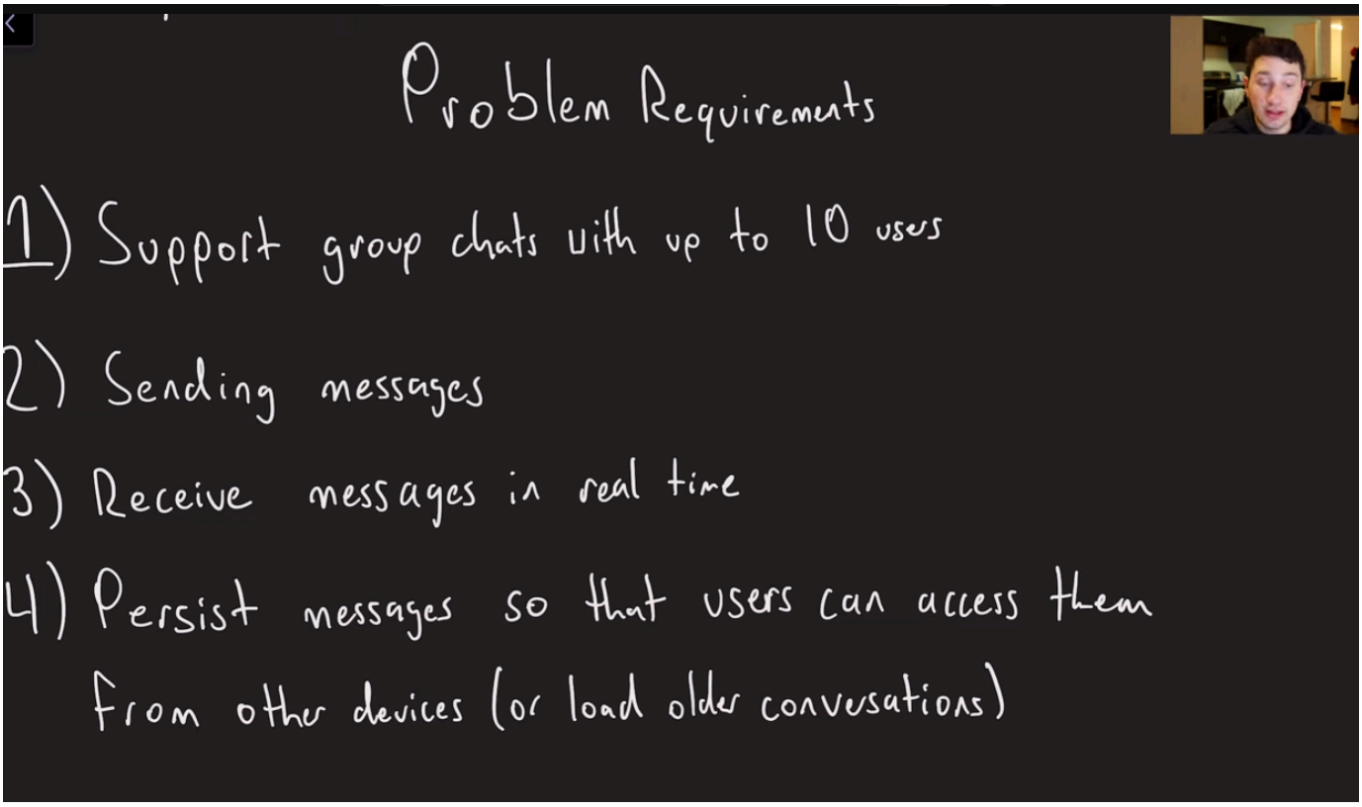
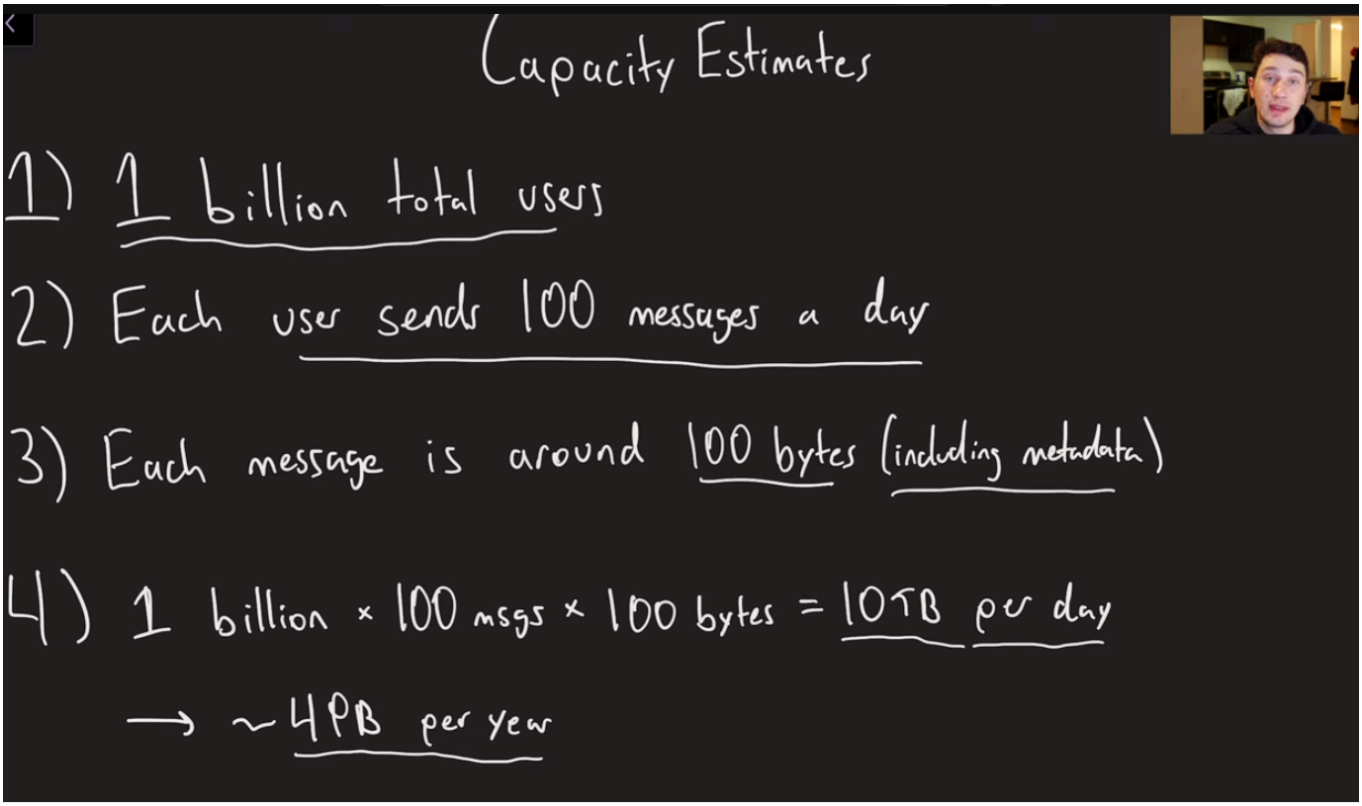
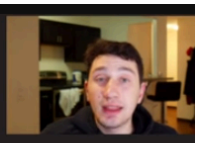
FacebookMessenger-Whatsapp





