Database Scaling Patterns

Step by Step Scaling

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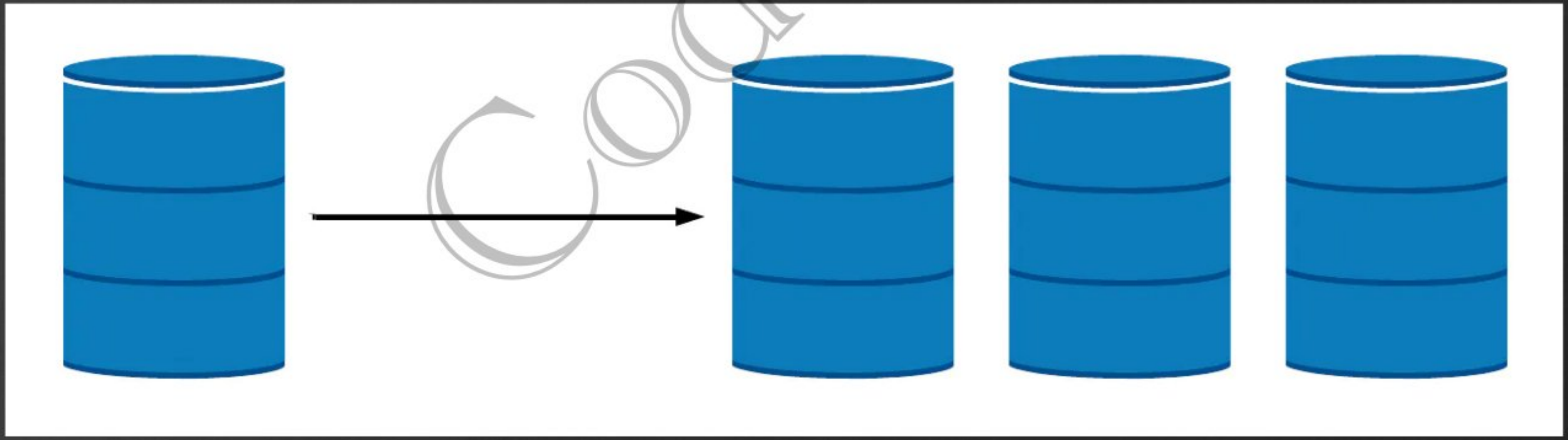
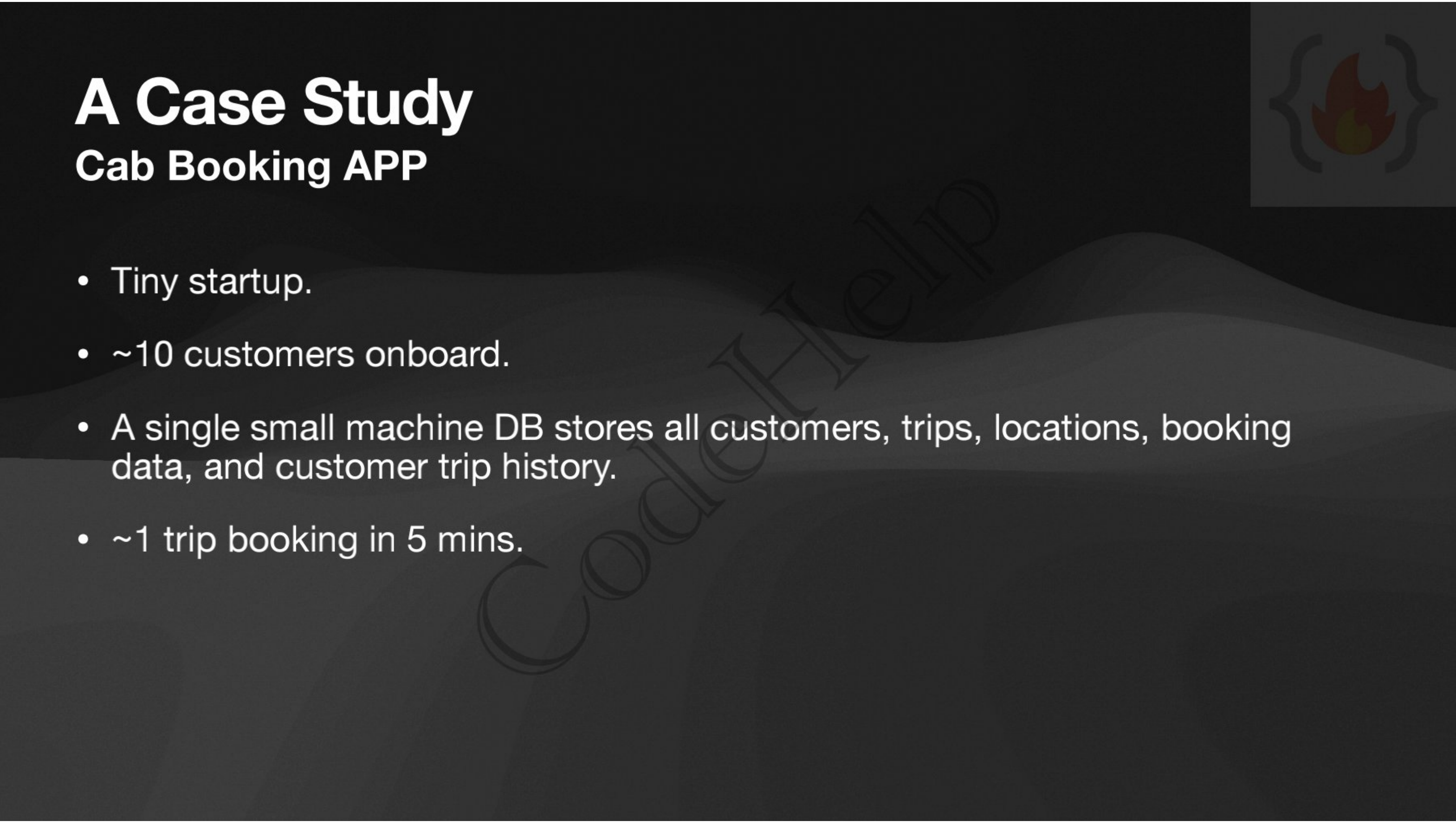
What will you learn?

