A Quick Overview of

Server Side Caching Strategy

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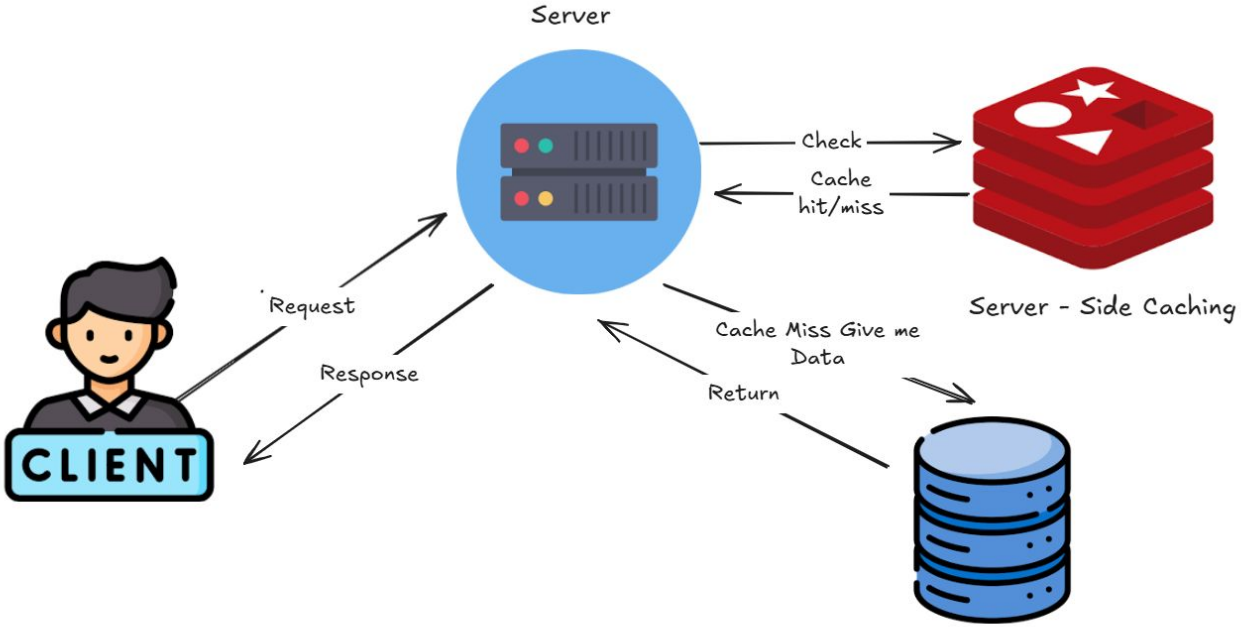
What is Server Side Caching?



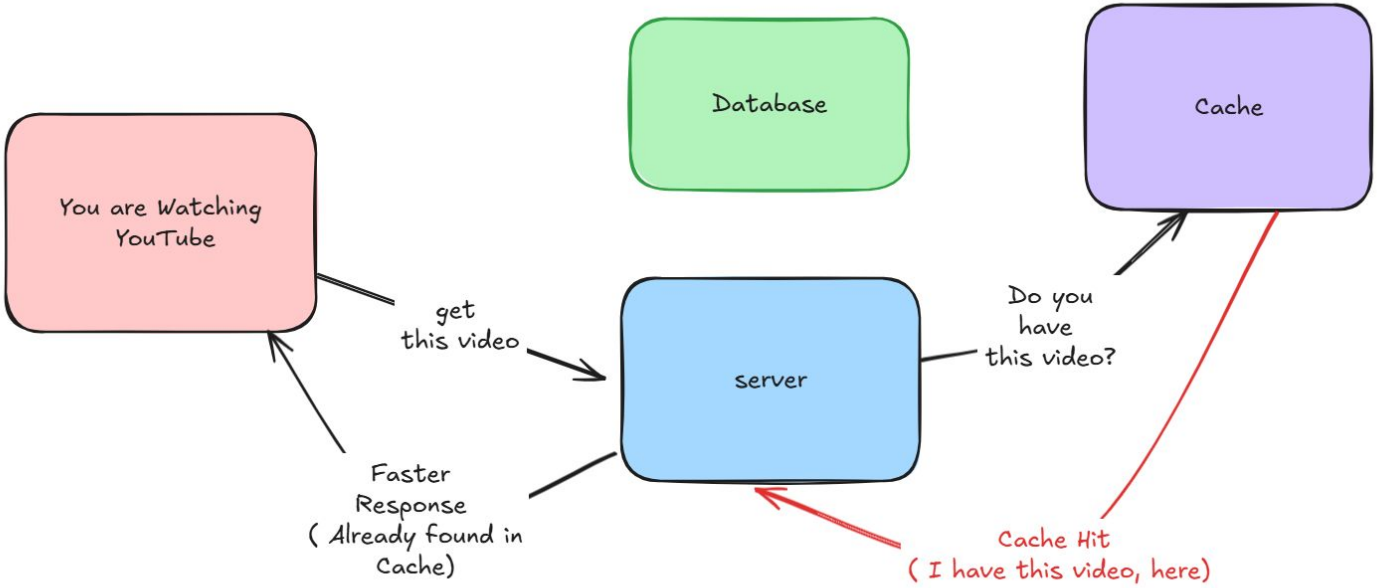
Server-side caching generally refers to the cache layer positioned between the server's application logic and the database.

What is Cache Hit & Cache Miss?

What is Cache Hit?

- Requested data is already stored in the cache
- The cache quickly returns the data without needing to fetch it from the original source, saving time and resources.

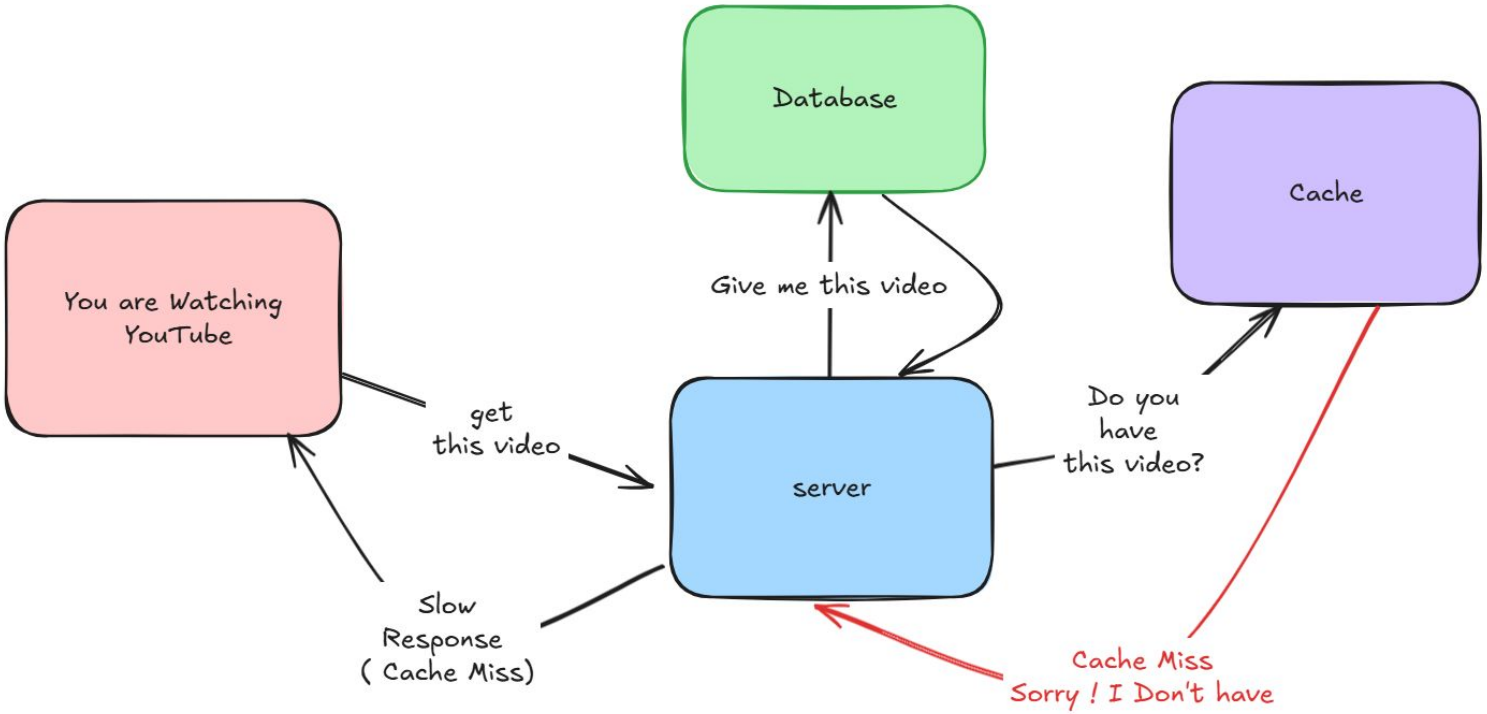
What is Cache Hit?



What is Cache Miss?

- Requested data **is not stored** in the cache
- The system fetches the data from the original source (like a database or server), which takes more time.

What is Cache Miss?

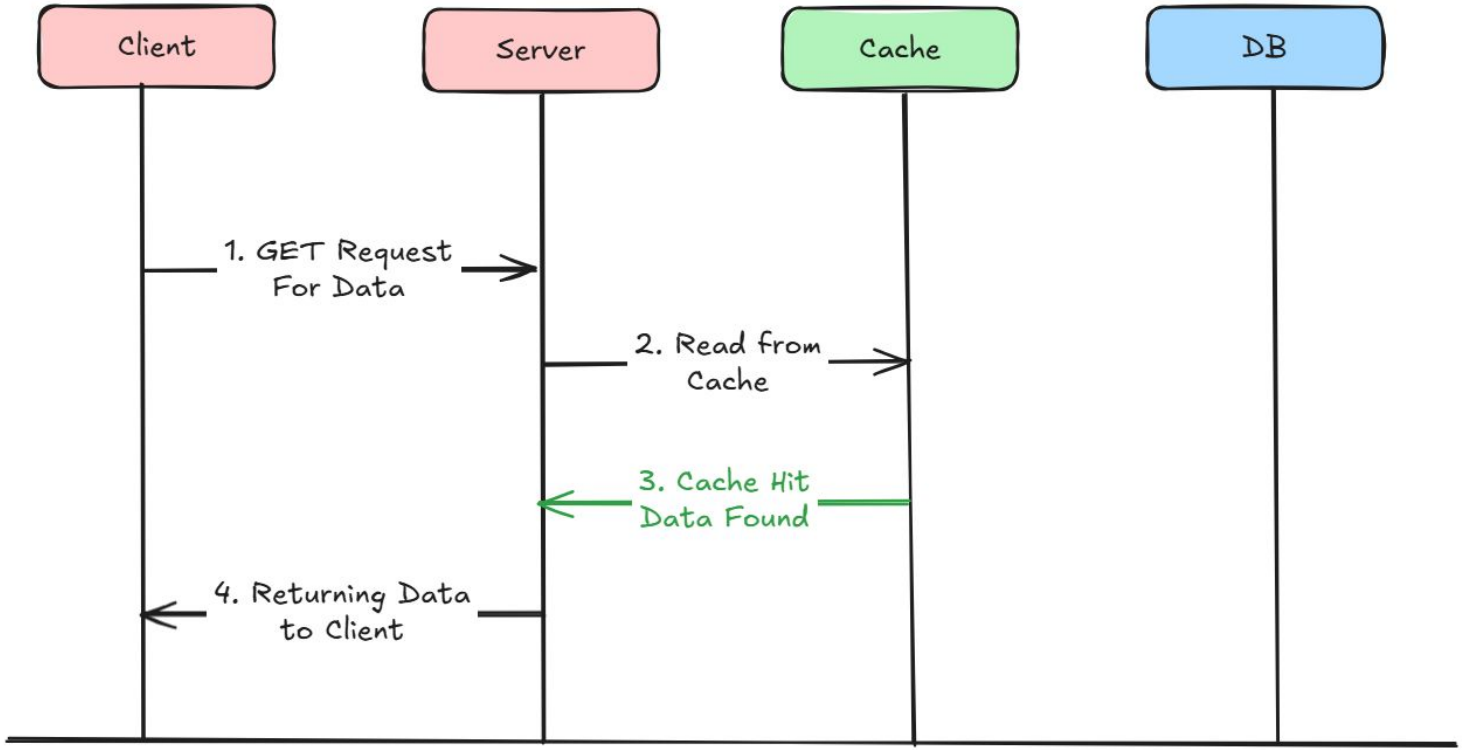


Cache Aside Caching Strategy

Cache Aside Strategy

- First check cache for data
- Cache Hit ! Return data to Client
- Cache Miss !
  - Server Fetch data from DB
  - Store data in Cache
  - Return data to client

What happens in Cache Hit?



