⇒ What is LLD ?

↓

Architecture of Code.

⇒ Extensible, Maintainable

⇒ Design DB.

HLD : Architecture of m/c or servers that runs the code.

↓

High Level Design ⇔ System Design

Q.

Given a file containing strings, sort the strings in dictionary (lexicographic) order.

input
cat, dog, apple, laptop, class, high, level, design

output
apple, cat, class, design, dog, high, laptop, level

⇒ sort fun.

⇒ Staff Engineer @ Google.

Catch :

↳ Size of the file : 50 PB.

1 B ⇒ 8 bits.

1 KB = 1000 Bytes

1 MB = 10^6 Bytes

1 GB = 10^9 Bytes

1 TB = 10^{12} Bytes.

1 PB = 10^{15} Bytes.

50 PB = 50×10^{15} Bytes.

= 50×10^3 TB

= 50,000 TB.

Q. Can we fit this much data in RAM | HDD ?

⇒ NO.

Challenges.

→ N/w issues

→ Complex

→ Servers can crash.

⇒ Simple problems become challenging at scale.

⇒ HLD is the study of problems that arises at scale, and the solution to these problems.

⇒ Trade off.

SCALE.

- Amount of Data
- No. of users.
- No. of requests / sec (RPS)
  - Request per sec.

Case Study : del.icio.us.

- 2003.
- Bookmarking Website.

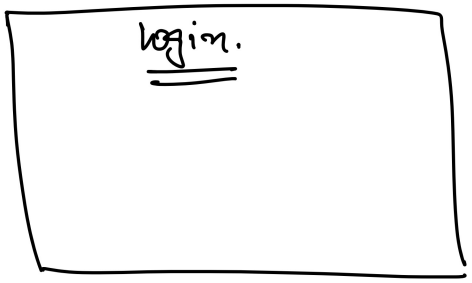
Youtube : 2004

Amazon AWS : 2006

Chrome : 2008.

⇒ Bookmarks used to get stored locally, Bookmarks stored on a m/c can't be access on another m/c.

