Overview

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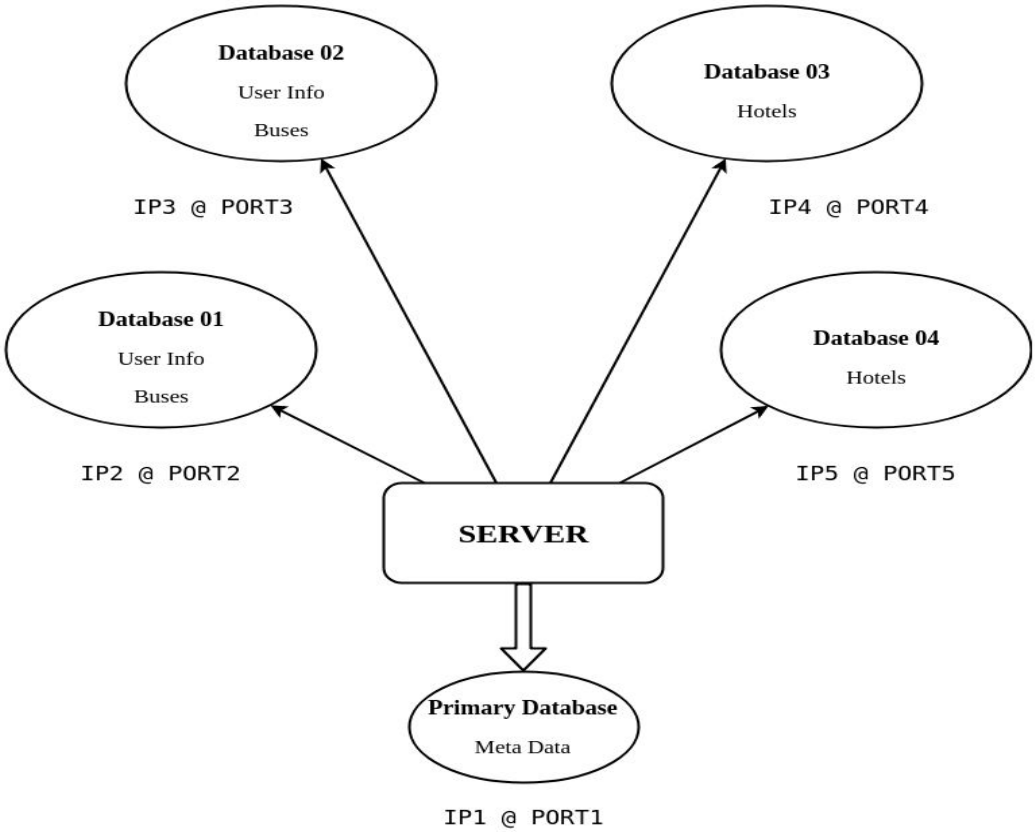
INTRODUCTION