- Step by Step manner, when to choose which Scaling option.
- Which Scaling option is feasible practically at the moment.





A Case Study

Cab Booking APP

- Tiny startup.
- ~10 customers onboard.
- A single small machine DB stores all customers, trips, locations, booking data, and customer trip history.
- ~1 trip booking in 5 mins.

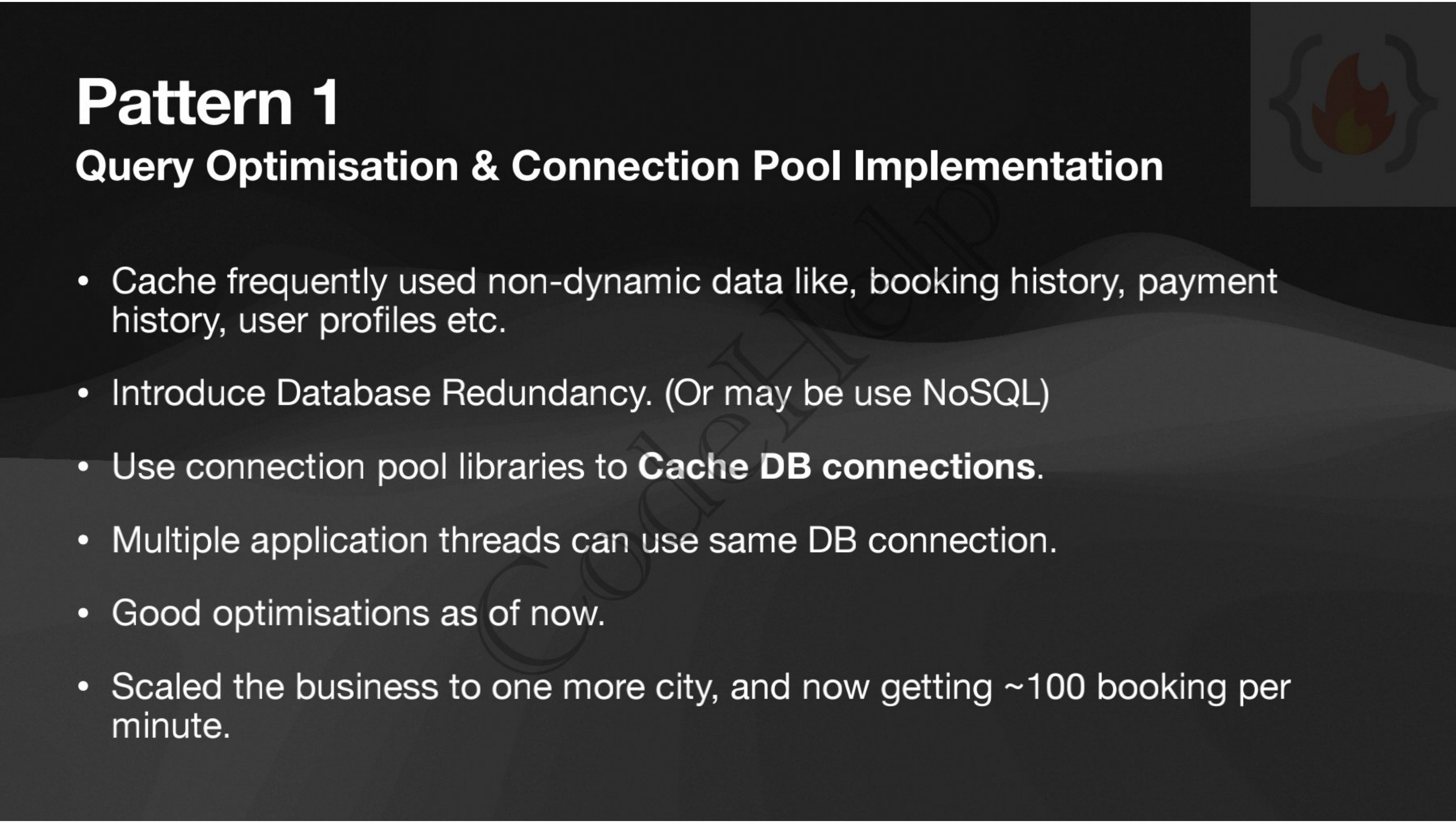
Your App becoming famous, but…

The PROBLEM begins

- Requests scales upto 30 bookings per minute.
- Your tiny DB system has started performing poorly.
- API latency has increased a lot.
- Transactions facing Deadlock, Starvation, and frequent failure.
- Sluggish App experience.
- Customer dis-satisfaction.

Is there any solution?

