Project 1: Group RPC Communication report

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1.Design of functional data structure

1) server

(1) we need a map to store the key and value

since conflicts may happens, so we need a array to store the values

```
kayValue = MAP {key, []int}
```

(2) we need a map tp store the key and vector clock

```
keyVector = MAP {key, [][]int}
```

(5) server struct

```
type Server struct {
  mu            sync.Mutex
  IsClient      bool
  kayValue      MAP {key, []int}
  keyVector     MAP {key, [][]int}
  myVector      []int
}
```

2) client

client class

```
type Client struct {
  serversIpPort []string
}
```

2. Design of RPC and RPC's data structure

In communication, there is only one RPC. Client send the message to server ① retrieve the data ② update the value of specific key

1) client -> server

(1) When a client send a message to the group, the server should store it

```
Operation RPC

Arguments:
  Operation int    // 0 means update, 1 means retrieve data
  key       string
  value     string // if Operation == 1, value = ""
  vector    []int

return value:
  Operation int    // 0 means update, 1 means retrieve data
  dataVector       [][]string // retrieved value
  dataValue        [][]int // retrieved vector
```

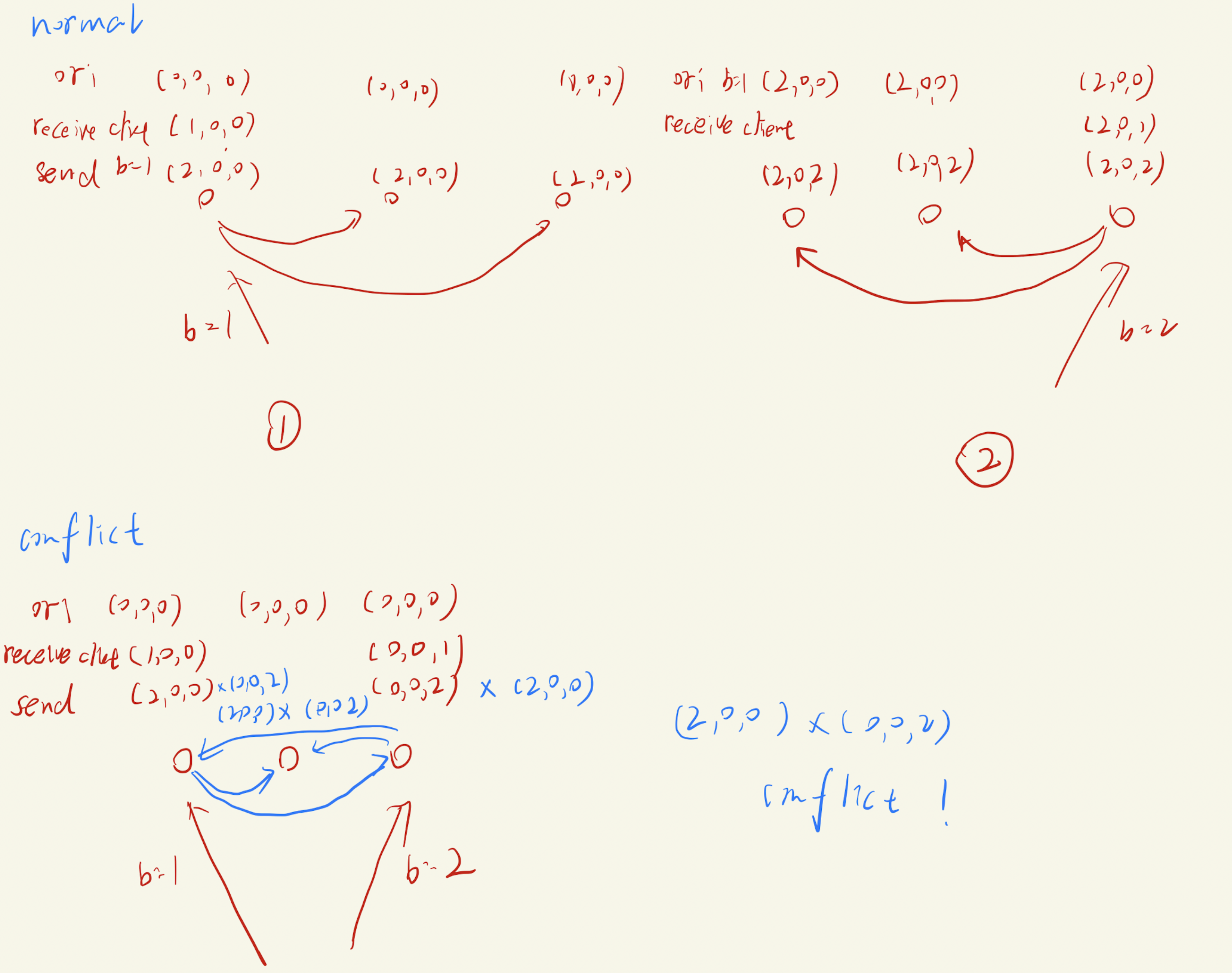
3) Defaul RPC port

For server: 1230 ~ 1235

For client：1220~1230

3. Pseudocode and logic

basic logic


normal
ori (0,0,0) (0,0,0) (0,0,0)
receive clie (1,0,0)
send b=1 (2,0,0) (2,0,0) (2,0,0)
b=1
①
ori b=1 (2,0,0) (2,0,0) (2,0,0)
receive client (2,0,1)
(2,0,2) (2,0,2) (2,0,2)
b=2
②
conflict
ori (0,0,0) (0,0,0) (0,0,0)
receive clie (1,0,0) (0,0,1)
send (2,0,0)×(0,0,2) (2,0,0)×(0,0,2) (0,0,2) × (2,0,0)
b=1
b=2
(2,0,0) × (0,0,2)
conflict !

Only if the server receive the new_update request, local_clock[myId] += 1

when a server want to broadcast the data, local_clock[myId] += 1.

1) server:

```
if receive  RPC:
  if request == new_update{
    if client send:
      local_clock[myId] += 1
    verify whether conflict between received clock and my clock
    if conflict:
      not rewrite the key value
      store the conflict value and received vector to corresponding key
    if not conflict:
      update my clock and rewrite the key value
    broadcast the message to all servers with (key, value, local clock)
  }
  if request == retrieve{