Chat Members Database



We should be able to fetch all chats for a given user

→ Recall left pane of initial diagram

→ Want all chatIds for given user to be on same shard, next to each other on disk

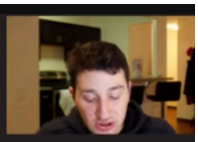
userId	chatId
3	12
3	19
10	12
10	65

index + partition key

→ To avoid causal dependency write conflict of adding and removing a user from a chat, let's use single leader replication ↘ set CRDT?

→ This DB likely not a performance bottleneck, let's just use MySQL

Users Database



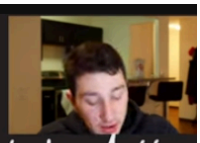
Schema → userId, email, passwordHash

Partition on userId

While this table will have a lot of rows, it is also unlikely to be a bottleneck as it will not be written to or read from nearly as much as our messages table will

→ For simplicity's sake, let's stick to MySQL again

Messages Table



We want to make sure that getting all the messages for a given chat is fast!

Schema: chatId (partition key), timestamp (sort key), message, metadata

2	1000	"Hiii"	From: Kate
2	1003	"Send Bobs"	From: Jordan

→ Messages for chat already on same partition and pre-sorted!

→ Timestamps ensure consistent ordering on all devices (order by TS on frontend)

↳ Distributed timestamps are unreliable, but does it matter?

Messages Database

What should we optimize for?

Reads → B-tree index, column oriented storage? (HBase)

→ read from one place → traverse tree

Writes → LSM tree index, leader less replication

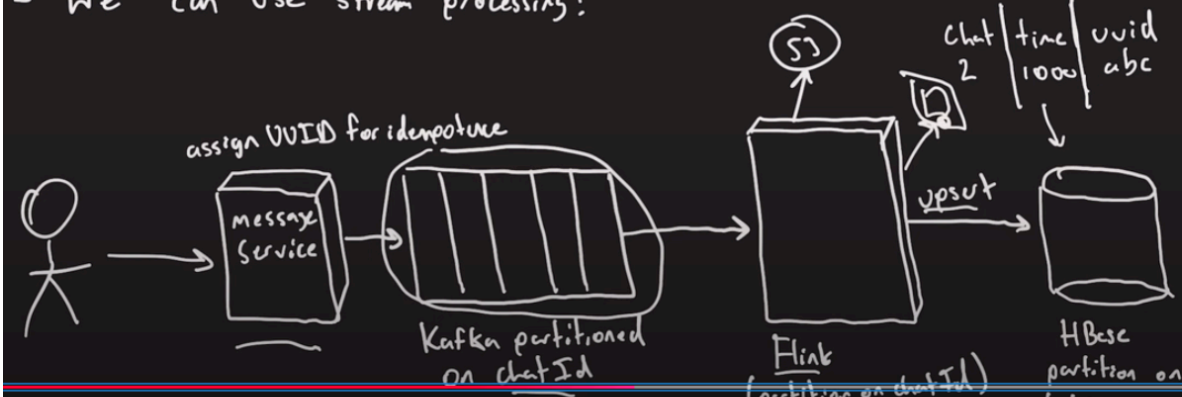
↳ Cassandra?

Maybe we can get the benefits of HBase without having to worry about write throughput!

Message Delivery

It would be great to be able to read messages from HBase while being able to quickly ingest them in our system!

→ We can use stream processing!



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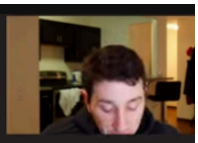
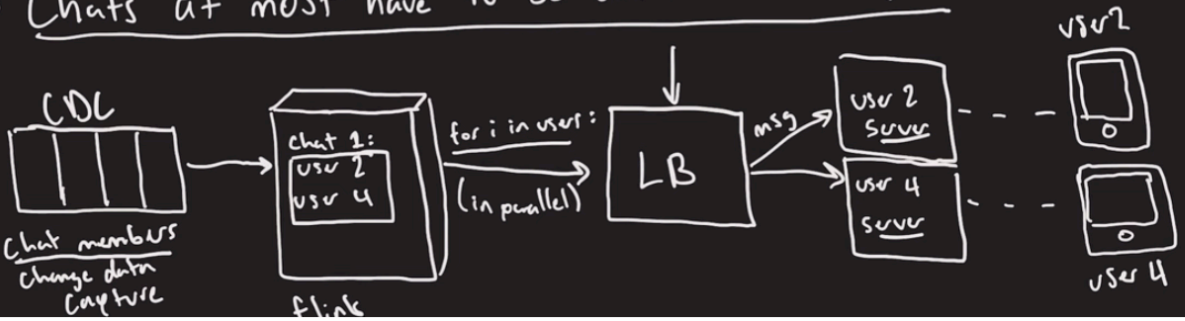
Message Routing



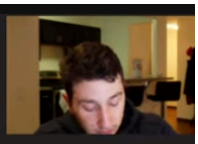
To minimize load on client devices we want them to maintain as few active connections as possible