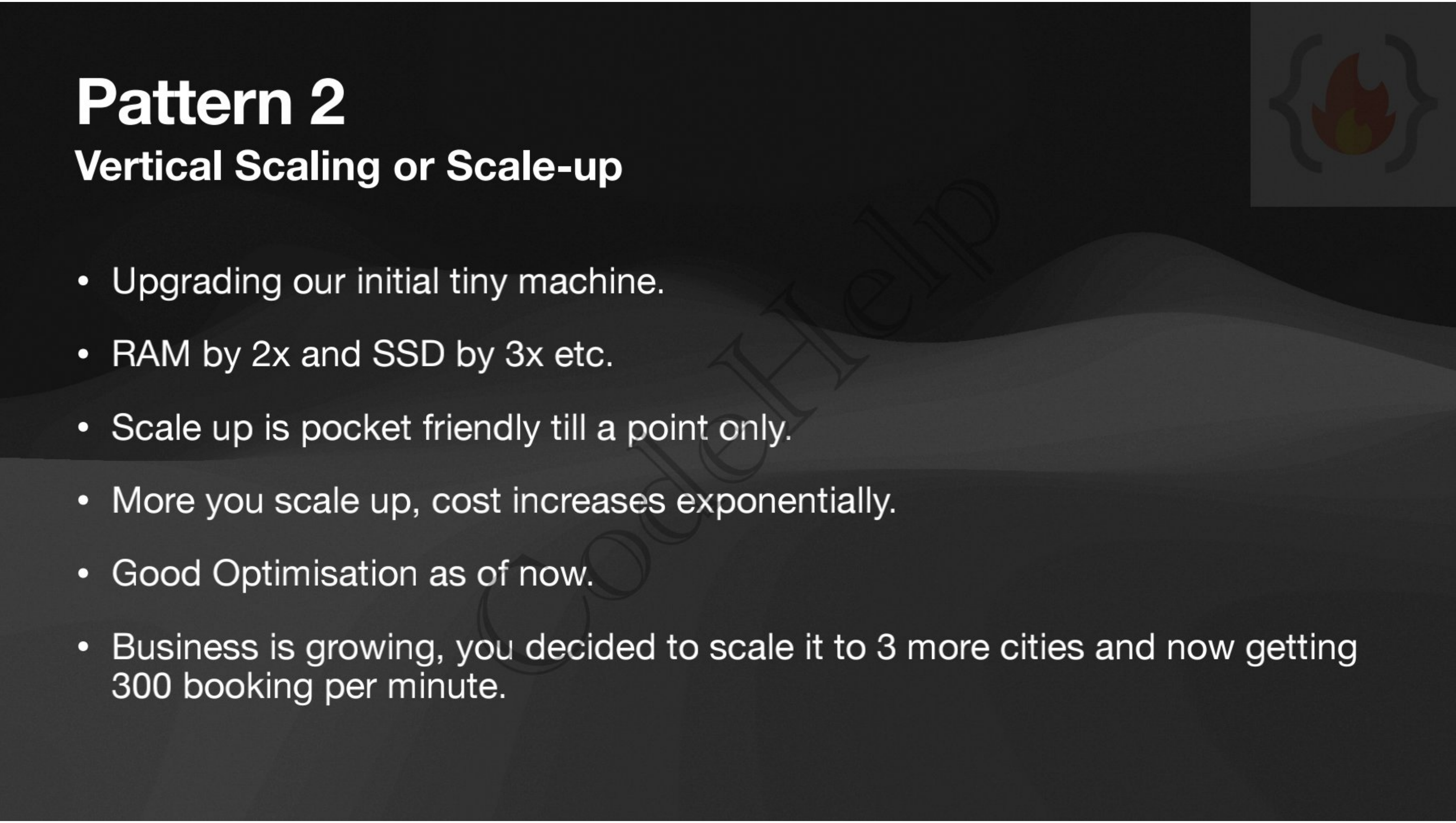
- We have to apply some kind of performance optimisation measures.
- We might have to scale our system going forward.