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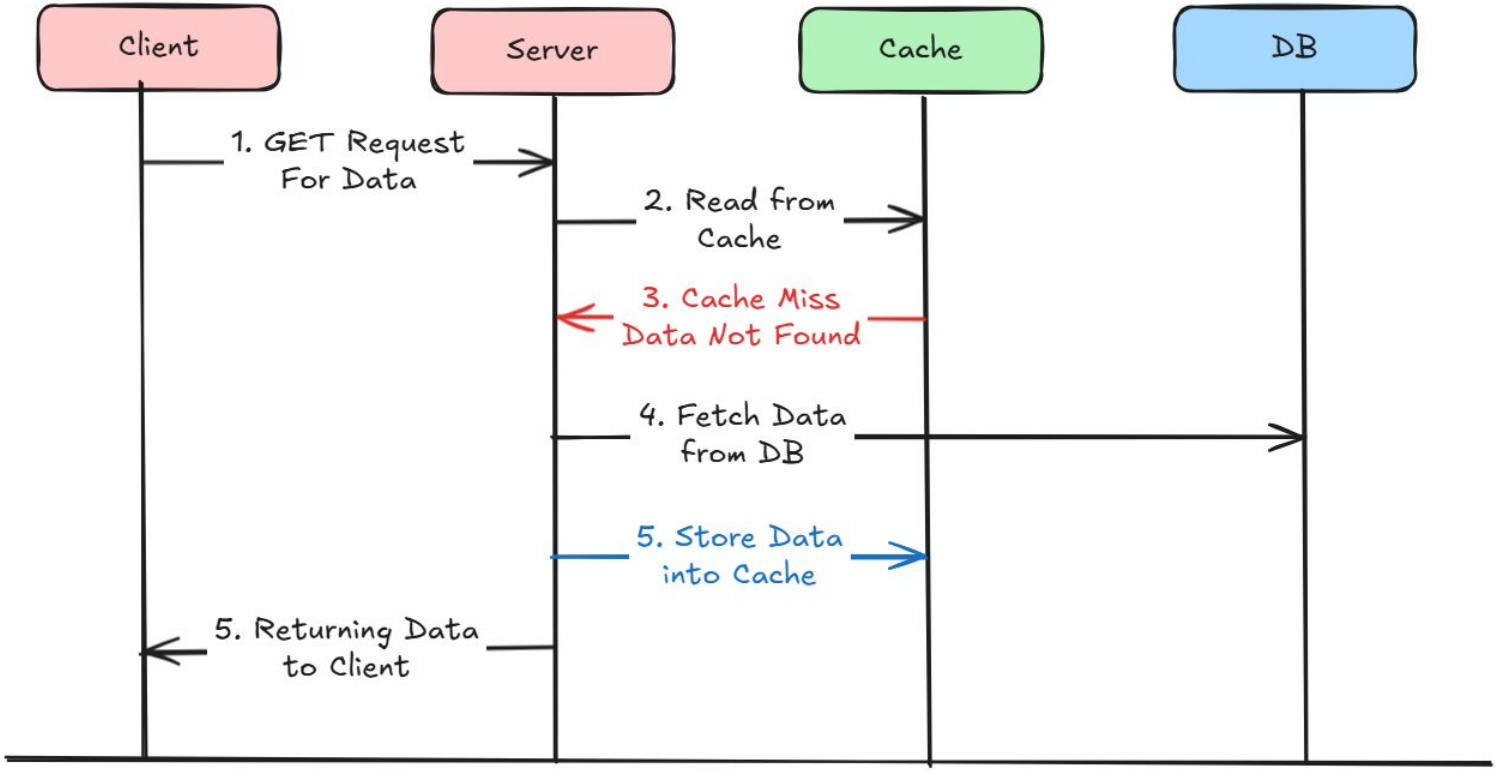

Cache Aside : Advantages

- Good Approach for Heavy Read applications
- Even Cache is down, request will not fail, It will directly fetch from data.
- Cache document data structure can be different that data present in DB

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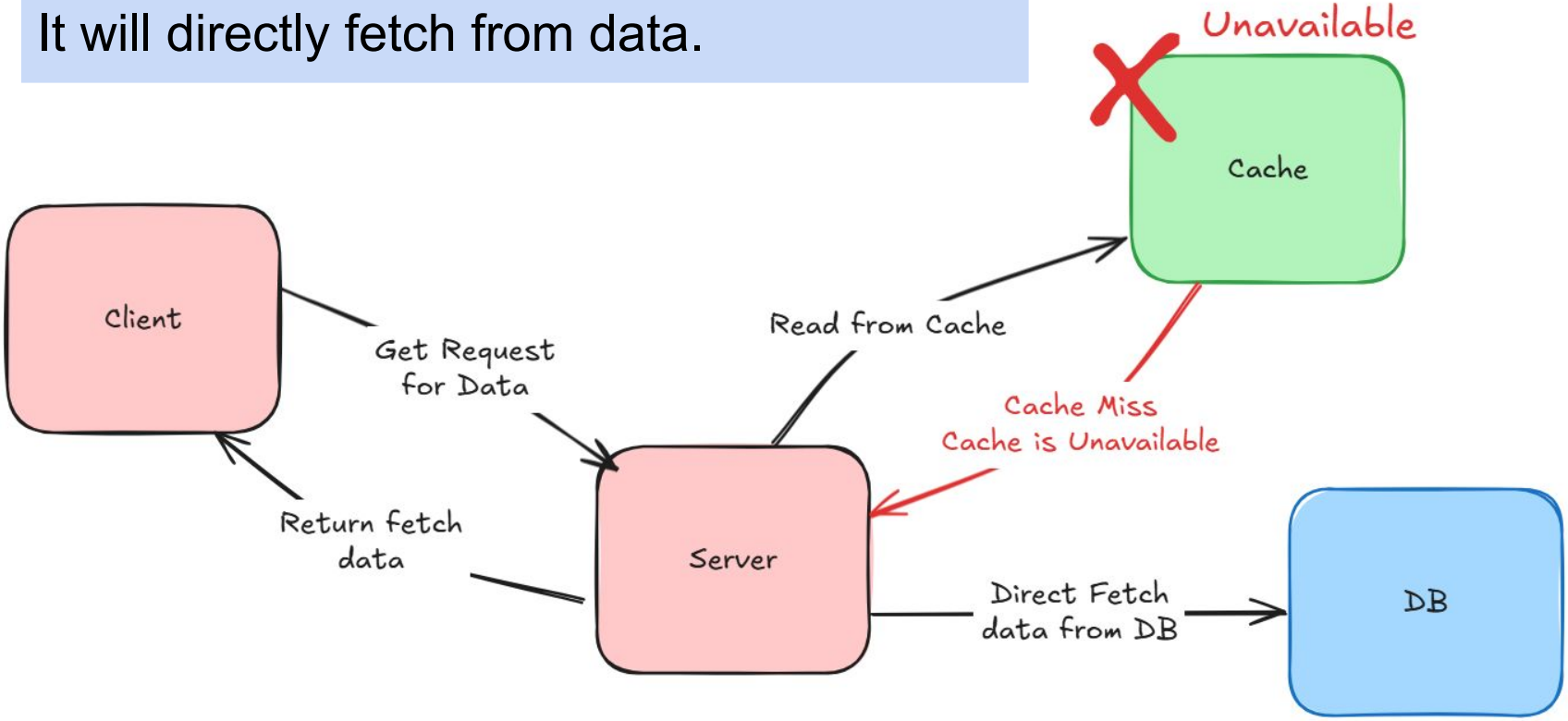

Cache document data structure can be different that data present in DB

```sql
CREATE TABLE Users (
    UserID INT PRIMARY KEY,
    Name VARCHAR(255),
    Email VARCHAR(255),
    Phone VARCHAR(15)
);
CREATE TABLE Posts (
    PostID INT PRIMARY KEY,
    UserID INT,
    Content TEXT,
    FOREIGN KEY (UserID) REFERENCES Users(UserID)
);
```

Database (Structured for Storage)

```json
{
  "UserID": 1,
  "Name": "John Doe",
  "Email": "john.doe@example.com",
  "RecentPosts": [
    {
      "PostID": 101,
      "Content": "Hello, world!"
    },
    {
      "PostID": 102,
      "Content": "Loving the sunny weather today!"
    }
  ]
}
```

Cache (Optimized for Access)

Cache Aside : Cons

- Write Only Method will always directly write to DB
- For new data read, there will always be Cache - Miss first.
- If appropriate caching is not used during write operation, there is a chance of inconsistency between Cache and DB

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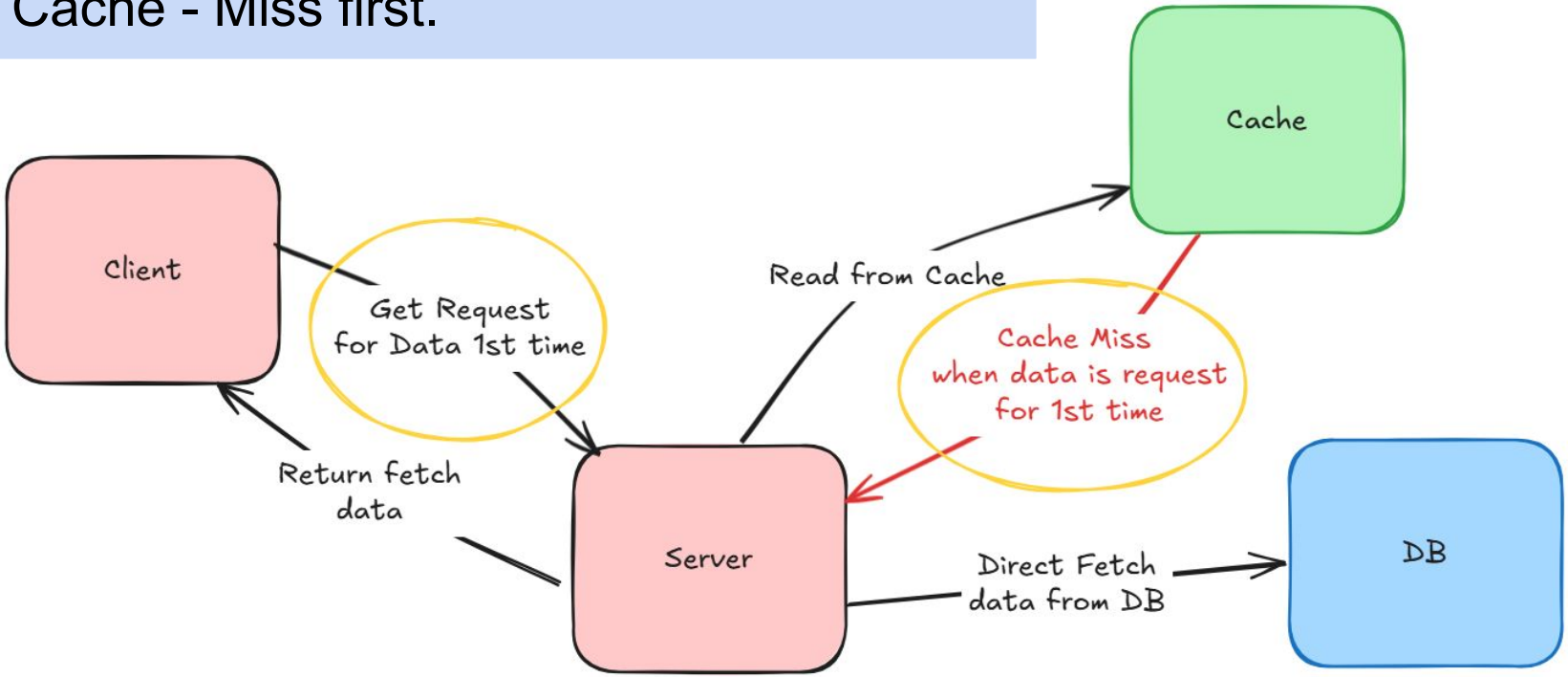
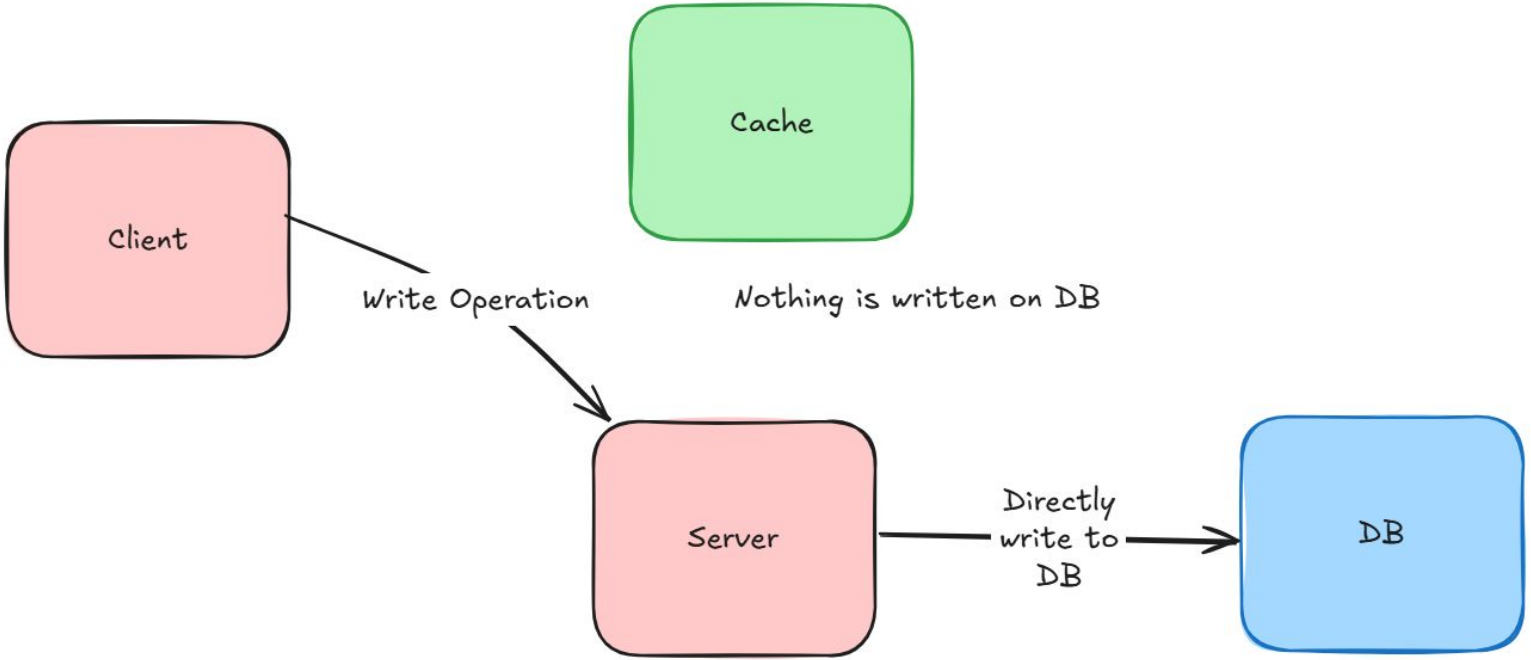