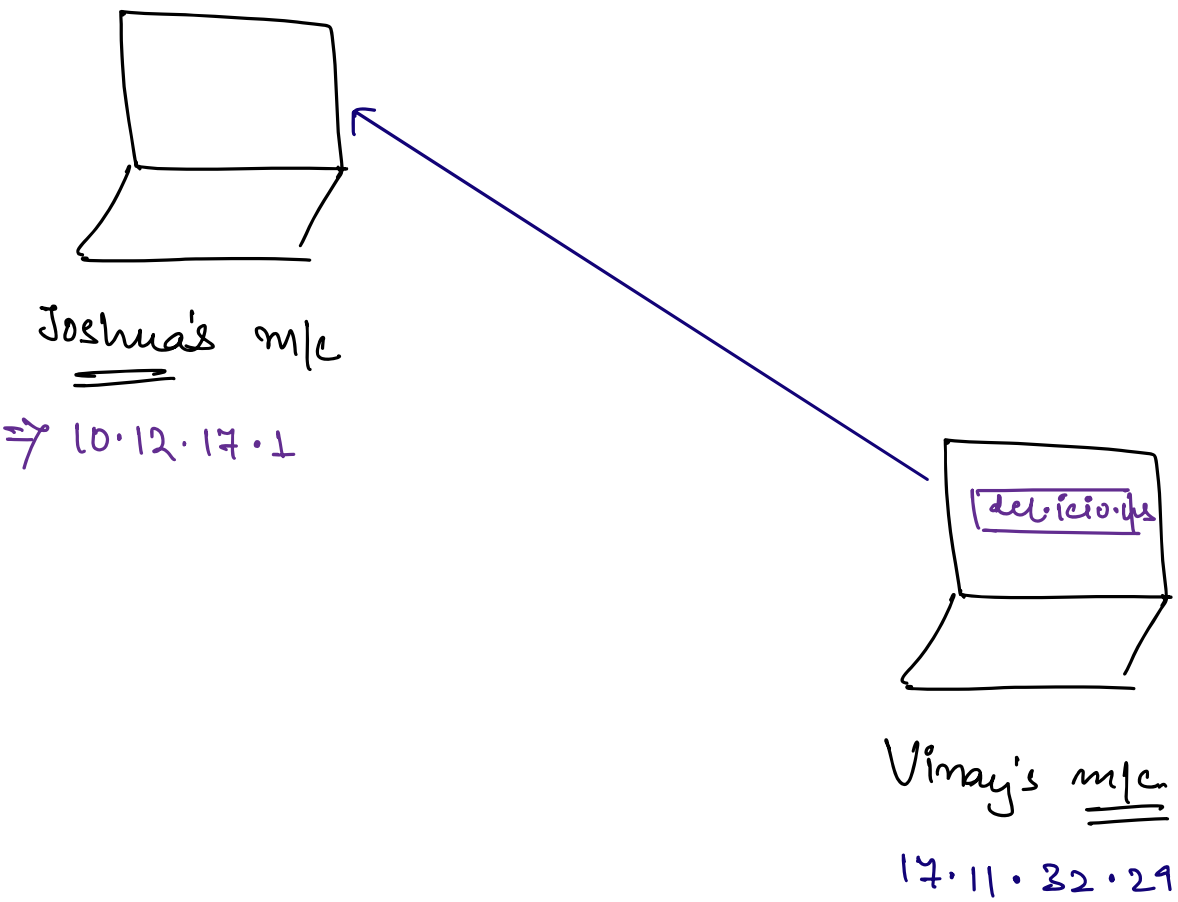
⇒ Joshua



⇒ MVP.

- SignUp & login
- Store bookmarks
- View bookmarks

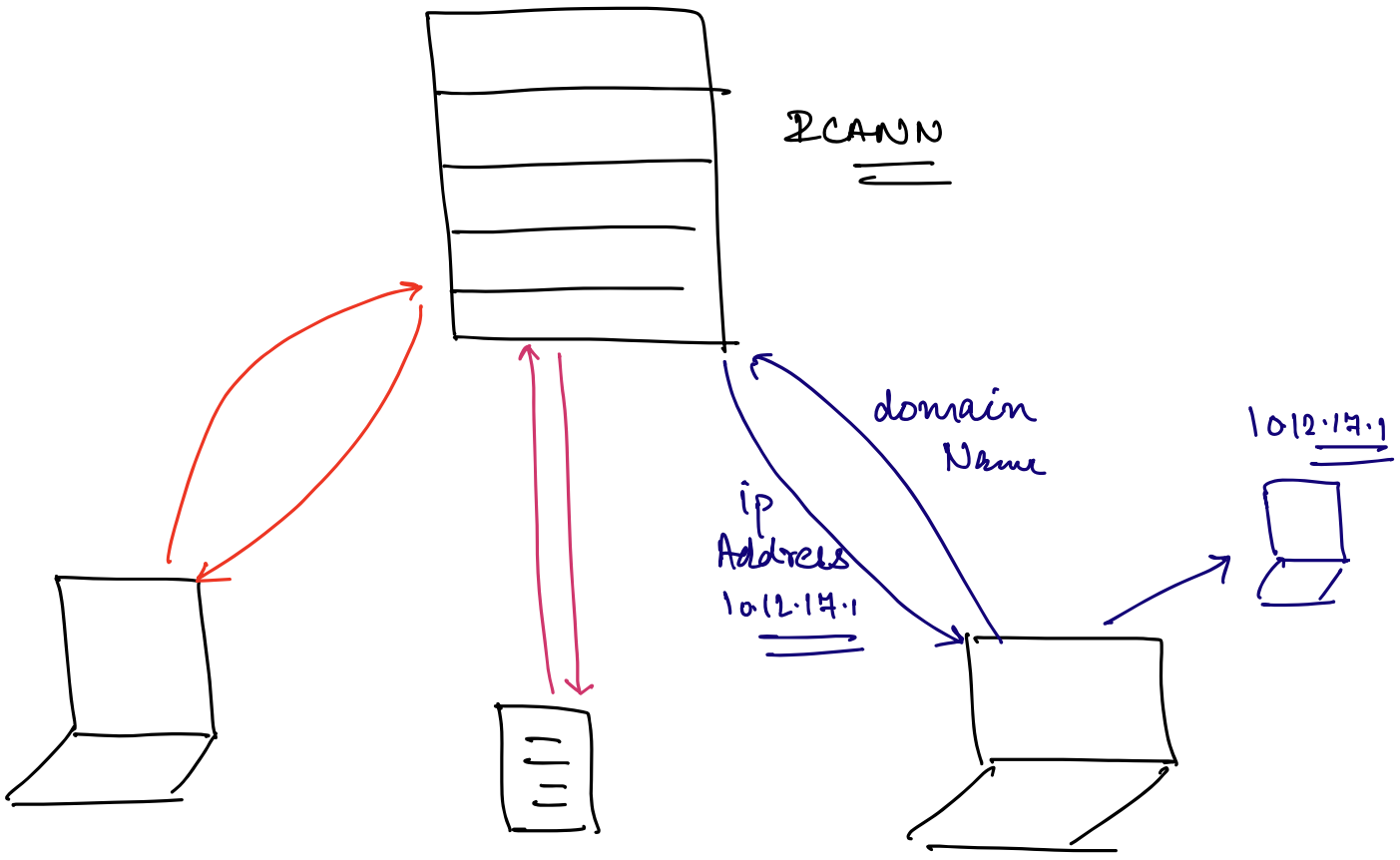
Internet.