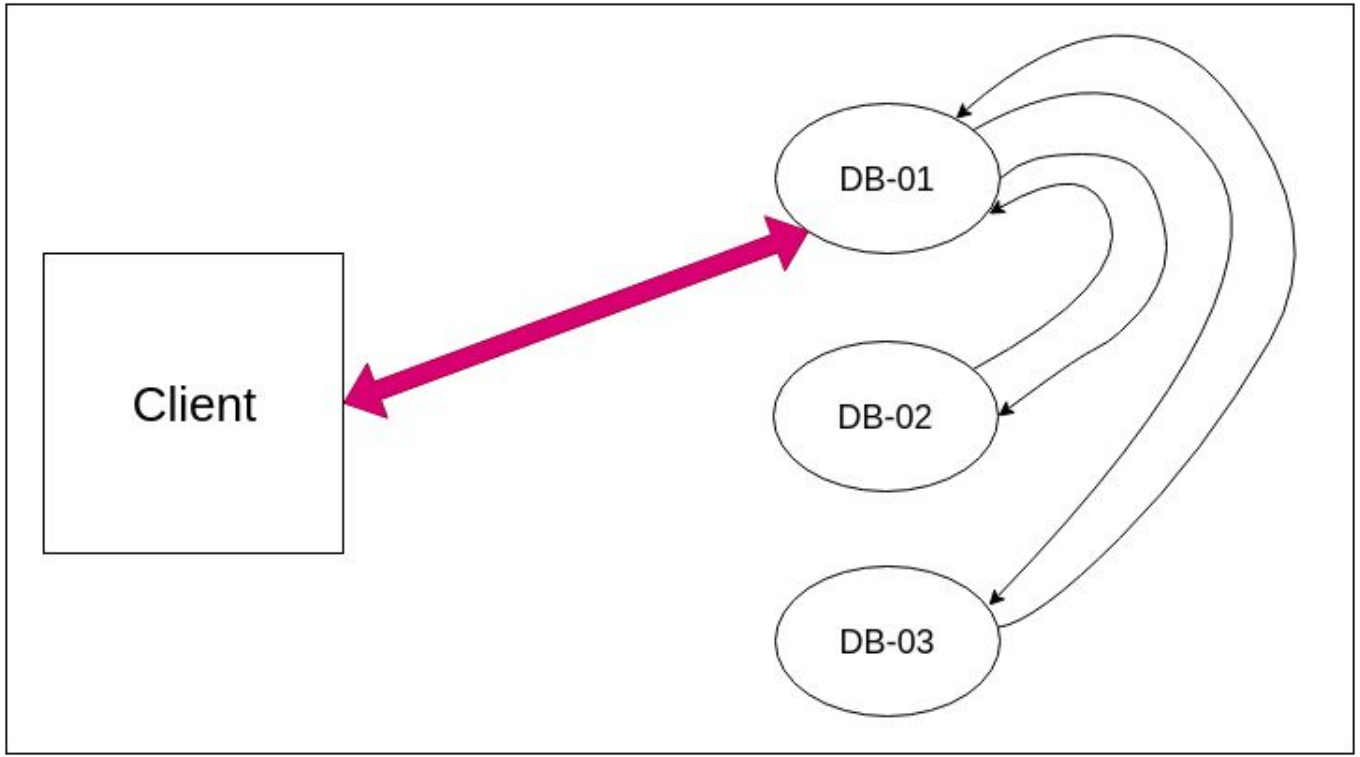
- Distributed Storage
  - Do not store all data at one place
  - Reliable
  - Fault tolerance?
  - Transparency

- Architecture
  - Master Slave - Master contains metadata
  - Integrated with Google File System architecture
  - Primary and Secondary Data Servers
  - Replication (3)

ARCHITECTURE



ARCHITECTURE



ASSUMPTIONS and DETAILS

- The master server never crashes (single point failure)
- More than 2 servers are never down at any point of time (replication = 3)
- Transaction handling is out of scope for this project
- There may be a finite delay in message requests
- There are no permanent crashes
- There are atleast 3 databases available (active) at any point of time
- Primary server may not crash while waiting for response

- There is a single master server and 8 data servers
- Heartbeat rate can be changed by the admin
- New databases can be added only by the superuser
- Replication factor is set to 3, i.e 3 copies of any data are stored.

Handling Writes

- Request received at master:
  - Master forwards the request until 3 data servers respond positive
  - Assign “primary” to one of the 3 servers and “secondary” to the other 2
  - Returns status = 200 OK (positive) to the client

- Request received at active data server:
  - Request forwarded by master
  - Write data
  - Respond status = 200 OK to the master, if successful
  - Respond status = 404 BAD REQUEST (or any other relevant status), if unsuccessful

Handling Updates

- Request received at master:
  - Figure out the primary database and secondary databases
  - If primary is not active, make any of the active secondary server primary
  - Forward update request to the primary and wait for response

- Request received primary server:
  - Write data
  - Forward the request to the secondary servers
  - Return relevant response
    - All OK
    - Any DB not updated?

Handling Updates

- Request received at secondary servers:
  - Write data
  - Return response to primary

- Response received at Master:
  - Check if any DB not updated
  - Add request to “Pending Requests” corresponding to the crashed DB
  - Return relevant response

Handling Reads

- Request received at master server:
  - Forward request one after another to all active databases (or just 3, depends on the situation)
  - Return as soon as any one responds

- Request received at Data Server:
  - Return status along with requested data

Failures

- Primary data server may not crash while waiting for response (Assumption)

- Consider the following situations:

MASTER

1. Make sure primary is active
2. Forward update request to primary

What if primary crashed in between 1 and 2?

MASTER

Heartbeat rate = 30 seconds

1. T = 0, hearbeat detects primary data server alive
2. T = 5, primary data server fails
3. T = 10, update request for a record where primary is the failed server
4. Next heartbeat at t = 30

IN BOTH CASES, USER RECEIVES A MESSAGE - “Internal Error”

HeartBeat

- A parallel thread manages heartbeat requests along with the running master server
- Sends request to all registered data servers and marks their status
- HeartBeat rate can be set by the admin
- Recommended to have heartbeat below 10 seconds, else user has to wait long to update data (receives Internal Error)

Tools Used

1) Front End : HTML, CSS (Bulma UI), Javascript
2) Back -End : Python Django
3) Database : Postgres SQL

Thank You