Write Only Method will always directly write to DB



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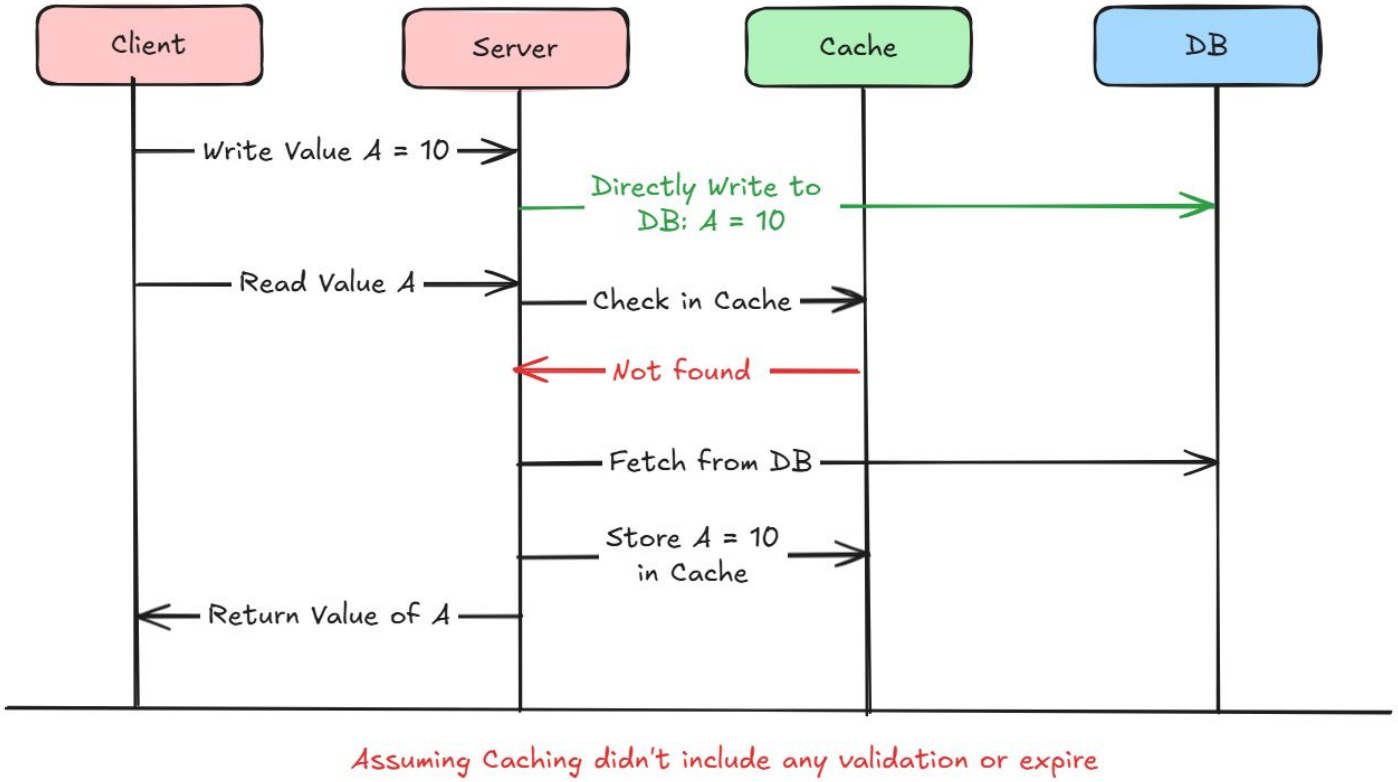

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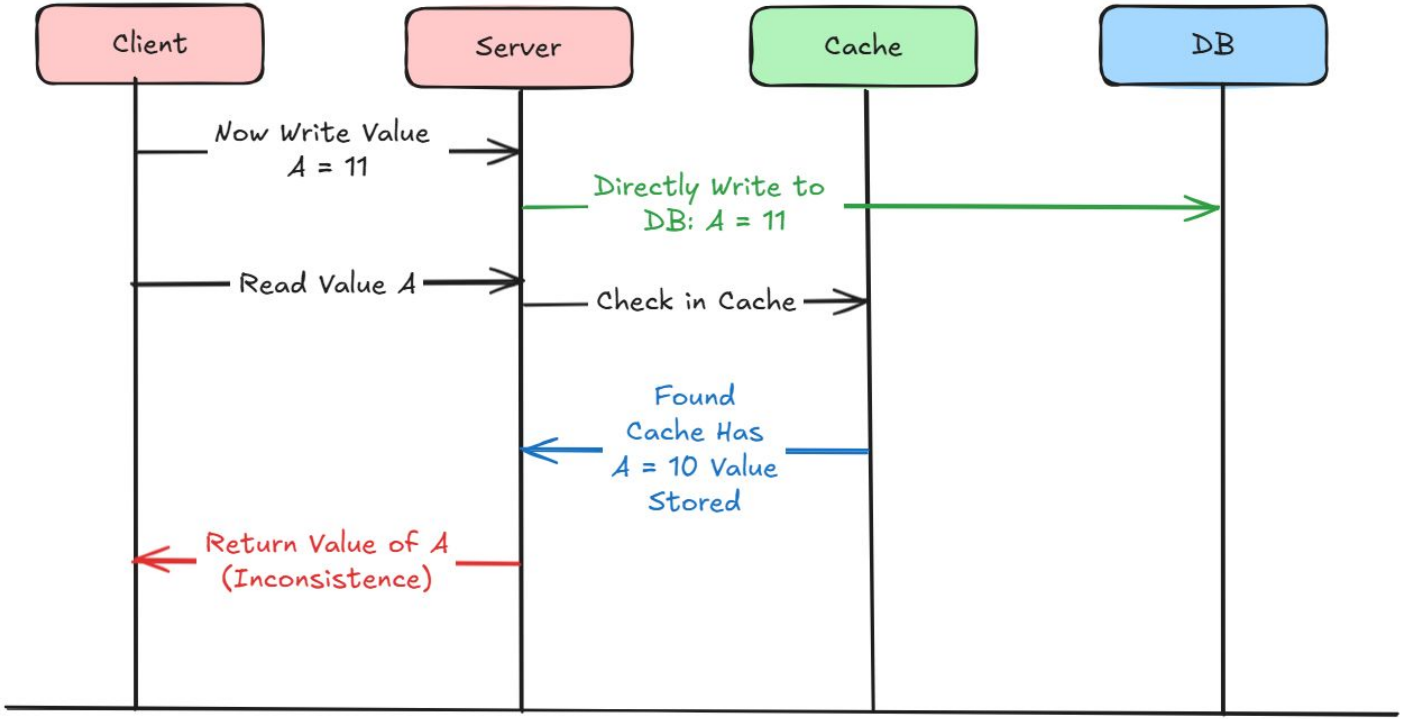
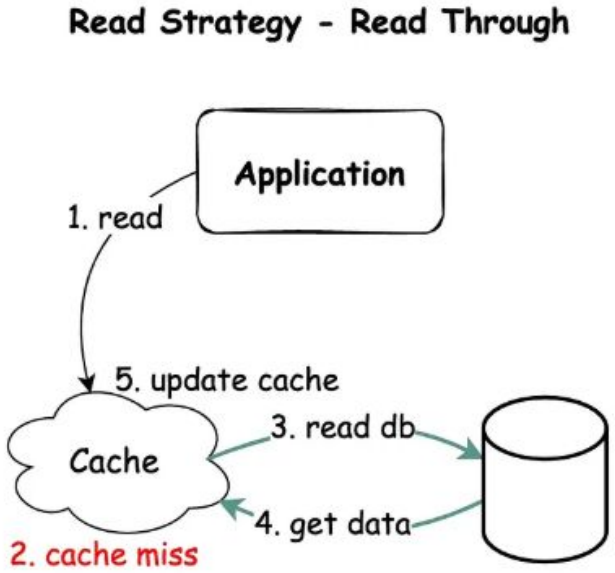


Assuming Caching didn't include any validation or expire

Read Through Caching Strategy

Read Through Strategy

- First check cache for data
- Cache Hit ! Return data to Client
- Cache Miss !
  - Fetch data from DB
  - Store data in Cache
  - Return data to server



What’s the difference then?

What's the difference then?