→ Each user can just maintain a connection with one chat server

→ Chats at most have to be sent to 10 different places



Connection to Chat Servers

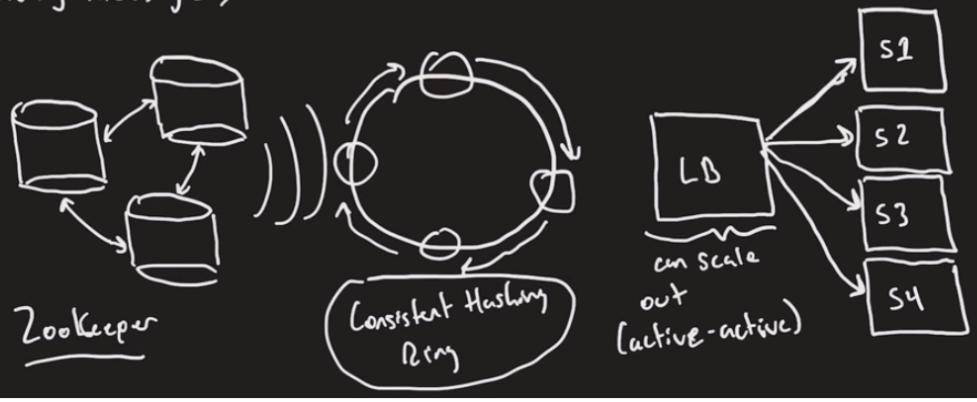


We need to reliably know the function to connect a given userId to a Server for:

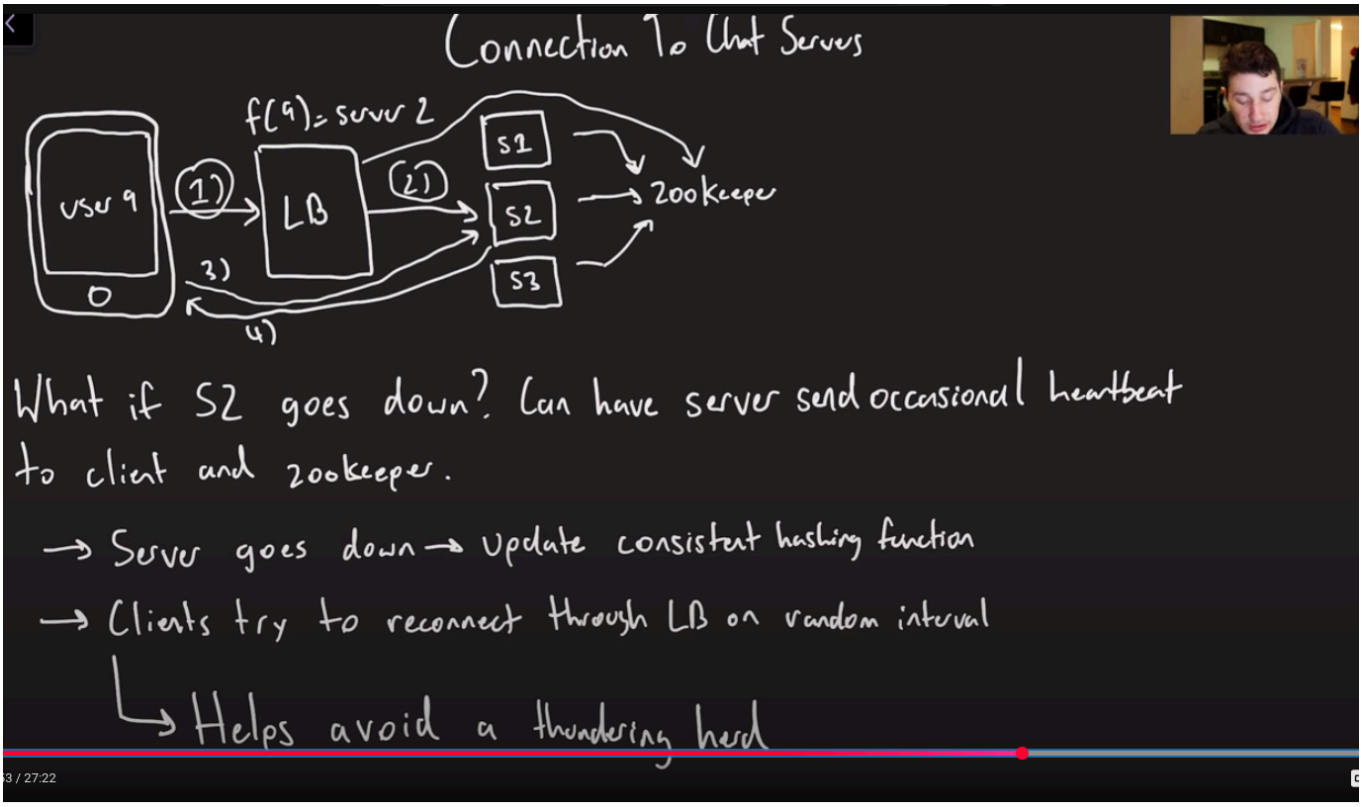
f(userId)