Pattern 1

Query Optimisation & Connection Pool Implementation

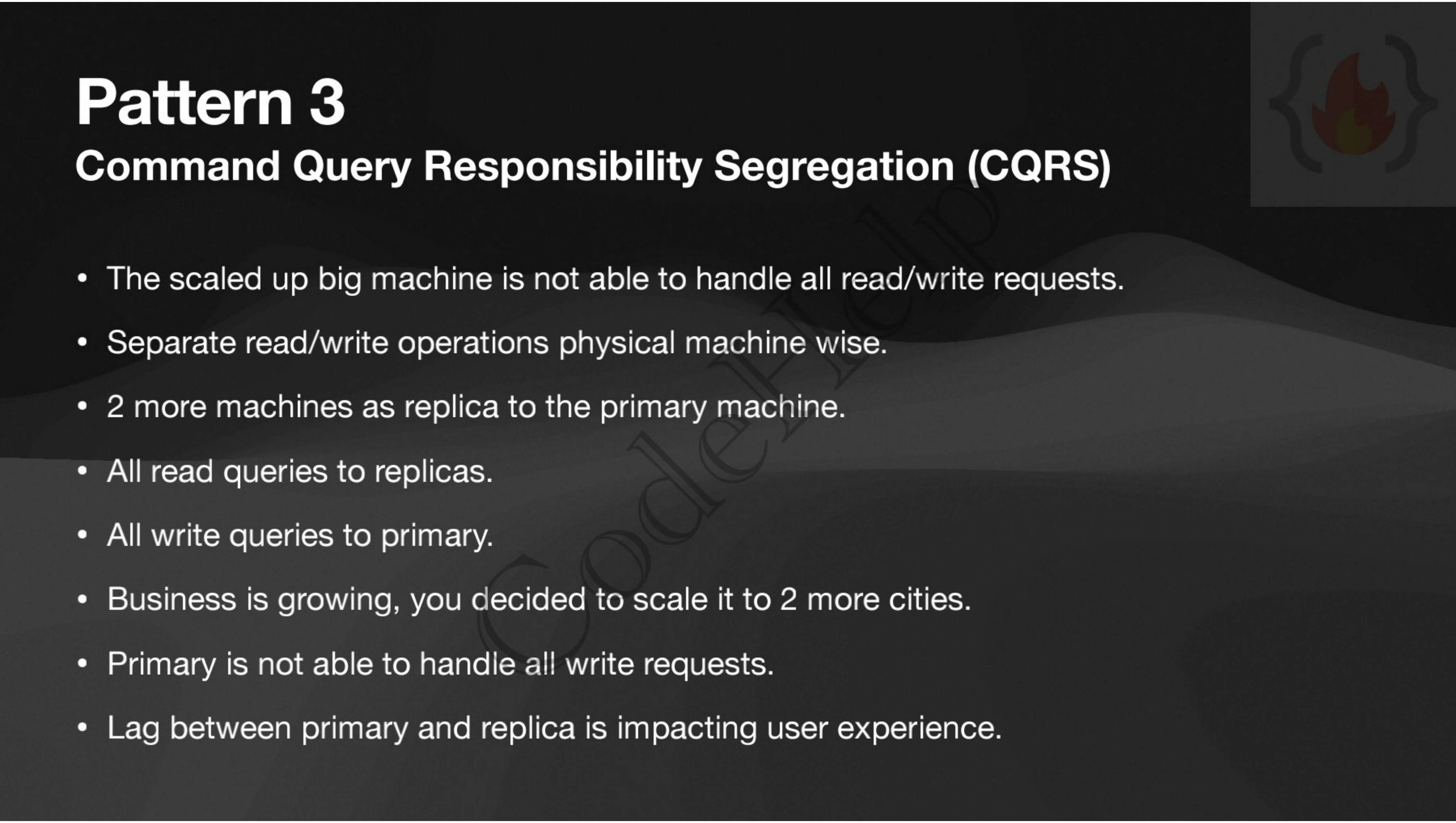
- Cache frequently used non-dynamic data like, booking history, payment history, user profiles etc.
- Introduce Database Redundancy. (Or may be use NoSQL)
- Use connection pool libraries to **Cache DB connections**.
- Multiple application threads can use same DB connection.
- Good optimisations as of now.
- Scaled the business to one more city, and now getting ~100 booking per minute.



Pattern 2

Vertical Scaling or Scale-up

- Upgrading our initial tiny machine.
- RAM by 2x and SSD by 3x etc.
- Scale up is pocket friendly till a point only.
- More you scale up, cost increases exponentially.
- Good Optimisation as of now.
- Business is growing, you decided to scale it to 3 more cities and now getting 300 booking per minute.



Pattern 3

Command Query Responsibility Segregation (CQRS)

- The scaled up big machine is not able to handle all read/write requests.
- Separate read/write operations physical machine wise.
- 2 more machines as replica to the primary machine.
- All read queries to replicas.
- All write queries to primary.
- Business is growing, you decided to scale it to 2 more cities.
- Primary is not able to handle all write requests.
- Lag between primary and replica is impacting user experience.