- If cache miss, **application or server** takes the responsibility
  - Fetch data from DB
  - Store data in Cache
  - Return it to Client

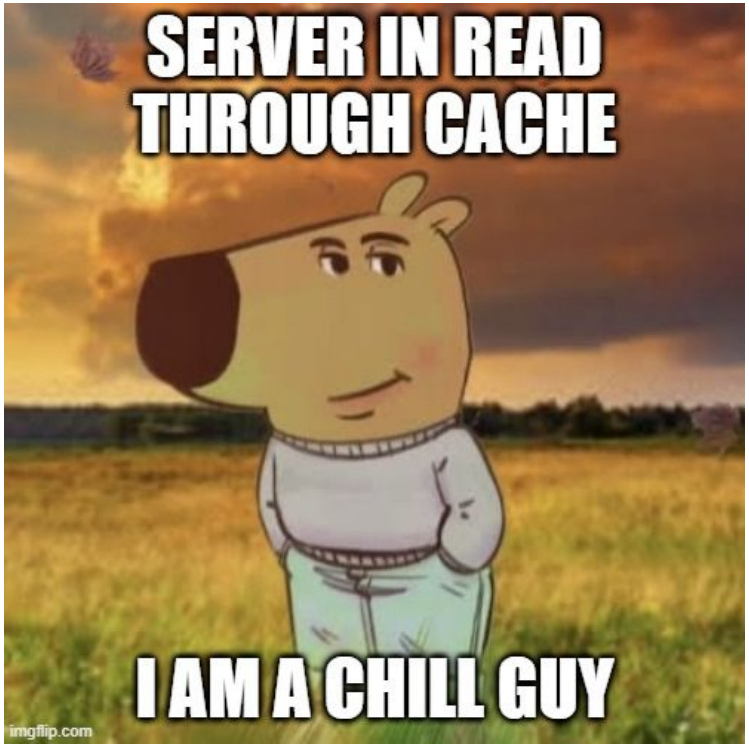
(Server has to do all of this task)

Cache Aside

- If cache miss, **cache library** takes the responsibility
  - Fetch data from DB
  - Store data in Cache
  - Return it to server

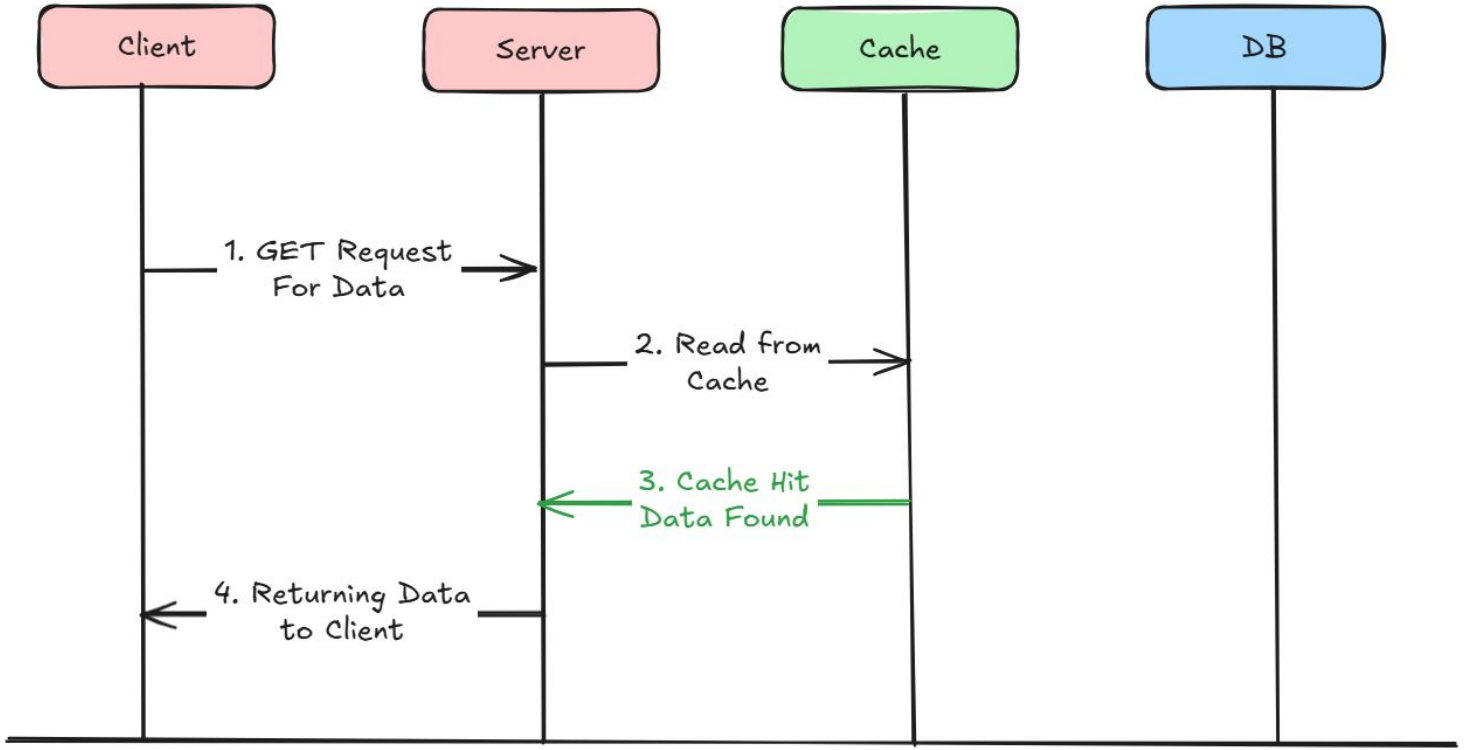
(Server has no tasks to do here)

Read Through


SERVER IN READ THROUGH CACHE
I AM A CHILL GUY
imgflip.com


CACHE MISS
SERVER IN CACHE ASIDE
imgflip.com

What happens in Cache Hit? (Same)



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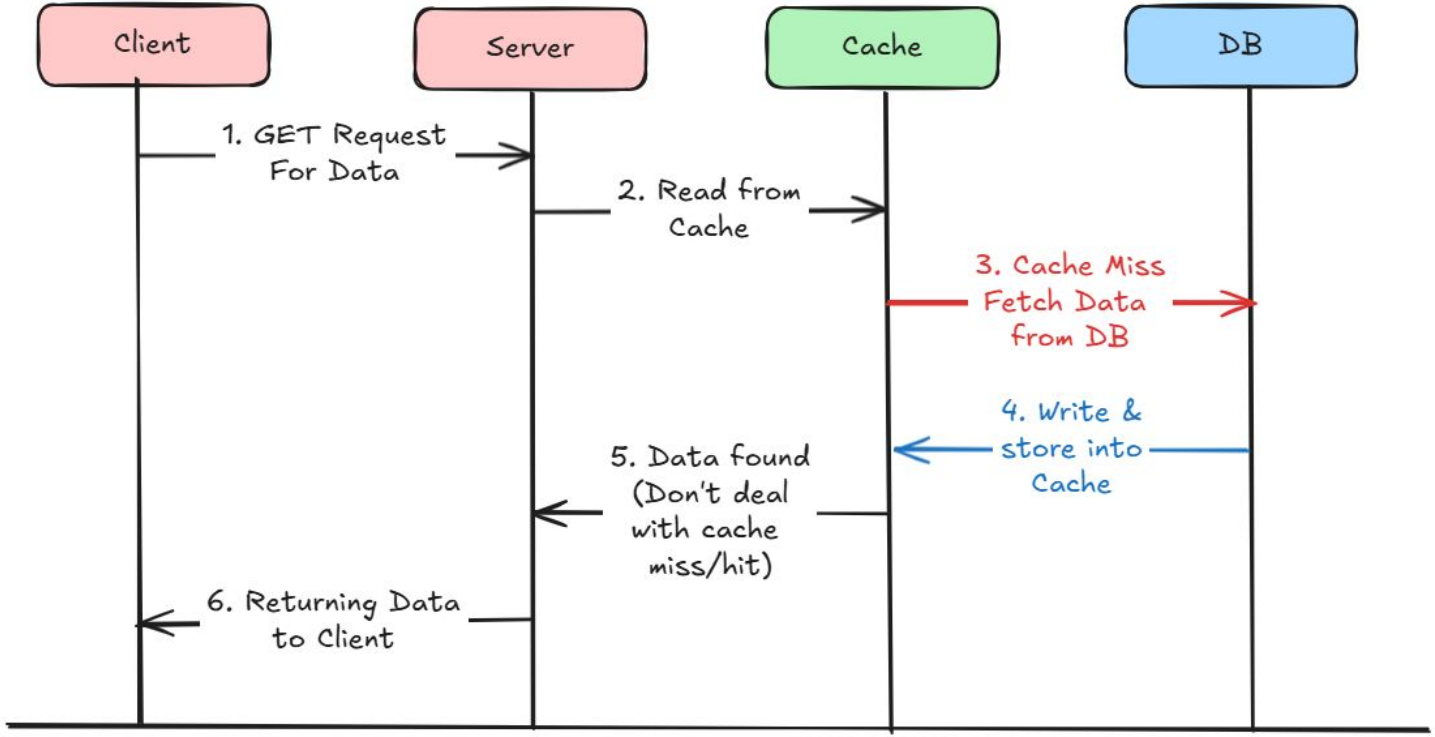

Read Through : Advantages

- Good Approach for Heavy Read applications
- Server don’t need to worry about whether it is a cache hit or miss
- Offloads the responsibility from the application, resulting in simpler application code.

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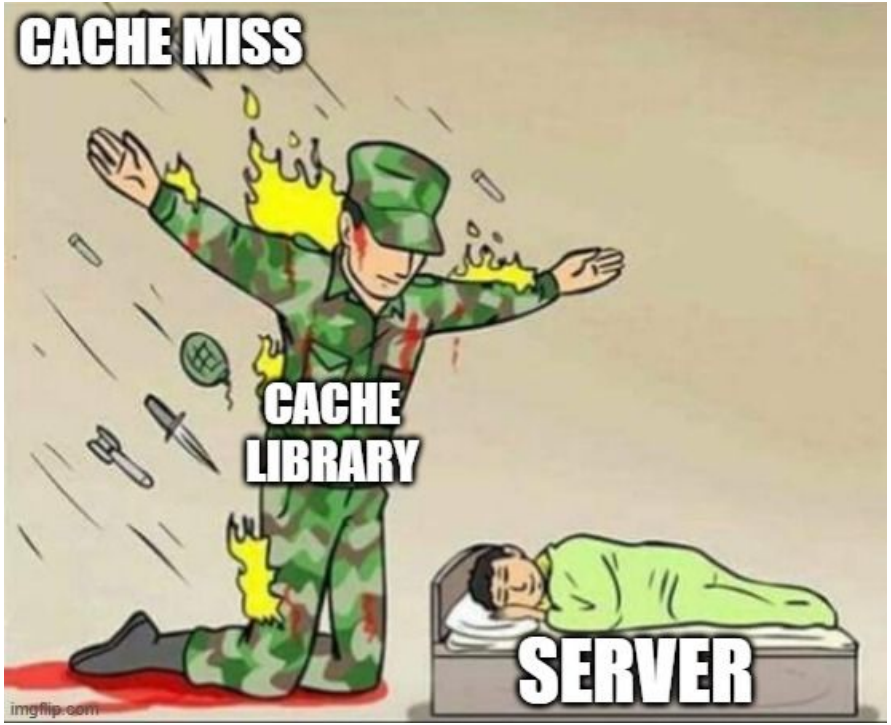

Read Through : Cons

- Write Only Method will always directly write to DB
- For new data read, there will always be Cache - Miss first.
- If appropriate caching is not used during write operation, there is a chance of inconsistency between Cache and DB

Read Through : Cons

- Cache document data structure **can not be different** that data present in DB

- If Cache goes down, **request will fail**, since the application interacts only with the cache.