Domain Name	ip.
del.icio.us	10.12.14.1
scaler.com	54.13.72.14

⇒ Joshua must purchase a Domain Name.

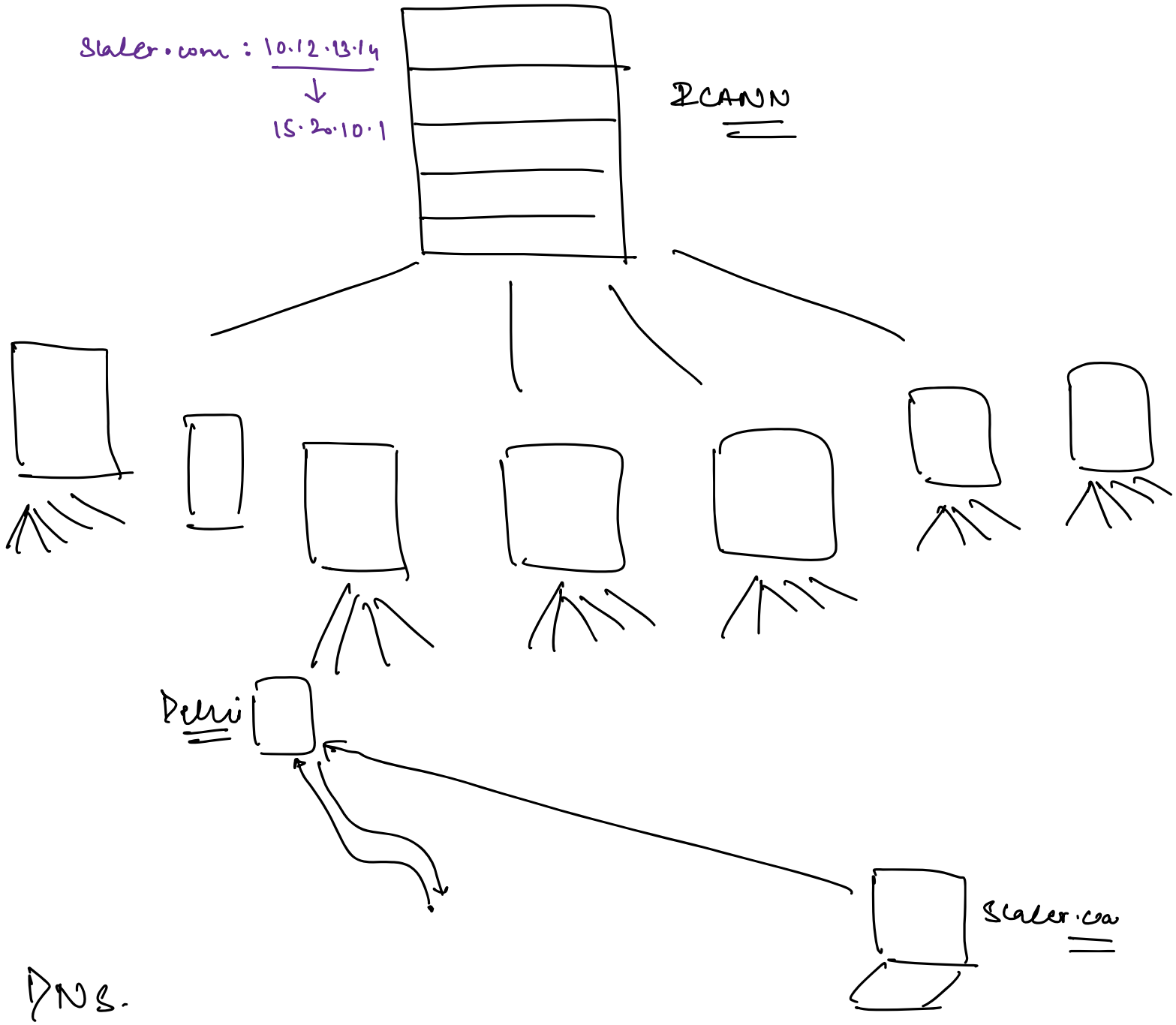
ICANN.