Pattern 4

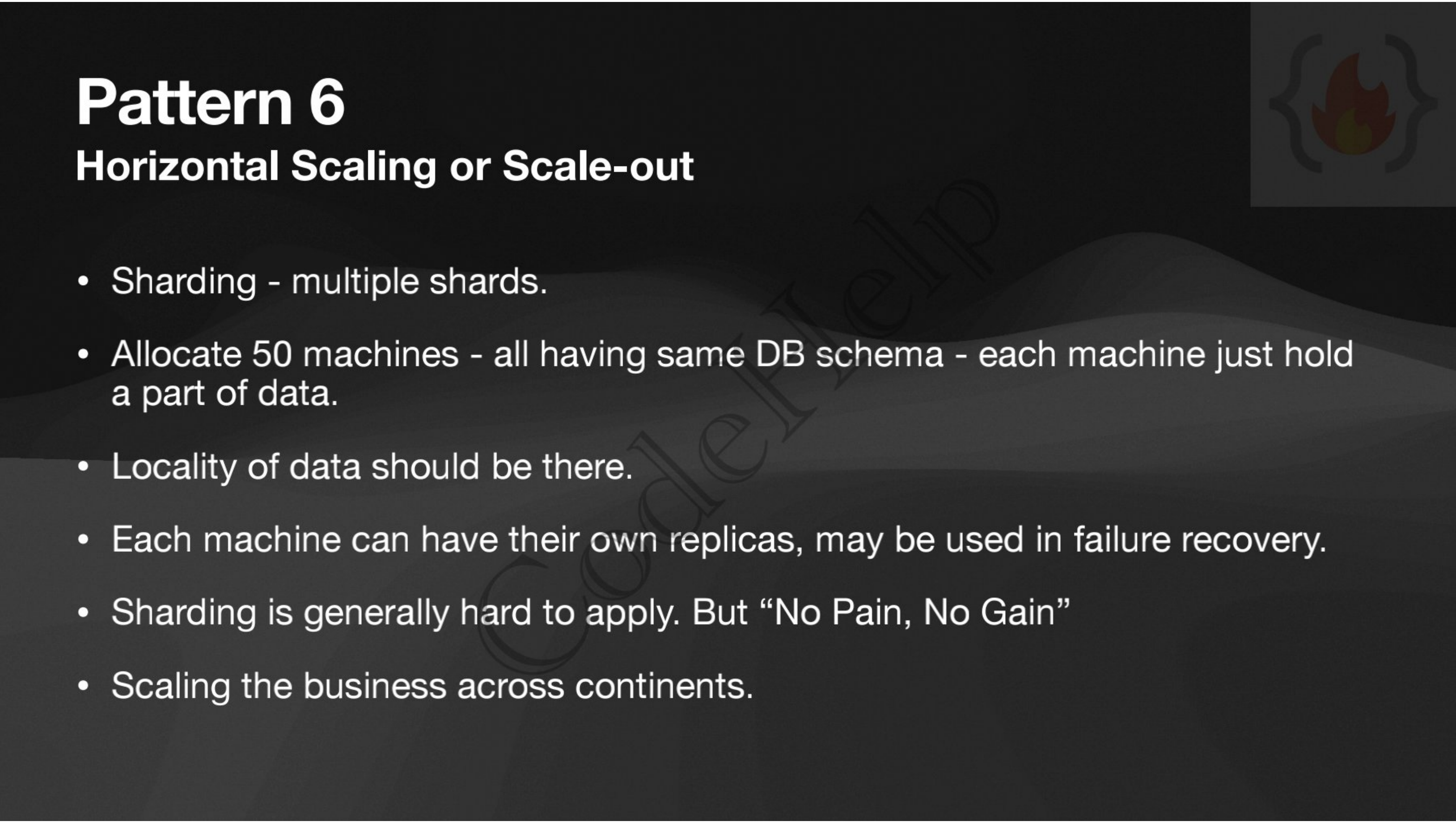
Multi Primary Replication

- Why not distribute write request to replica also?
- All machines can work as primary & replica.
- Multi primary configuration is a logical circular ring.
- Write data to any node.
- Read data from any node that replies to the broadcast first.
- You scale to 5 more cities & your system is in pain again. (~50 req/s)

Pattern 5

Partitioning of Data by Functionality

- What about separating the location tables in separate DB schema?
- What about putting that DB in separate machines with primary-replica or multi-primary configuration?
- Different DB can host data categorised by different functionality.
- Backend or application layer has to take responsibility to join the results.
- Planning to expand your business to other country.



Pattern 6

Horizontal Scaling or Scale-out

- Sharding - multiple shards.
- Allocate 50 machines - all having same DB schema - each machine just hold a part of data.
- Locality of data should be there.
- Each machine can have their own replicas, may be used in failure recovery.
- Sharding is generally hard to apply. But “No Pain, No Gain”
- Scaling the business across continents.

Pattern 7

Data Centre Wise Partition

- Requests travelling across continents are having high latency.
- What about distributing traffic across data centres?
- Data centres across continents.
- Enable cross data centre replication which helps disaster recovery.
- This always maintain Availability of your system.
- Now, Plan for an IPO :p