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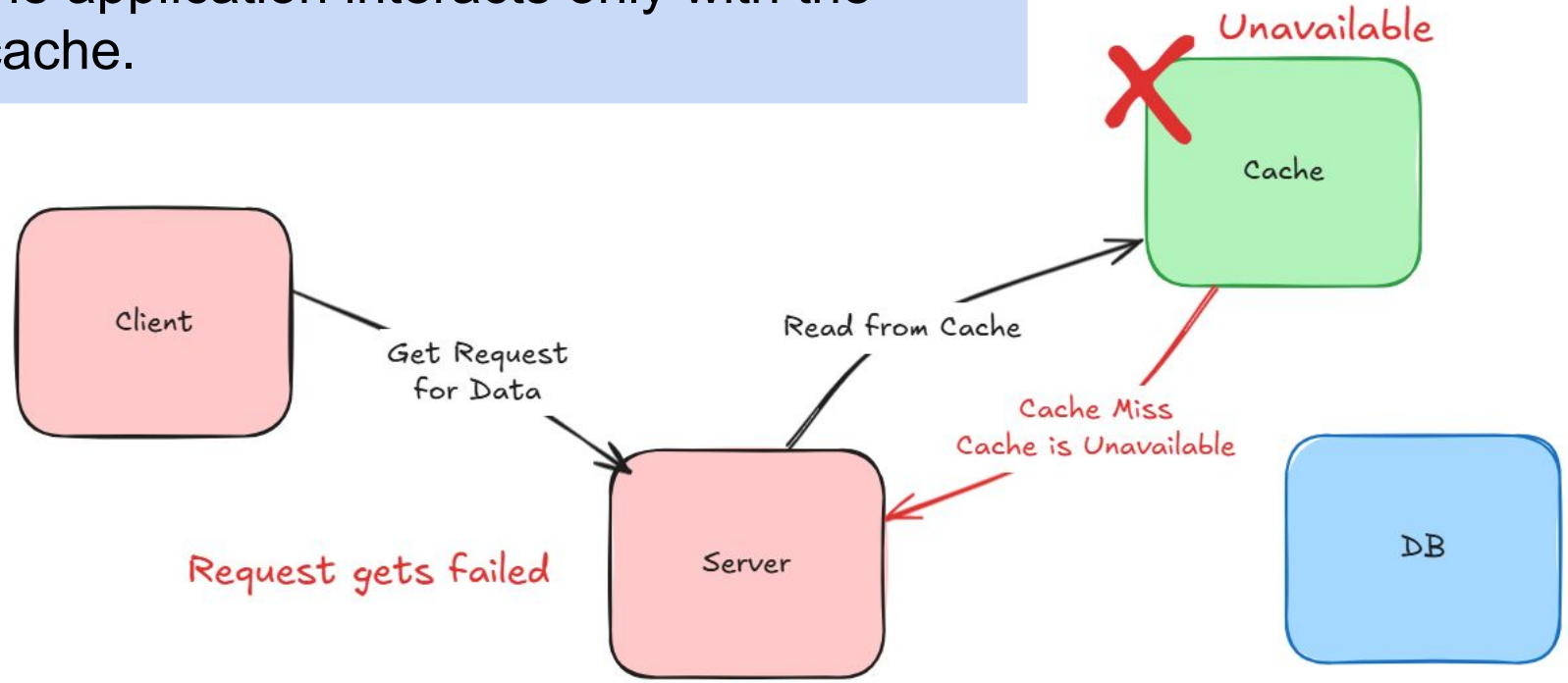

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```

```json
{
  "UserID": 1,
  "Name": "John Doe",
  "Email": "john.doe@example.com",
  "RecentPosts": [
    {
      "PostID": 101,
      "Content": "Hello, world!"
    },
    {
      "PostID": 102,
      "Content": "Loving the sunny weather today!"
    }
  ]
}
```

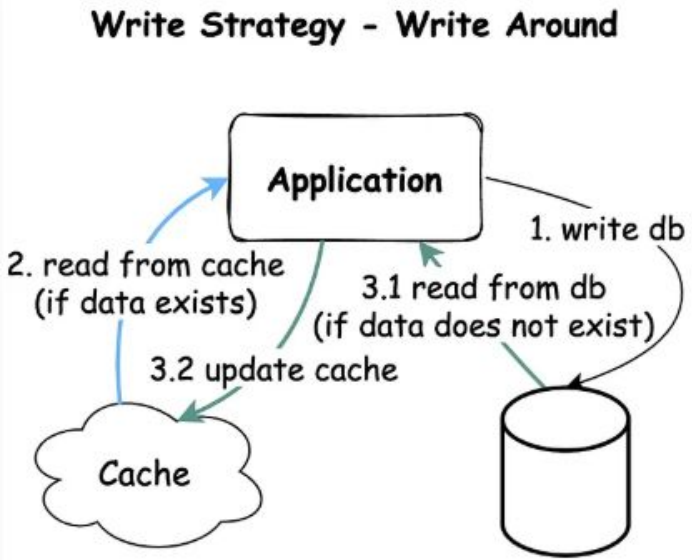
Database (Structured for Storage)

Cache (Optimized for Access)

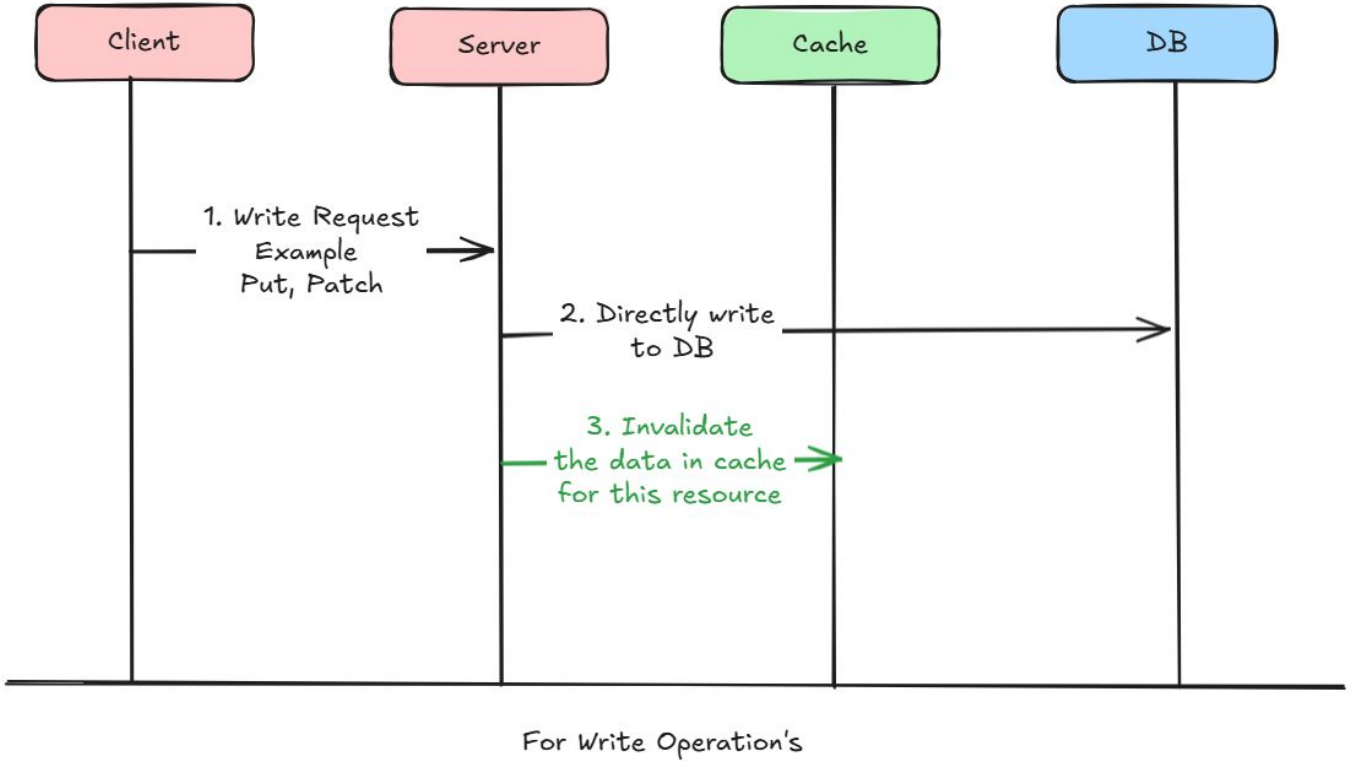
Write Around Caching Strategy

Write Around Strategy

- Directly writes data into the database
- For Read : Choose between
  - Cache Aside
  - Read Through

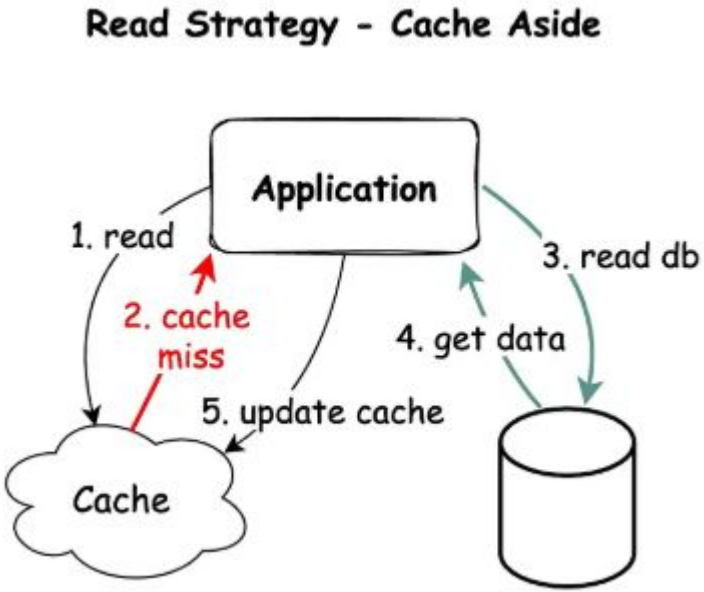


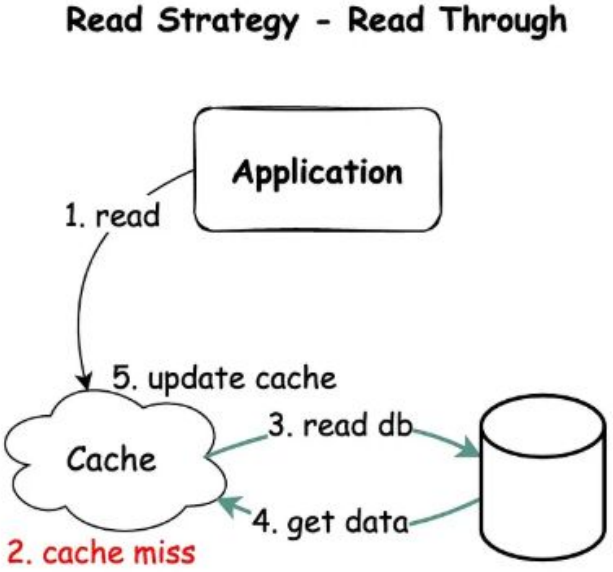
How write operation works?



For Write Operation's

What to do when read operations?

