

Lecture 1

2020年4月24日 星期五 上午2:46

Reasons for using distributed system:

1. Performance: parallelism
2. Fault Tolerance
3. Physical reason
4. Security

Challenges:

1. Concurrency
2. Partial failure
3. Performance

Infrastructure:

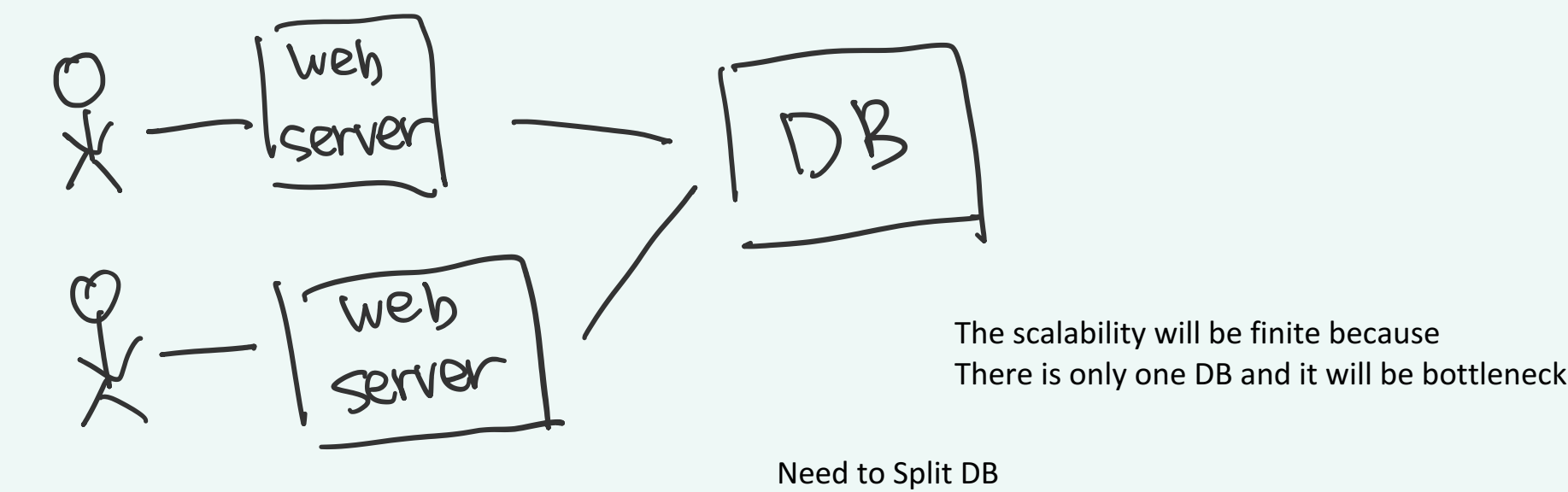
1. Storage
2. Communication
3. Computation (Mapreduce)

Implementation:

RPC, threads, concurrency
→ Structure concurrent programming

Performance:

Scalability (if I have a computer, and I have another new computer, whether the performance can also be doubled)



Fault Tolerance:

1. Availability (when part of the system crash)
2. Recoverability: if something goes wrong, it may stop for a while and when someone requires it, the system can continue working. May need to store information before crashes.