Issues in the above setup.

- ICANN becomes the Bottleneck.
- SPOF
  - Single Point of failure.

I LAN ⇒ I LAN'T.



DNS.

↳ Domain Name Server.

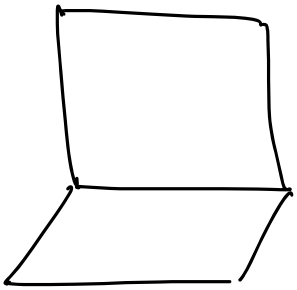
Who maintains DNS ?

- Google | Amazon | fb | - - -
- ISP
- =

⇒ 100 users | Day

del.icio.us

10.12.14.1



RAM: 128 MB RAM.

CPU: 2 Core CPU

HDD: 40 GB

N/w: 8 Kbps.

LLD.

- users (id, email, password) ~ 60B.
  - id: 8B
  - email: 30B
  - password: 20B
- user_bookmarks (user_id, url)
  - user_id: 8B
  - url: 1000 B.

10M users ⇒ user table

60B × 10M ⇒ 600 MB.

⇒ 1M Bookmarks | Day.

1 entry in Bookmarks table = 1KB.

1 Day ⇒ 1M x 1KB.

⇒ 1GB.

⇒ 40 Days.

⇒ Get a better H/w.

Q. Is HDD the only resource should we care?

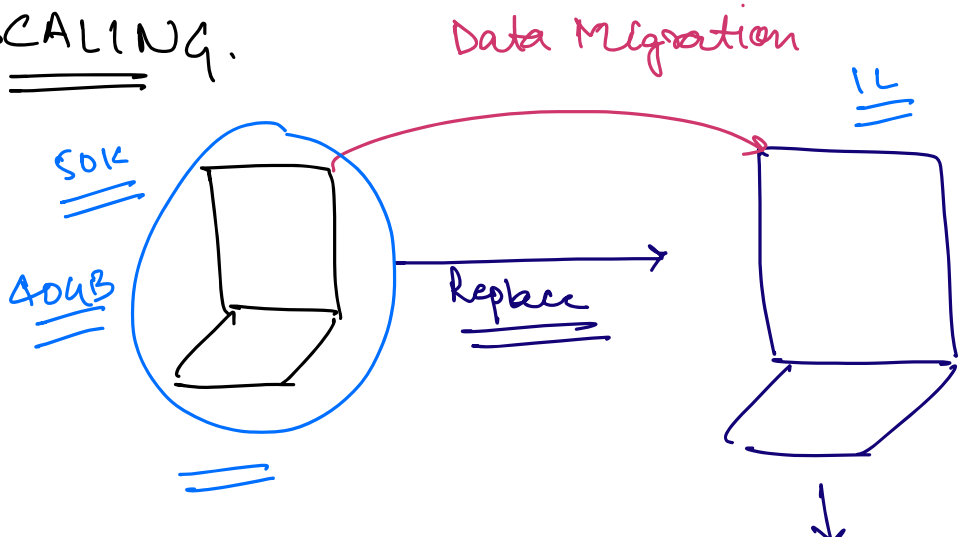
No.