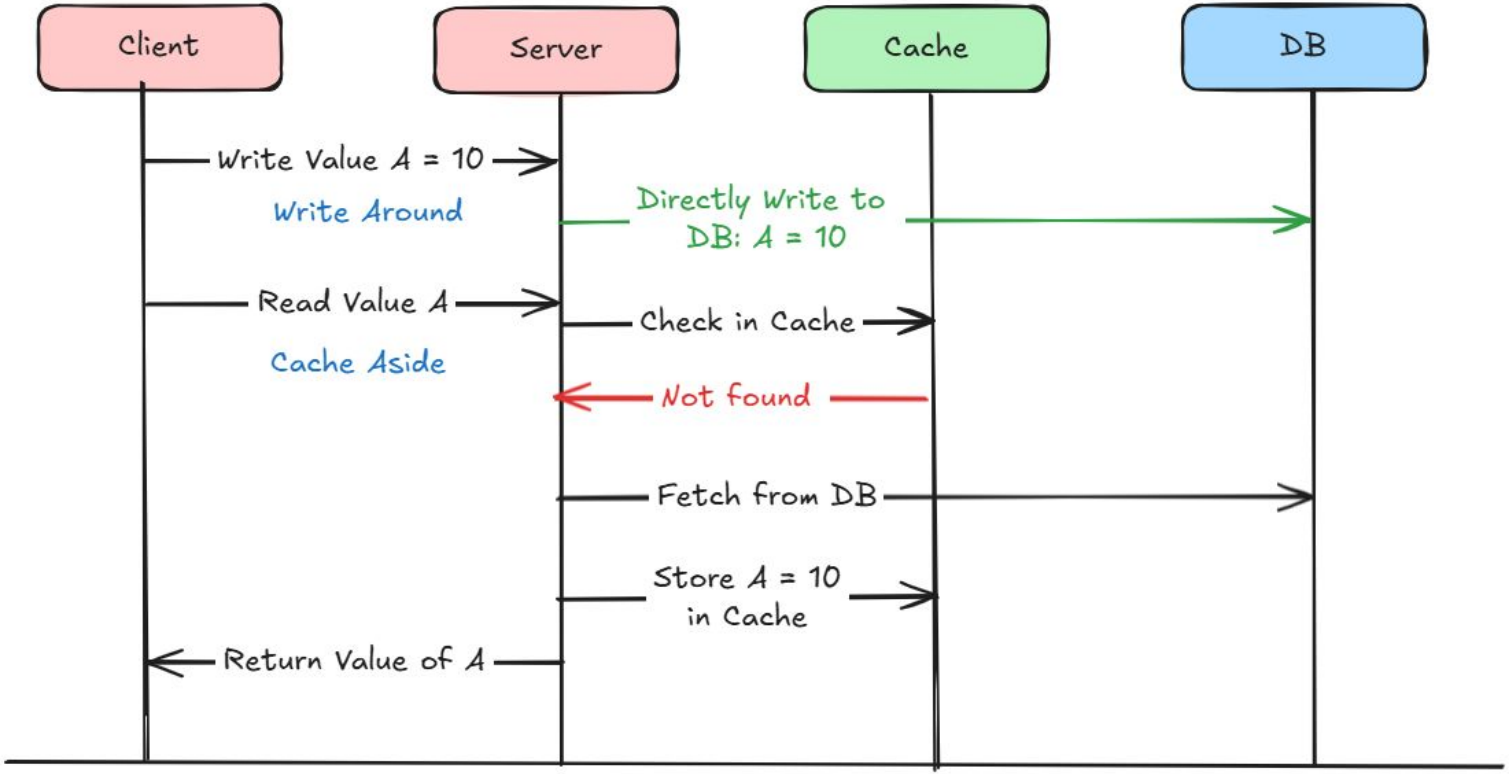




Have to choose a strategy between Cache Aside & Read Through

Combination of
Read : Cache Aside
Write : Write Around

Combination of Cache Aside & Write Around Strategy



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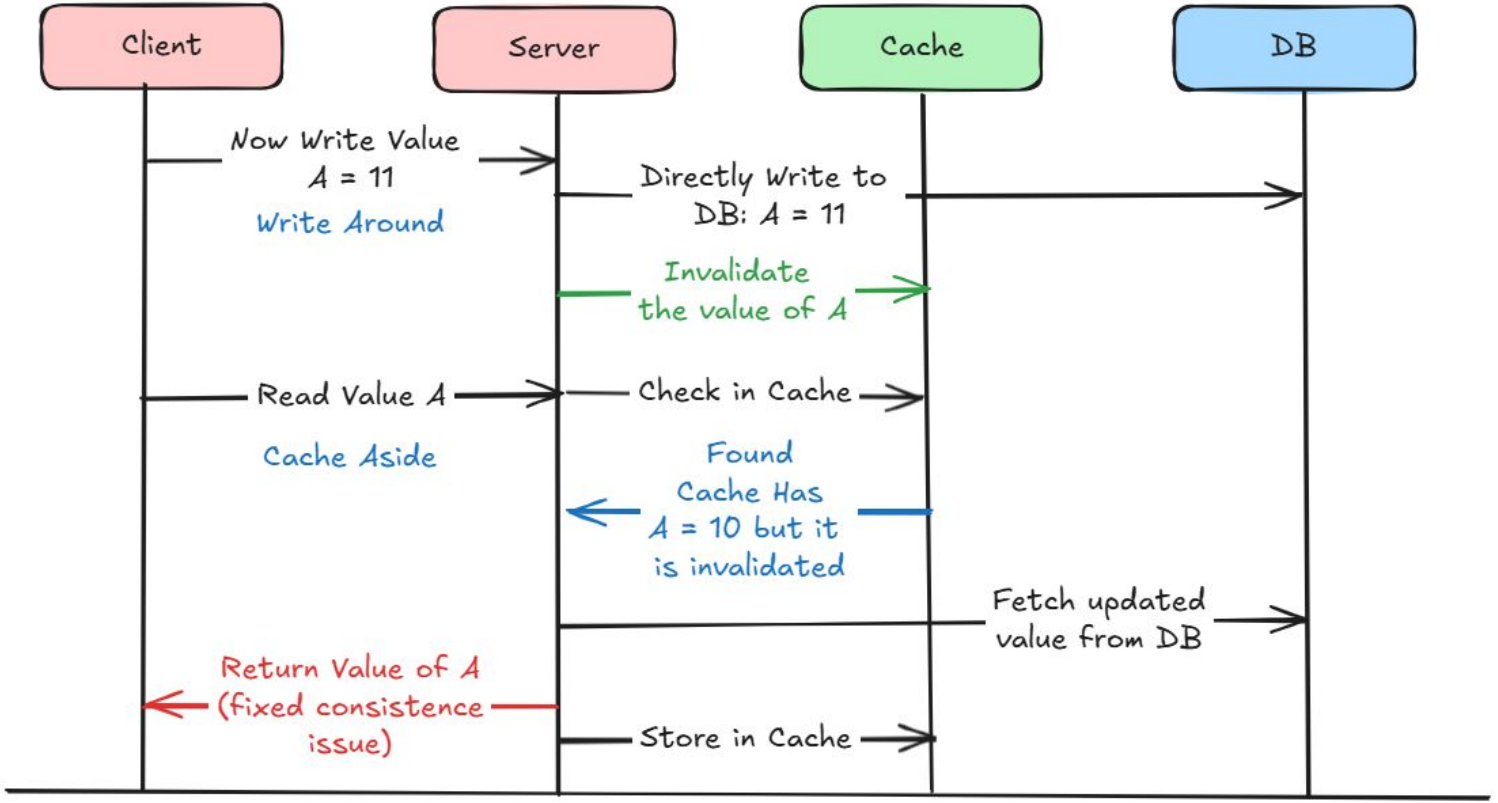

Write Around : Advantages

- Good Approach for Heavy Read applications

- Resolves the inconsistency problem between Cache and DB

Write Around : Cons

- For new data read, there will always be Cache - Miss first.

- If DB is down, request for write operation will fail

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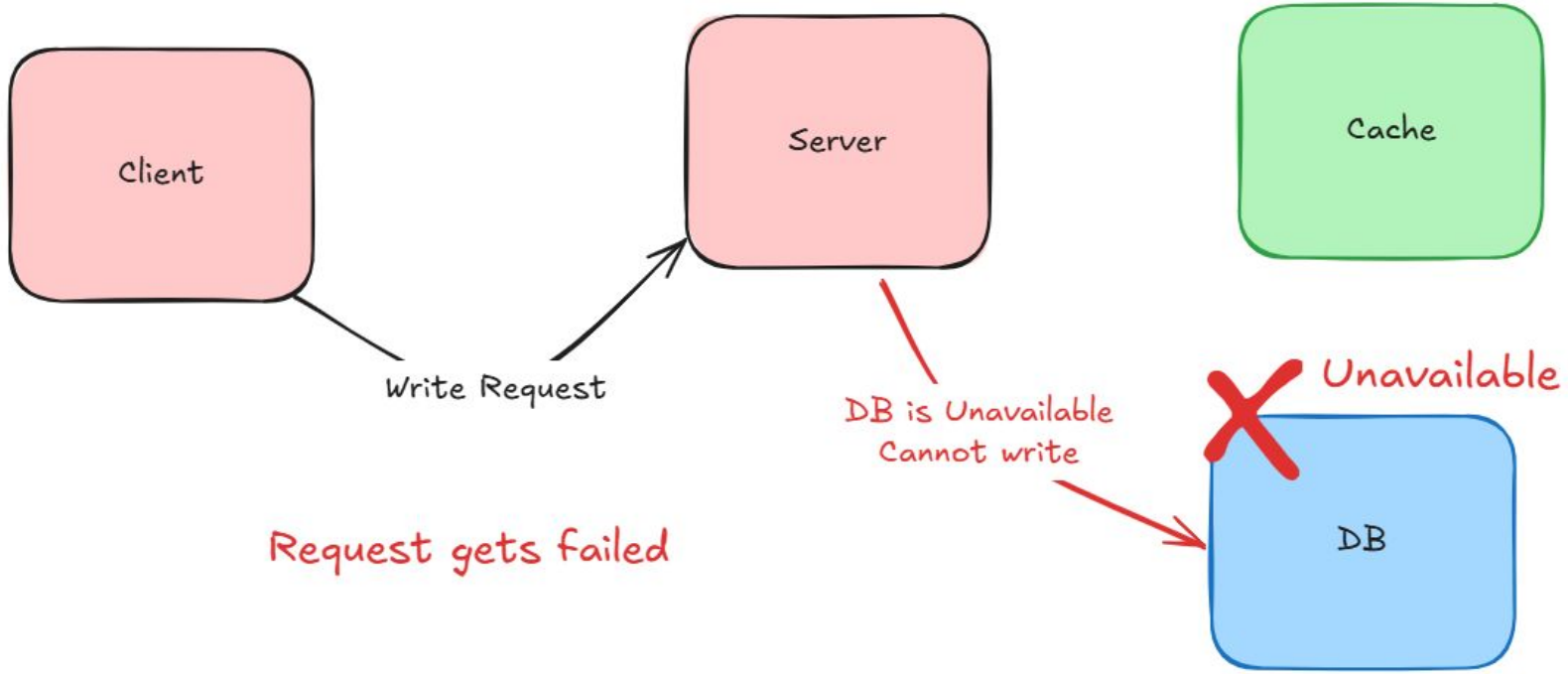

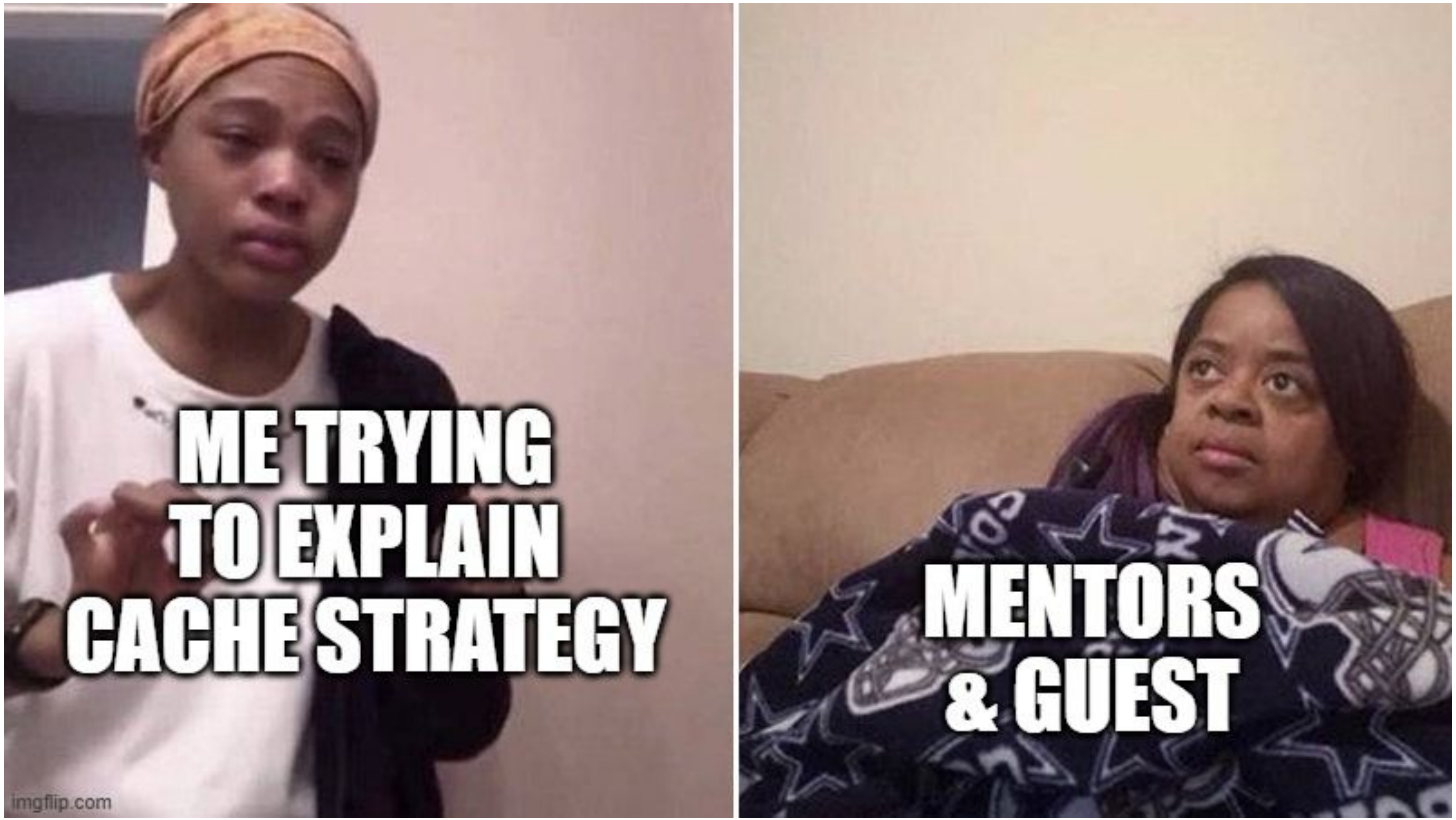
ME TRYING
TO EXPLAIN
CACHE STRATEGY
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MENTORS
& GUEST

