Notification System

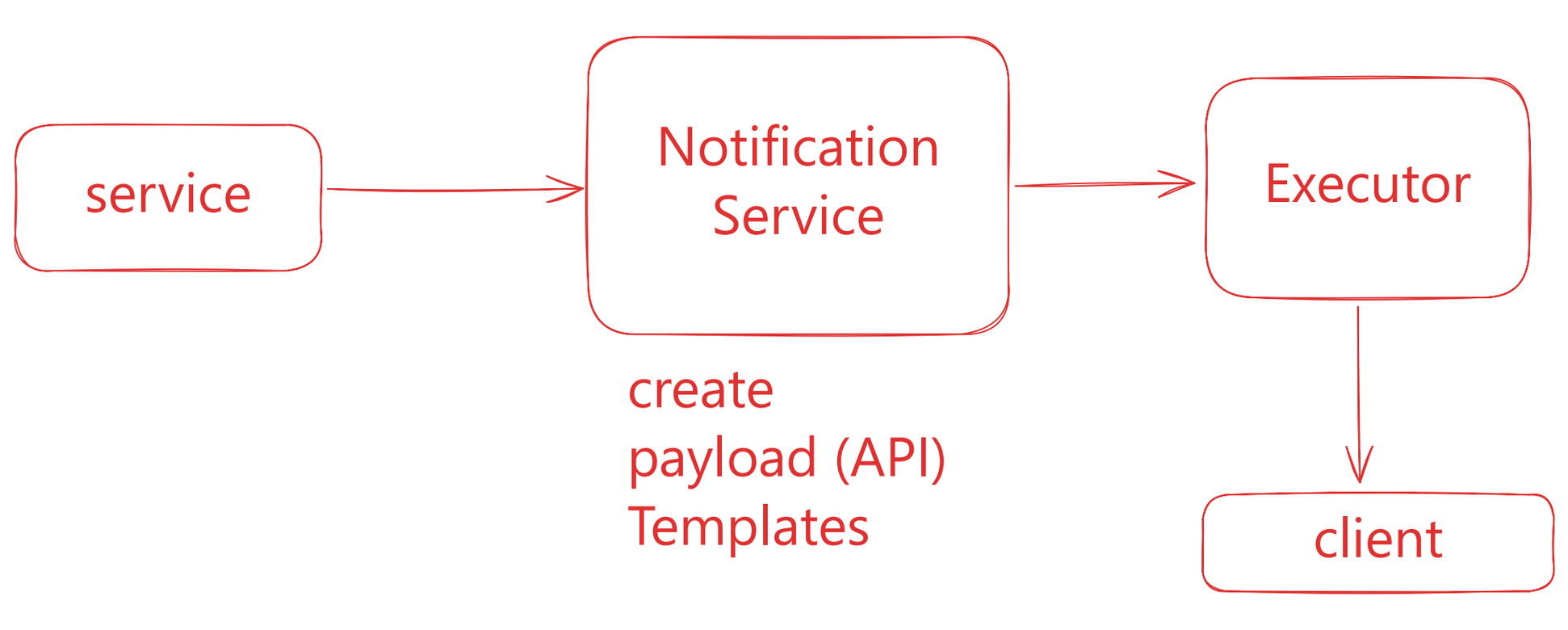
Questions:
Q. What are the type of notifications?
PUSh notification (Mobile push)
SMS notification
EMail Notification
In-App notification

Real time System : Immediately send notification to user.
vs.
Soft Real time system :
We try to send Notification as soon as possible.
--> there can be exceptions.
--> system is down
--> server is busy.

Q. Real time/ Soft real system?
Soft real time.

Q. Device type?
IOS, Android, Web(windows, macos)

Core Entitites:



Back of the Envelope calculations
QPS: (Read / write) HW
Storage Unit:
Bandwidth Calculations:

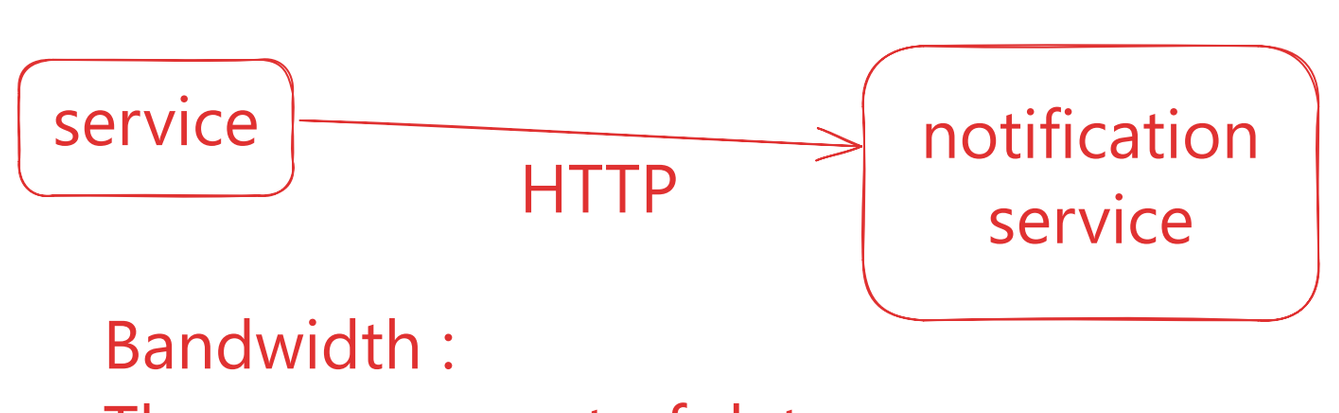
Assumptions:
Daily Active users : 1 Million
how many notifications are to be sent :
1 user --> 10 notifications. likes or comments notification
Total notifications = 1 million * 10 = 10 million/day

Storage Unit:
1 notification = 200 bytes (content, timestamp, userId, notificationId etc)

total = 10 million * 200 byte
= 10 * 2^20 * 0.2 * 10^3
= 10 * 2^20 * 0.2 * 2^10
= 2^30 * 2
= ~2GB/ day

Notification store for 1 month = 2GB * 30 days
= ~60GB

Bandwidth Calculations:



Bandwidth :
The max amount of data that can be transmitted through the network in a given time.

How busy our server will be?

Calculations:
Notification payload : 1KB (upload/download)
headers, Body, request param etc.

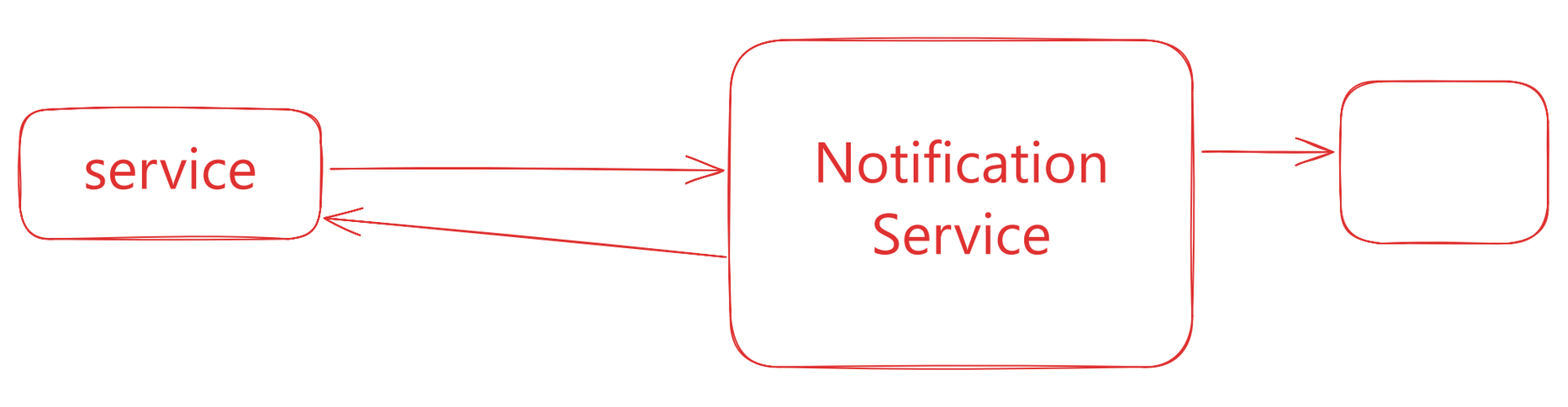
DAU = 1 million
Total notifications/day = 10 Million

1 KB * 10 Million
= 1 * 2^10 * 10 * 2^20
10GB/day

Bandwidth = 10 million * 1 KB / 86,400 seconds
= 10 * 2^20 * 1 * 2^10 / 86.4 * 2^10
= 0.115 * 2^20
= 115 * 10^-3 * 2^20
= 115 * 2^-10 * 2^20
= ~ 115KB/sec

Server :
server scaling
Server RAM increase.

API Interactions:



user --> userID.