⇒ More CPU

⇒ More RAM

⇒ More Disk.

SCALING.



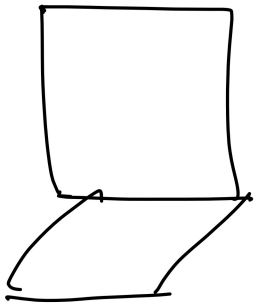
CPU : 4 Core

Ram : 256 MB

HDD : 80GB

N/w : 16 Kbps.

4L



CPU : —

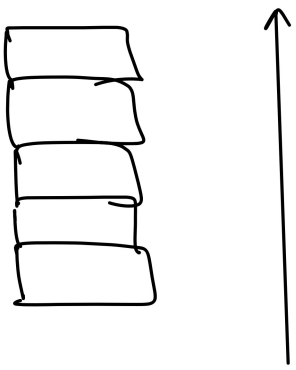
RAM : 512MB

HDD : 200GB

N/w : 32 Kbps

⇒ Vertical Scaling

↳ Scaling up.



⇒ Vertical scaling has limitation.

⇒ Can't be scaled after a certain limit.

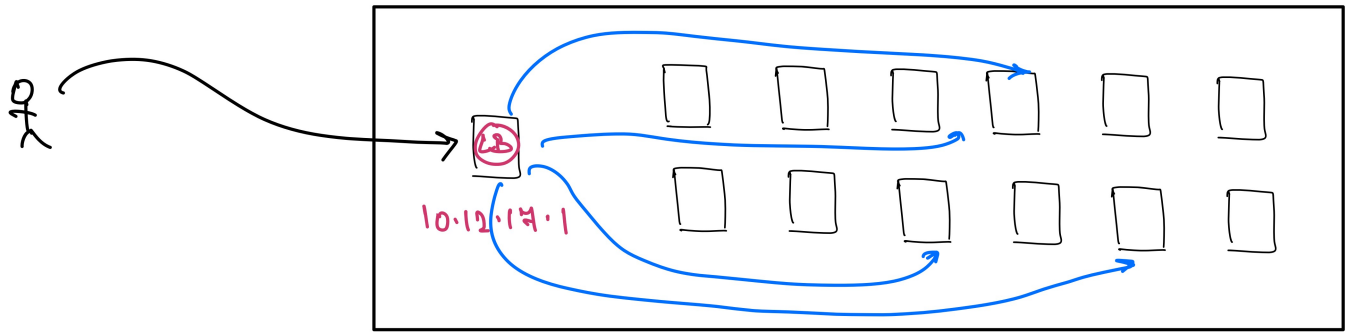
⇒ More costly.

⇒ Horizontal Scaling

Add more m/c to the existing ones.

DNS

delicious : 10.12.17.1



⇒ Not limited to the current technology.

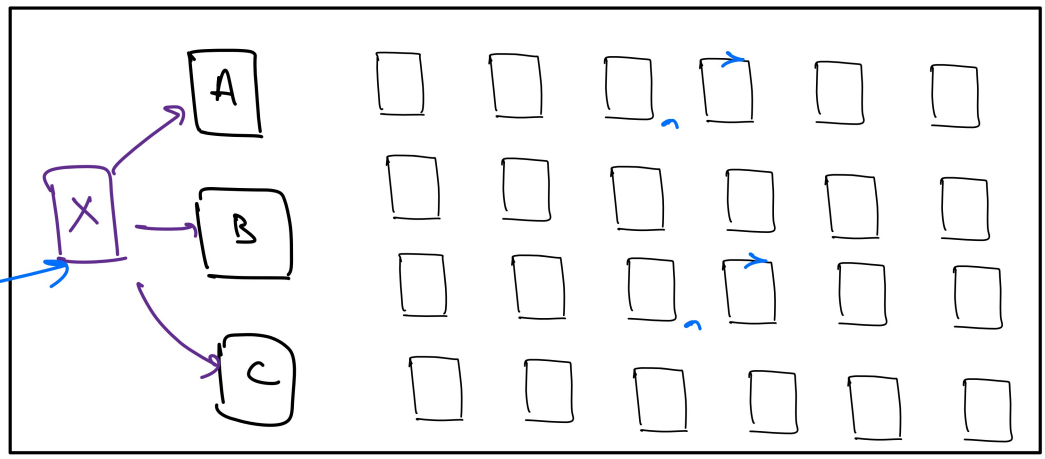
⇒ Managing these many m/c will be very complex.