Write Through Caching Strategy

Write Through Strategy

- First writes data into the cache
- Then in **synchronous** write data into the DB
- For Read : Choose between
  - Cache Aside
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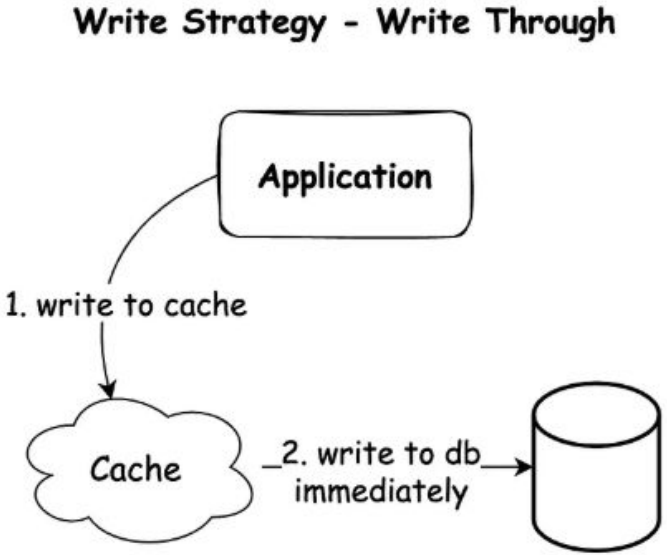
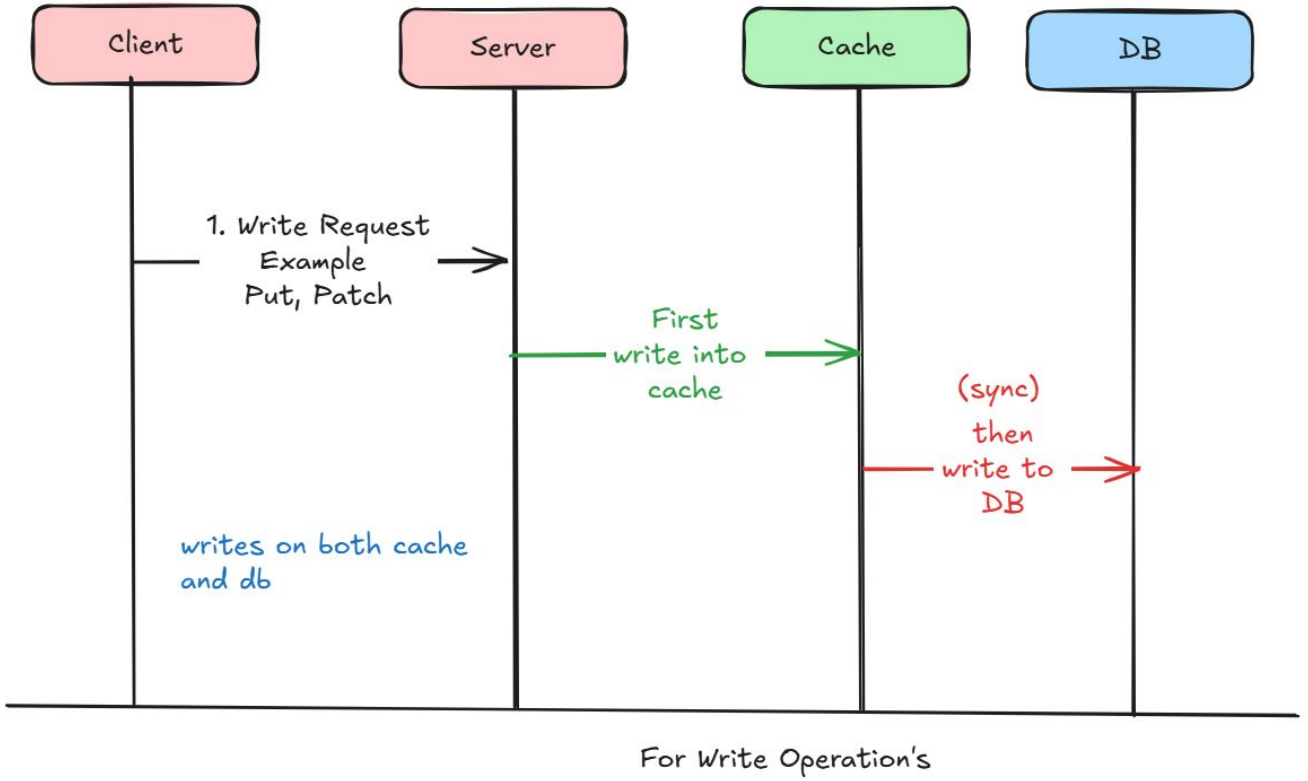


How write operation works?



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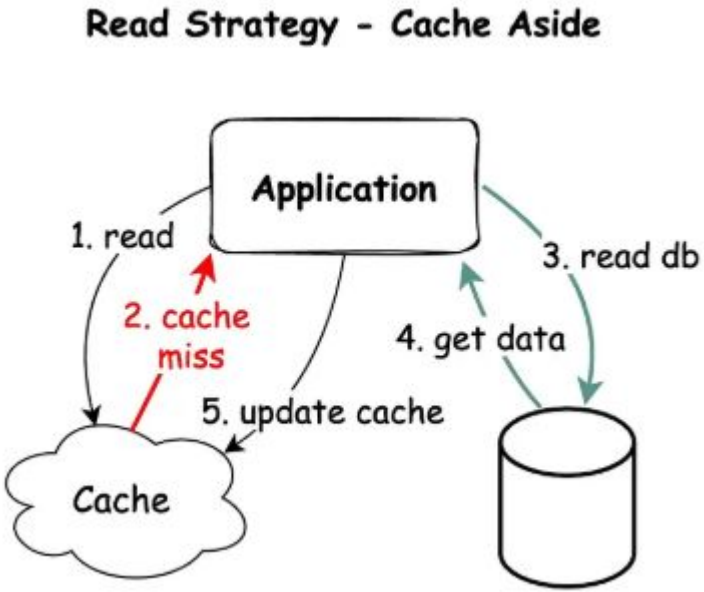

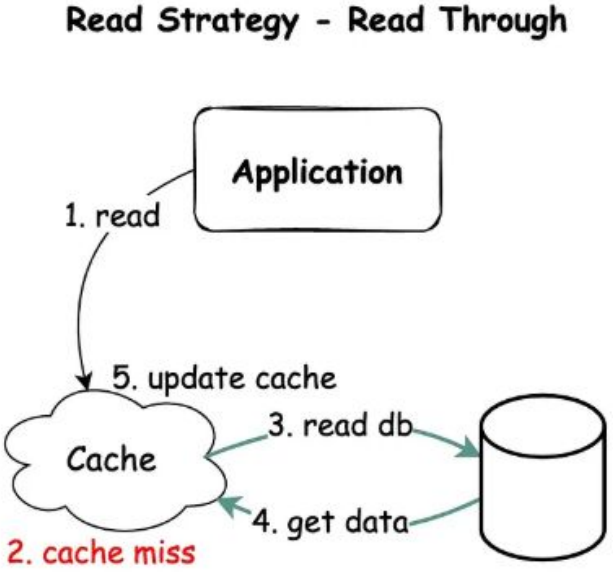

Have to choose a strategy between Cache Aside & Read Through

Write Through : Advantages

- Resolves the inconsistency problem between Cache and DB

- Increase Cache Hit chances : Even if for new data read there is a chance of cache hit

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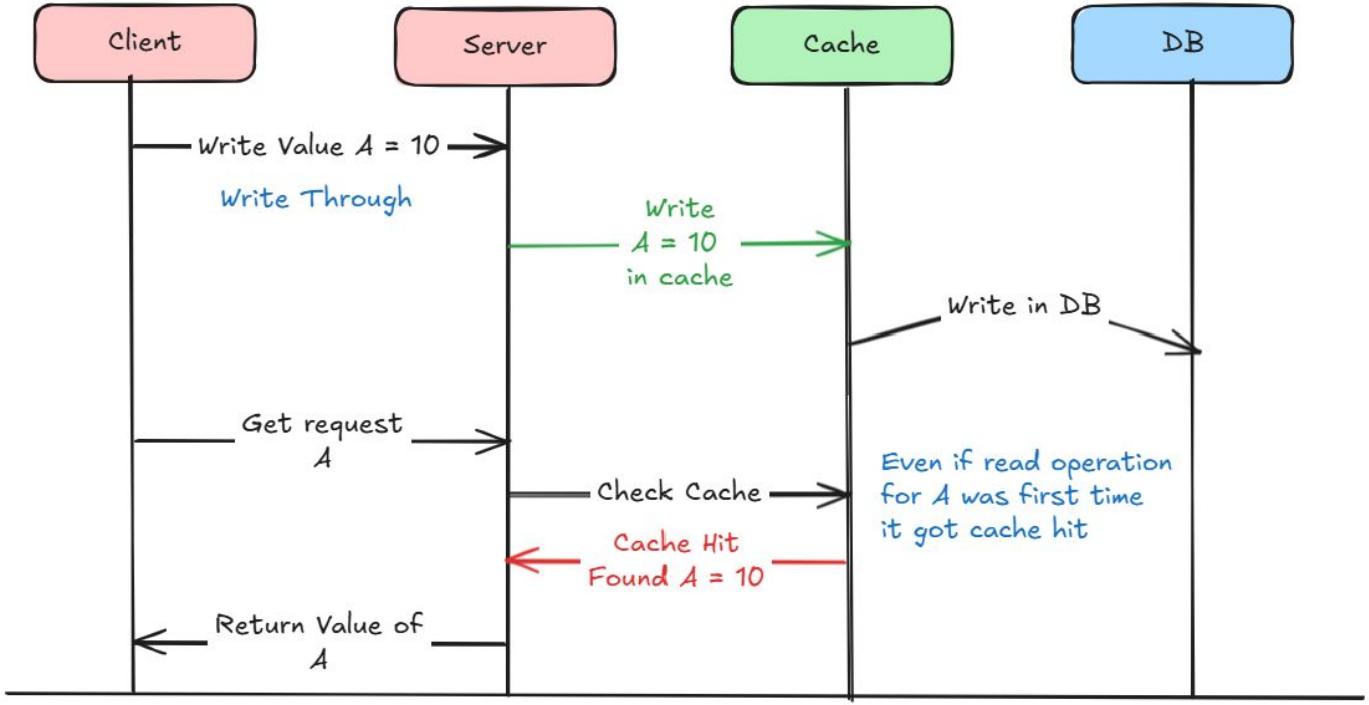
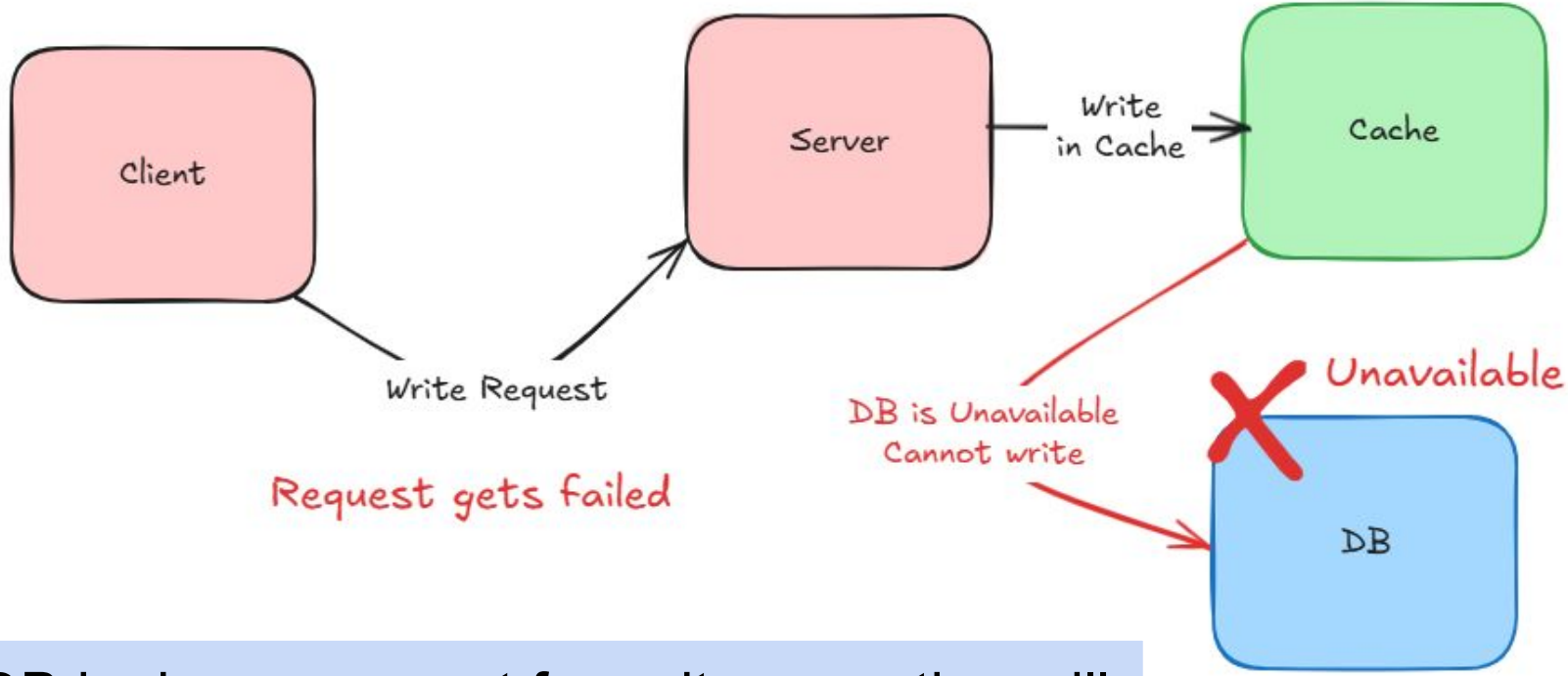