→ Sending messages
→ Receiving messages

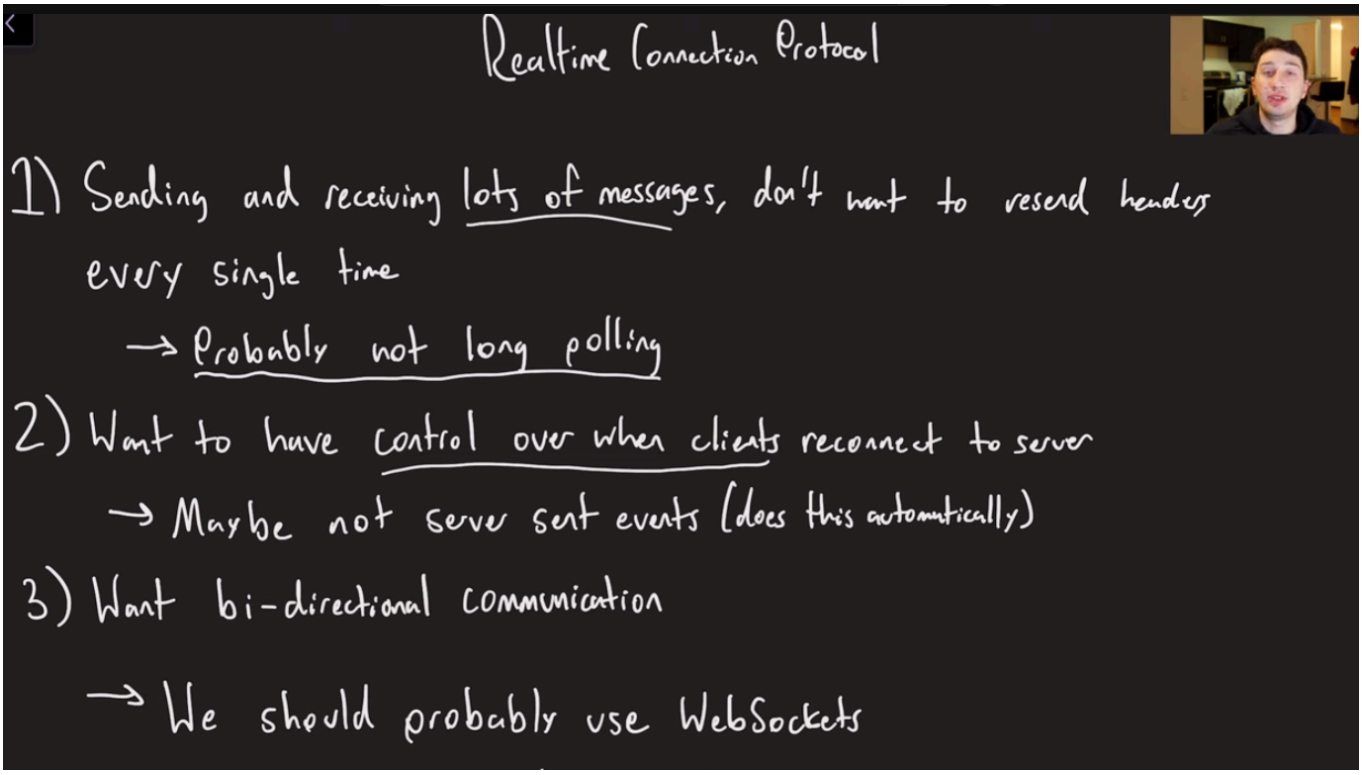
} allows us to use BiDirectional realtime communication!