SQL — Considering user has its details stored in some DB
User :
userId, Name, mobile...

1. To retrieve user information

```
GET : /fetchuser/{{userId}}
Response:
200 ok
{
   "userId" : 101,
   "userName" "Aditya",
   "notificationPermissions" : {
      "PUSh"  : true,
      "Email " : true,
      "SMS" : false
   }
}
```

2. Send Notification

```
POST : /sendNotification/{{userId}}
Body :
{
   "from" : null,   system is sending notification
   "to" : "202",
   "subject" : "",
   "content" : "",
    "type" : "push/email/sms"
}

Response:
200 ok
{
   "status" : sent
   "notificationId" : "301"
}
```

3. To fetch notification history. (optional)

```
GET : /fetchAllNotifications
Queryparam : filters :
date : from, to
Type : email/sms etc.

Response:
200 ok
[
   {
      "status" : "sent",
      "content" : ""
   },
   {
     "status" : "sent",
      "content" : ""
   }

]
```

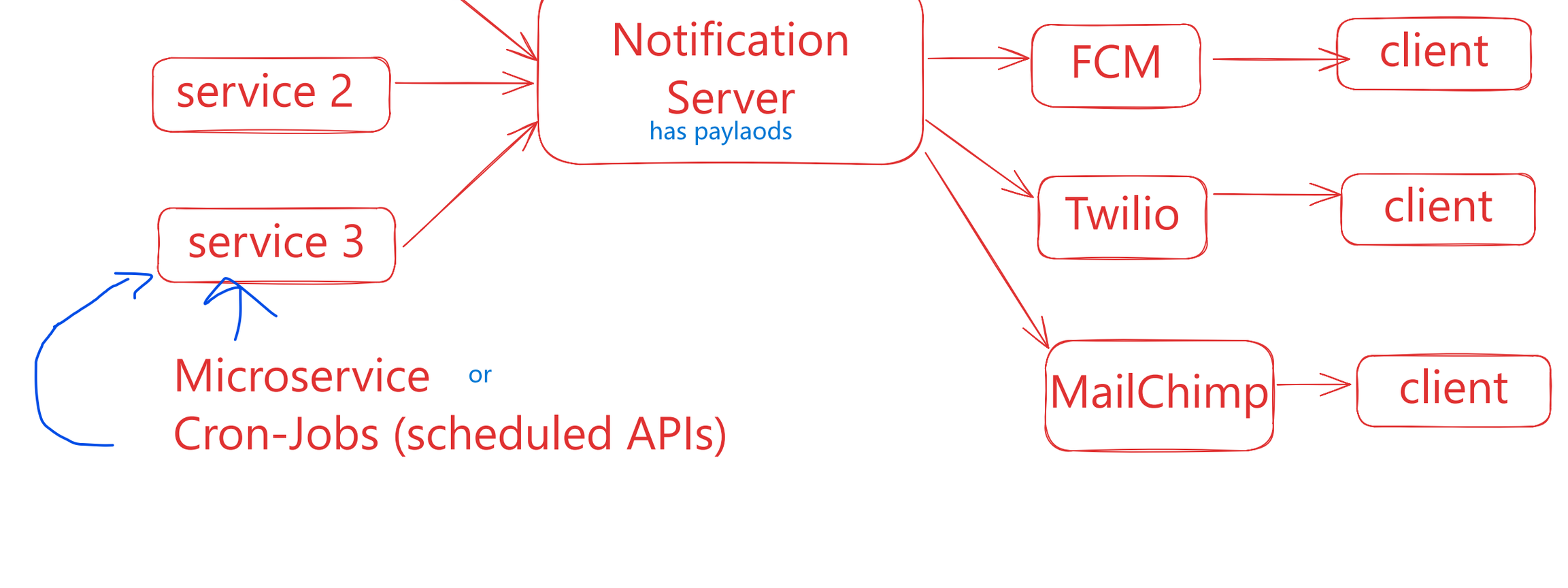
Core Entities
BEC
Api flow

Basic Design:

Push Notifications --> Mobile

IOS (Apple) --> APNs (Apple push Notifications)
Android --> FCM (Firebase Cloud Messaging)

SMS Notification --> Twilio, nexmo etc
Email --> MailChimp, Sendgrid etc



Flow:
1. Any service (microservice, cronjobs) trigger Notifications and send it to our notification server.
2. The notification server has APIs that builds up the paylaod, for 3rd party services(APIs) to send the requested notifications.
3. Third party sercice actually send the notification to the client.