    return stored value and corresponding vector
  }
```

2) client

```
operations:
new key update the key
retrieve the data

set args.vector = {0,0...}
set operation key etc....
send the args to server:
if reply.data.length > 1: conflict
print(data)
```

4.Test design

(1) No conflict

① open 0 ~ 3 servers, but not 4

② client new b = 1 on server 0

③ server 4 online

③ client update b = 2 on server 1

④ client retrieve all of the value of b in each servers, print the corresponding key, value and vector

Sample log:

```
2022/03/11 08:57:22 client new b = 1 to server0, in this time, 0 ~ 3 are online, but 4 offline
2022/03/11 08:57:26 4 online now
2022/03/11 08:57:28 client update b = 2 to server0, in this time, 0 ~ 4 are online
2022/03/11 08:57:30 client retrieve all of the servers b = ?
2022/03/11 08:57:30 server0:
2022/03/11 08:57:30 the value:[2], the vecotor:[[2 2 0 0 0]]
2022/03/11 08:57:30 server1:
2022/03/11 08:57:30 the value:[2], the vecotor:[[2 2 0 0 0]]
2022/03/11 08:57:30 server2:
2022/03/11 08:57:30 the value:[2], the vecotor:[[2 2 0 0 0]]
2022/03/11 08:57:30 server3:
2022/03/11 08:57:30 the value:[2], the vecotor:[[2 2 0 0 0]]
2022/03/11 08:57:30 server4:
2022/03/11 08:57:30 the value:[2], the vecotor:[[2 2 0 0 0]]
```

(2) conflict

① open 0 ~ 4 (all) servers

② client new b = 1 on server 0 and client new b = 2 on server 3

Sample log:

```
2022/03/11 09:01:04 client new b = 1 to server0, in this time, 0 ~ 3 are online, but 4 offline
2022/03/11 09:01:06 client update b = 1 to server0, and send b = 2 to server 4 simutaneously, 0 ~ 4 are online
2022/03/11 09:01:08 client retrieve all of the servers b = ?
2022/03/11 09:01:08 server0:
2022/03/11 09:01:08 the value:[1 2], the vecotor:[[2 0 0 0 0] [0 0 0 2 0]]
2022/03/11 09:01:08 conflict happens !!!!!
2022/03/11 09:01:08 server1:
2022/03/11 09:01:08 the value:[1 2], the vecotor:[[2 0 0 0 0] [0 0 0 2 0]]
2022/03/11 09:01:08 conflict happens !!!!!
2022/03/11 09:01:08 server2:
2022/03/11 09:01:08 the value:[1 2], the vecotor:[[2 0 0 0 0] [0 0 0 2 0]]
2022/03/11 09:01:08 conflict happens !!!!!
2022/03/11 09:01:08 server3:
2022/03/11 09:01:08 the value:[2 1], the vecotor:[[0 0 0 2 0] [2 0 0 0 0]]
2022/03/11 09:01:08 conflict happens !!!!!
2022/03/11 09:01:08 server4:
2022/03/11 09:01:08 the value:[2 1], the vecotor:[[0 0 0 2 0] [2 0 0 0 0]]
2022/03/11 09:01:08 conflict happens !!!!!
```