⇒ Load Balancer.

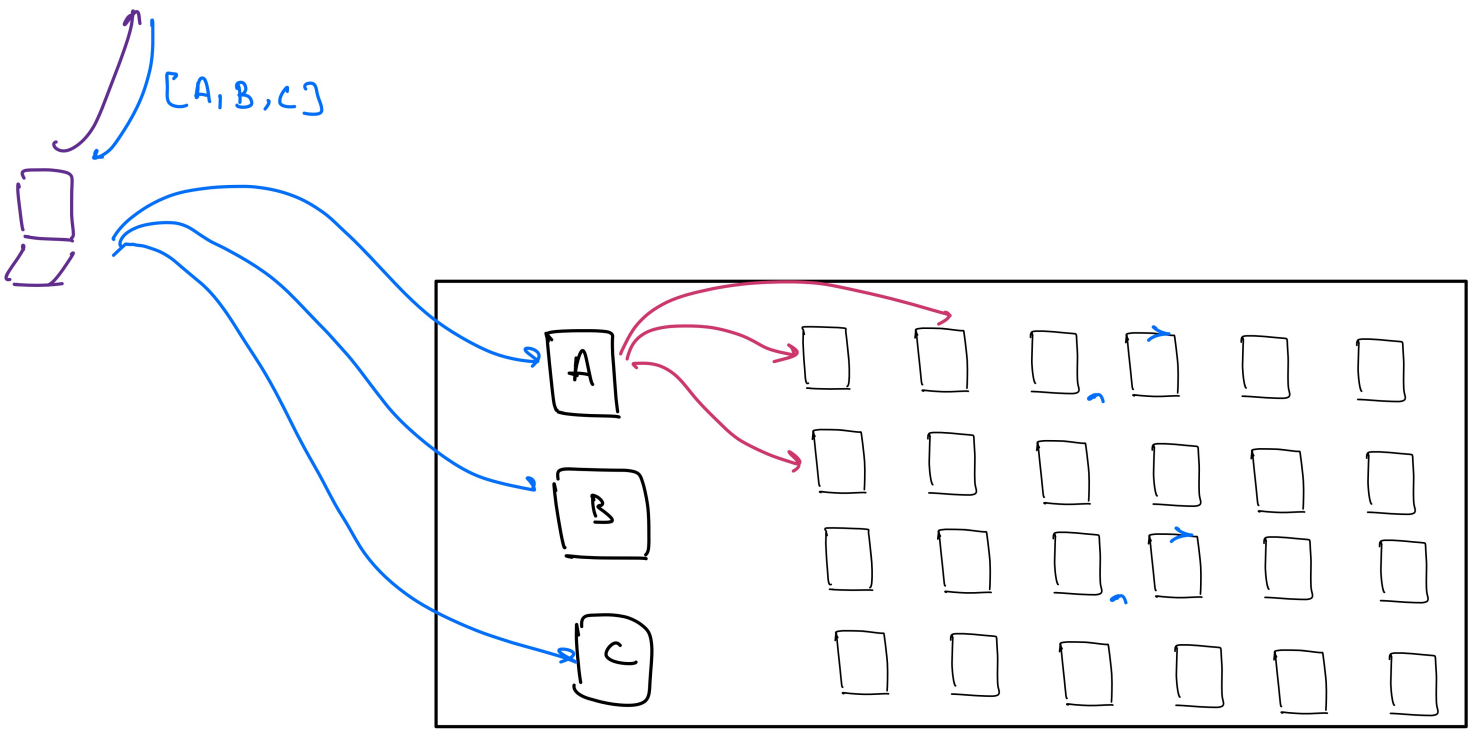
⇒ SPOF

DNS

delicious : x



DNS. deliciousness: [A, B, C]



⇒

DELICIOUS: Horizontal Scaling

↳ less compute intensive operations.

CHAT GPT | Video processing

↳ Horizontal + Vertical Scaling.