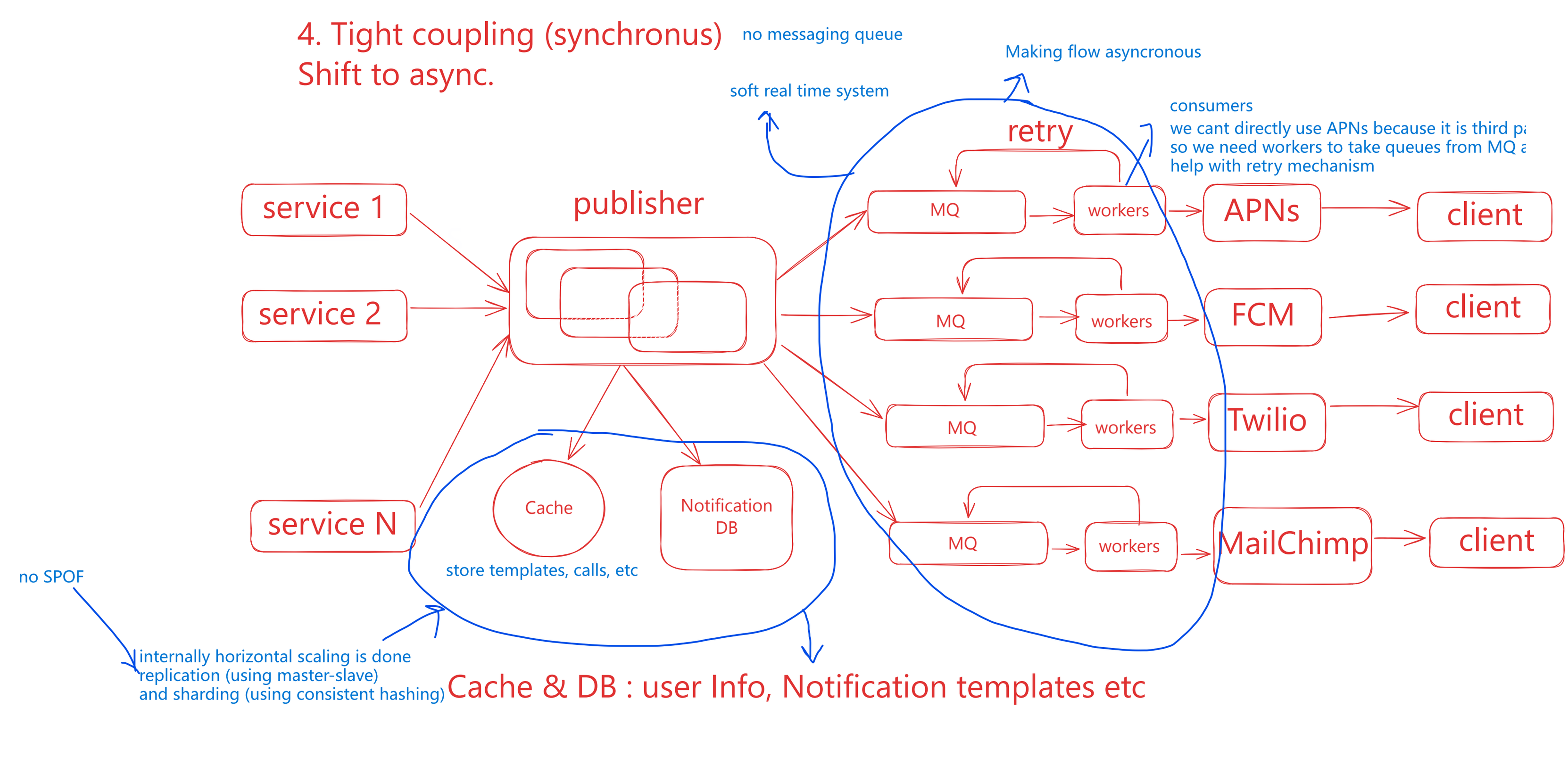
Problems(issues) with initial design:

1. SPOF (Single Point of Failure) — notification server
I need to scale the Notification server.

2. hard to scale :

3. Retry mechanism missing.

4. Tight coupling (synchronus) — no messaging queue
Shift to async.



Cache & DB : user Info, Notification templates etc

MQ : Removed dependency bw 3rd party APIs and our notification server. Sevice is now Async

Improvements:
1. Notification Templates
2. Notification settings on user level :
   user can turn on/off a particular type of notification
3. Rate Limiting
4. API authentication
5. Monitoring Logic — to fetch all notifications and delete it time to time in DB
6. Notification Log.