

## Capacity estimations / Back of the envelope

Monday, May 29, 2023 3:01 PM

Estimations to do are : (Don't take more than 5 - 10 mins )

1. Traffic \*\*
2. Storage \*\*
3. Bandwidth
4. Memory

### Paste Bin Capacity Estimations

#### Traffic :

Daily Active Users (DAU) : 10 M

##### Write Requests :

1. Users -> requests

Write requests per day = 10 % of DAU  
 $= 10M * 0.1$   
 $= 1M$  user per day

2. Per day -> per sec

Write request per sec =  $1M / \# \text{ secs in a day}$   
 $= 1M / 24 * 60 * 60$   
 $= 1M / 3600 * 24$   
 $= 1M / 4000 * 20$  (approx)  
 $= 1M / 80K$   
 $= 1M / 100K$  (approx)  
 $= 10$  write requests / sec

##### Read Requests :

1. Users -> requests

Read requests per day =  $50 * 1M$   
 $= 50 M$  read requests / sec  
 Read requests per sec =  $50 * 10$   
 $= 500$  read requests / sec

#### Memory :

Caching 80 : 20 rule

Caching per day

$= 50 M$  (reads per day) \*  $10 KB$  (paste size) \*  $0.2$  (20%)  
 $= 100 GB$

#### Storage :

Paste size :

$= 200$  (lines) \*  $10$  (Words) \*  $5$  (Letters) \*  $1$  Byte (Char size)  
 $= 10,000$  Bytes =  $10 KB$

New data per day =  $1M$  (Write req per day) \*  $10 KB$  (Paste size)  
 $= 10 GB$

Retention Period = 5 Years

Storage =  $5 * 365 * 10 GB$   
 $= 5 * 400 * 10 GB$  (approx)  
 $= 20 TB$

Replication with 3 times =  $3 * 20 TB$   
 $= 60 TB$

Total Storage for 5 yrs =  $6 TB$   
 with retention (3 times)

#### Bandwidth :

Amount of data transferred per sec

Incoming data per sec (Write)  
 $= 10$  (write req per sec) \*  $10KB$  (Paste size)  
 $= 10 KB$

Outgoing requests per sec (Read)  
 $= 500$  (read req per sec) \*  $10 KB$  (Paste size)  
 $= 5 MB$

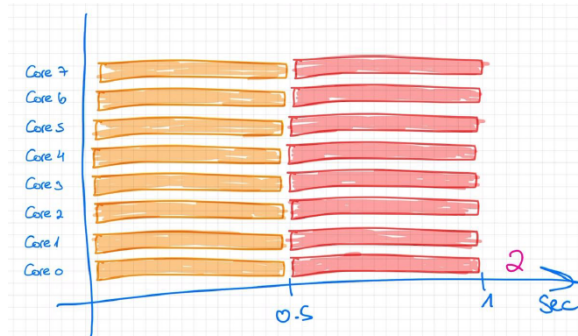
## ☆ How Many APP servers do we need ?

$$\frac{\text{\# requests per sec to handle}}{\text{\# requests per sec a single server can handle}} = \frac{500}{x} = \frac{500}{16} = 30 - 40 \text{ servers}$$

- CPU bound
- Memory bound
- I/O bound

$$X = \frac{\text{Number of physical cores}}{\text{Time to process a request}} = \frac{8}{0.5} = 16 \text{ requests / sec}$$

Each core can process 2 requests / sec parallelly and it has 8 cores



## ☆ Things to remember :

1 Byte = 8 Bits

Zero's	Traffic	Storage
3	Thousand	KB (Kilo)
6	Million	MB (Mega)
9	Billion	GB (Giga)
12	Trillion	TB (Tera)
15	Quadrillion	PB (Peta)

Type	Size
Char	1 Byte
Char (Unicode)	2 Bytes
Int	4 Bytes
Long	8 Bytes
UUID/GUID	16 Bytes

$$X \text{ million users} * Y \text{ KB} = XY \text{ GB}$$

$$10^6 * 10^3 = 10^9$$

## Media (Image / Video) :

- HD Image - 3 MB
- Profile Image - 300KB (300 \* 300)

$$\begin{aligned} &\text{Height * Width * Bit depth} \\ &1280 * 720 * 3 \text{ B} \\ &1\text{K} * 1\text{K} * 3 \text{ B (approx)} \\ &3 \text{ MB} \end{aligned}$$

- 1 min HD video = 50 MB -> (X)

$$\begin{aligned} &\text{Frame size * Frame rate(FPS) * Compression ratio * Duration (Sec)} \\ &3 \text{ MB} * 30 * 1/100 * 60 \\ &54 \text{ MB} \\ &50 \text{ MB (approx)} \end{aligned}$$

$$\text{Total size of all types of videos} = 2 X = 2 * 50 \text{ MB} = 100 \text{ MB}$$

All types of videos :

$$\left. \begin{aligned} 480\text{p} &= X/2 \\ 360\text{p} &= X/4 \\ 240\text{p} &= X/6 \\ 144\text{p} &= X/8 \end{aligned} \right\} X$$

