- (d) How much does the computation cost to process the data with our cloud provider assuming that each server hour of compute time costs \$0.075?

$$\begin{aligned} \text{Total local processing cost} &= 500 \text{ Shr} / \text{wk} \times 0.075\$ / \text{Shr} \\ \text{Cost}_{\text{cpu}} &= 37.5\$ / \text{wk} \end{aligned}$$

The computation time on cloud instances would cost \$37.50 per week.

- (e) What is the transfer cost to move the data to the cloud provider assuming that each GB will cost \$0.10 to transfer?

$$\begin{aligned}\text{Total transfer cost} &= 250GB/wk \times 0.1\$/GB \\ \text{Cost}_{tx} &= 25\$/wk\end{aligned}$$

The data transfer will cost \$25 per week.

- (f) How long will it take to transfer the full 250 GB of data to the cloud provider assuming that they can sustain an average of 20 Mb/second?

$$\begin{aligned}\text{Total transfer time} &= \frac{250GB/wk}{20Mb/s} \\ &= \frac{2,000,000Mb}{20Mb/s} /wk \\ &= 100,000s/wk \\ &= 100,000s/wk \\ &= 1666.6m/wk \\ &= 27.8h/wk\end{aligned}$$

The data transfer will take 27.8 hours each week.

- (g) How much will it cost to process one week's data in the cloud?

$$\begin{aligned}\text{Total cost} &= \text{Cost}_{tx} + \text{Cost}_{cpu} \\ &= \frac{\$25 + \$37.5}{wk} \\ &= \$62.5/wk\end{aligned}$$

Running the processing on the cloud will cost \$62.5 per week.

- (h) Compare the processing time and overall cost and make a recommendation as to whether or not this process should be moved to the cloud provider.

It is both less time consuming (28.8 hours vs 40 hours per week) and cheaper (\$63.50 vs \$1800 per week) to use a cloud provider for this workload.