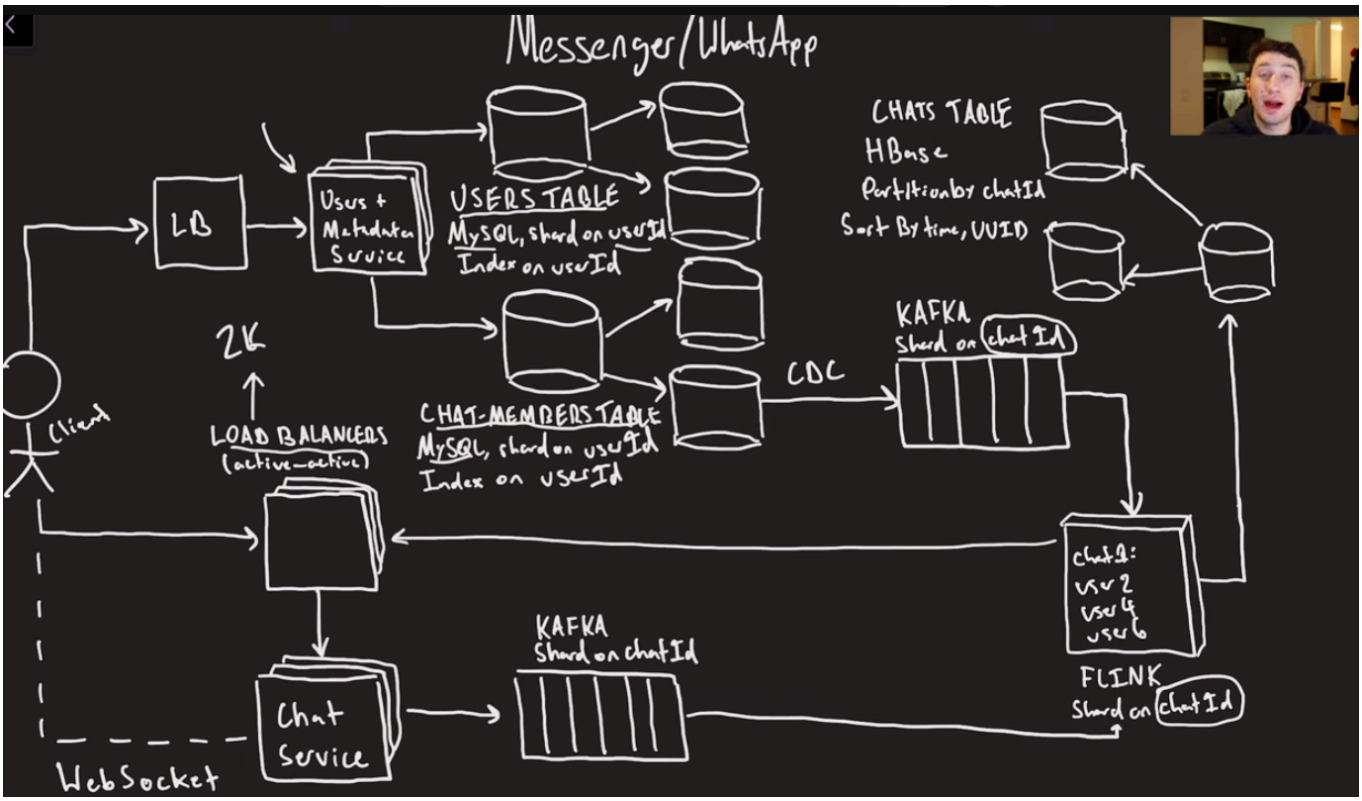


the load balancers will lsiten to zookeeper



thundering herd problem-https://medium.com/@venkteshsubramaniam/the-thundering-herd-distributed-systems-rate-limiting-9128d20e1f00
https://www.linkedin.com/pulse/stop-thundering-herd-problem-before-starts-mulualem-eshetu-16jfe/
https://encore.dev/blog/thundering-herd-problem#the-thundering-herd-problem





If a user need to write a message it would send to the webSocket server which would contact kakfa which is sharded on chatId , kafka will contact flink which is also sharded on chatId and get all of the users in that chat,
then flink will again contact the loadbalancers and get the servers for it to connect to and send the messages to those servers .the servers will then look at its local webSocket connections and send messages.