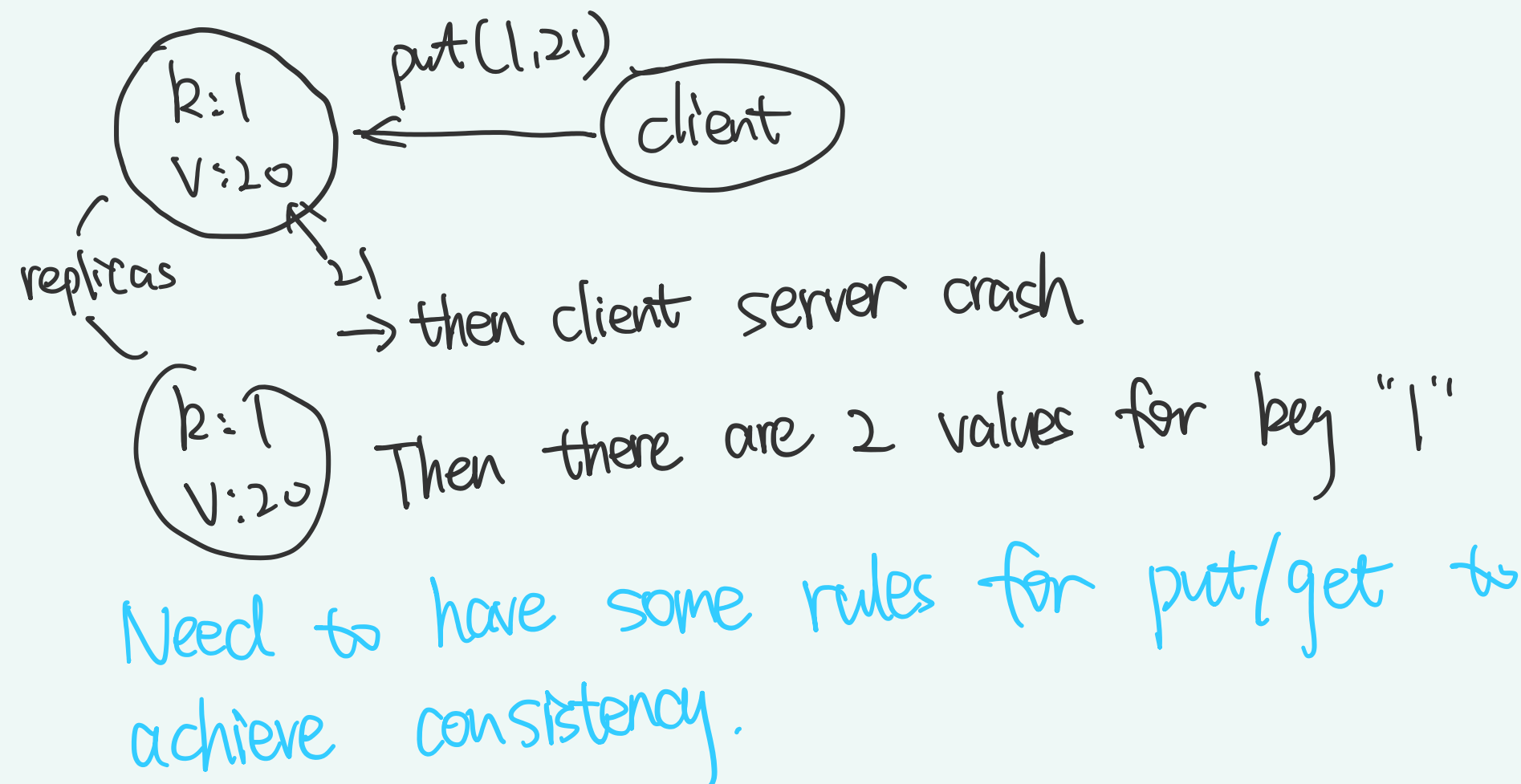
Solution:

1. Non-volatile storage
2. Replication

Consistency:

1. Put(k,v)
2. Get(k) -> v

In distributed system, due to replication/code, there may be different mapping of k/v:



Strong vs. Weak consistency

↓

expensive

↓

doesn't guarantee that always return latest value, can avoid communication as much as possible.

People tend to store the replicas of same file in difference locations.
So this makes strong consistency extremely expensive.

Mapreduce:

Run Map Function on each input file, output is a list of key/value pairs

Input 1 → Map() ex. "a", "b" → $\left[\left[a, 1 \right], \left[b, 1 \right] \right]$

Input 2 → Map() "b" → $\left[\left[b, 1 \right] \right]$

Input 3 → Map() "a", "c" → $\left[\left[a, 1 \right], \left[c, 1 \right] \right]$

calls reduce function for each key

→ $\left[\right] \rightarrow \text{reduce} \rightarrow (a, 2)$

→ $\left[\right] \rightarrow \text{reduce} \rightarrow (b, 2)$

→ $\left[\right] \rightarrow \text{reduce} \rightarrow (c, 1)$

Map (k,v) :

split v into words

for each word w:

emit (w, "1")

Reduce (k,v) :

emit (len(v))

How is the data stored and called ?

There is a master server, which will allocate each server which file it will be working on. When each map function emits something, the output will be stored on that server. When all map functions complete, the output files will be moved to a location where reduce function can reach.