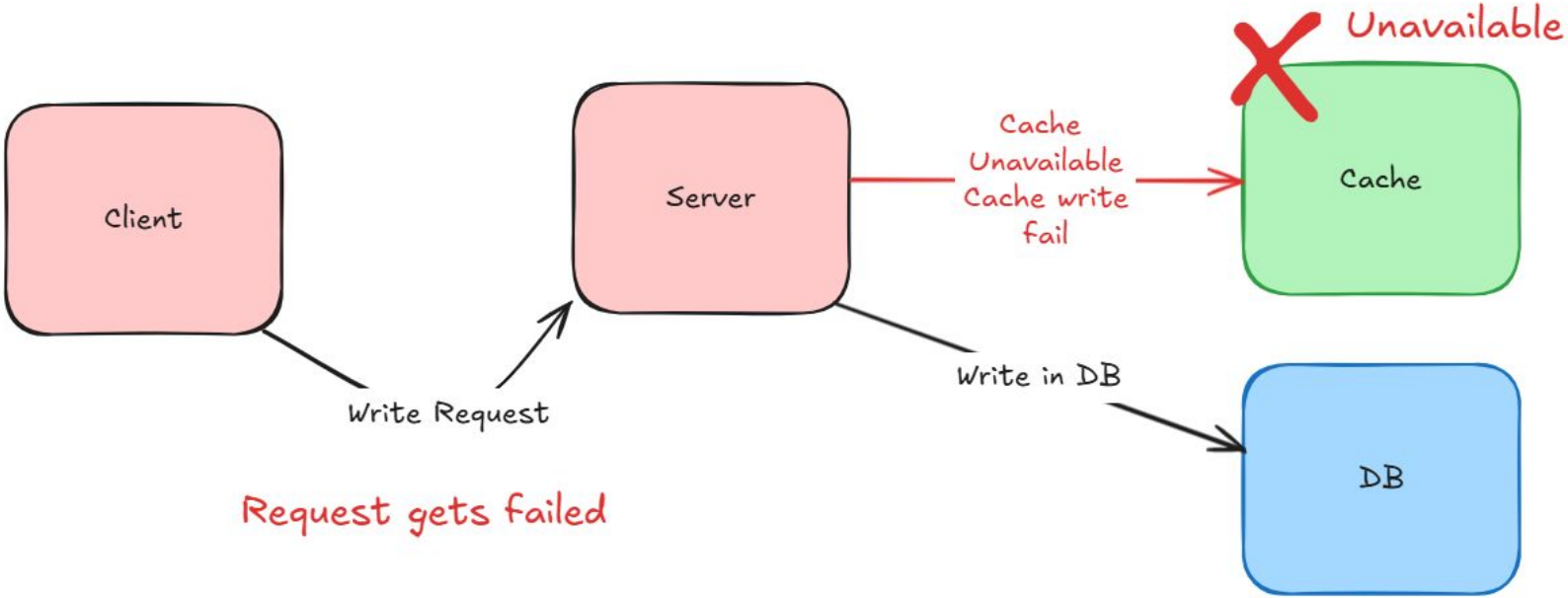
Write Through : Cons

- If any of DB or Cache is Unavailable, request will fail.

- 2 phase commit, need to be applied to maintain transaction property



If DB is down, request for write operation will fail Even if cache is available



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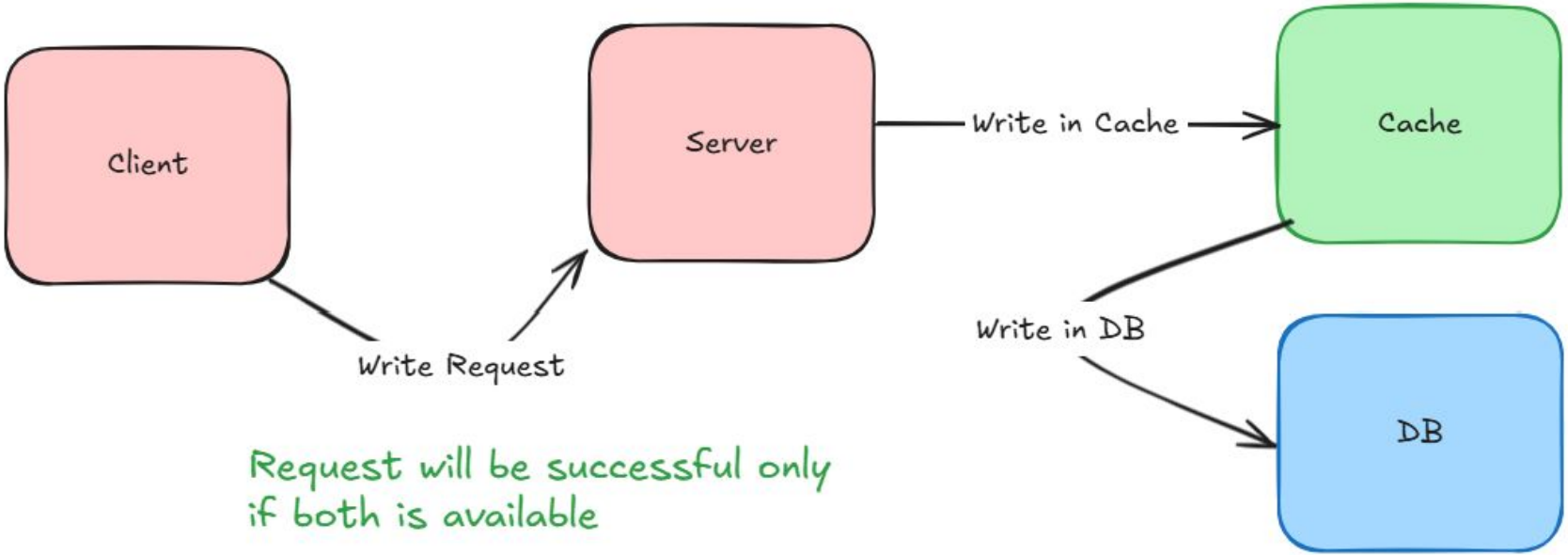
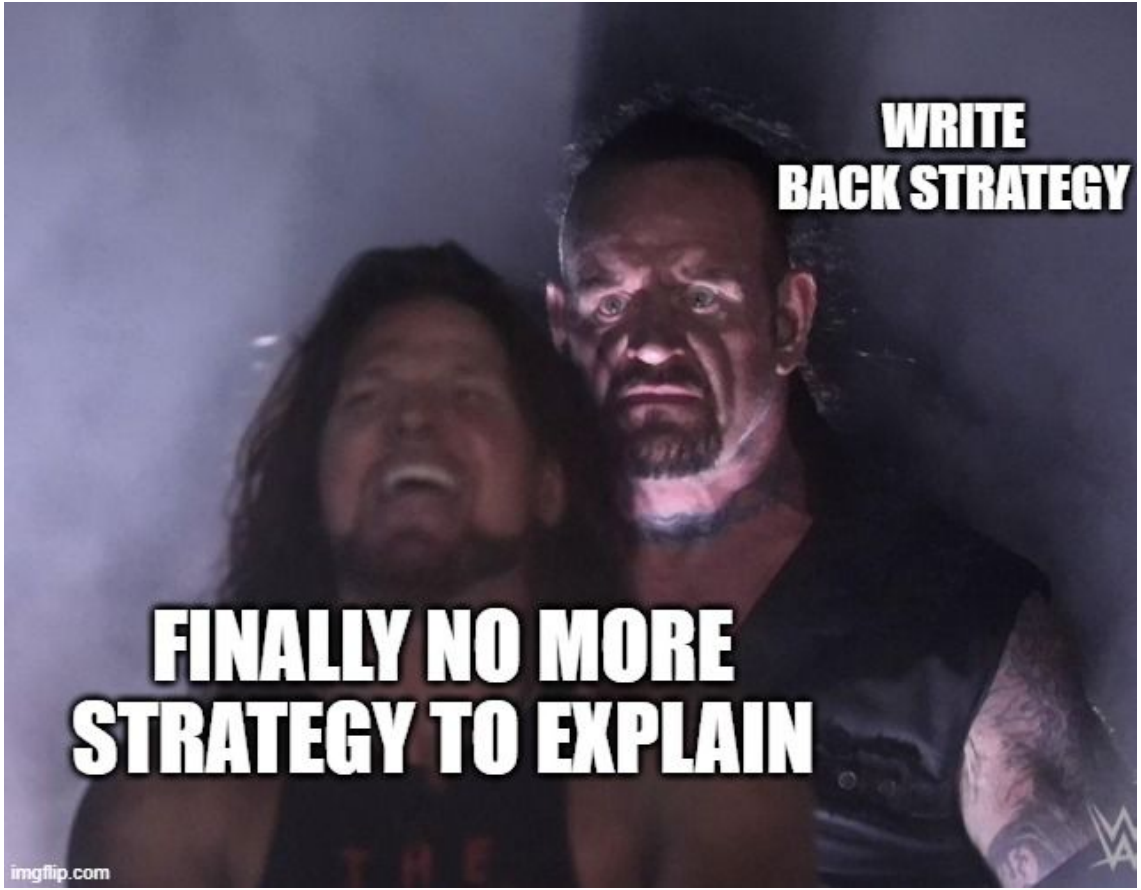


Both Cache and DB must be available for successful operation

Write in Cache	**Write in DB**	Action Output
Successful	Failed (Unavailable)	**Roll back** write in cache
Failed (Unavailable)	Successful	**Roll back** write in DB
Successful	Successful	Okay !

2 phase commit, need to be applied to maintain transaction property


WRITE
BACK STRATEGY
FINALLY NO MORE
STRATEGY TO EXPLAIN
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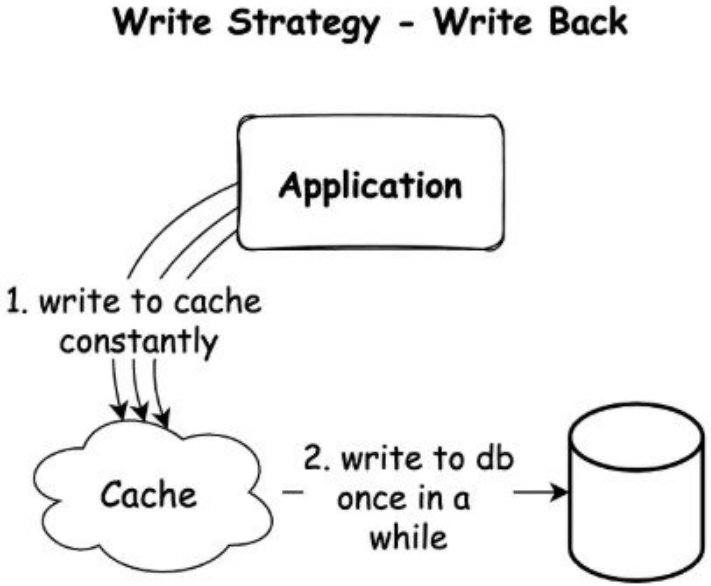
Write Back Caching Strategy

Write Back Strategy

- First writes data into the cache
- Then in **asynchronous** write data into the DB
- For Read : Choose between
  - Cache Aside
  - Read Through



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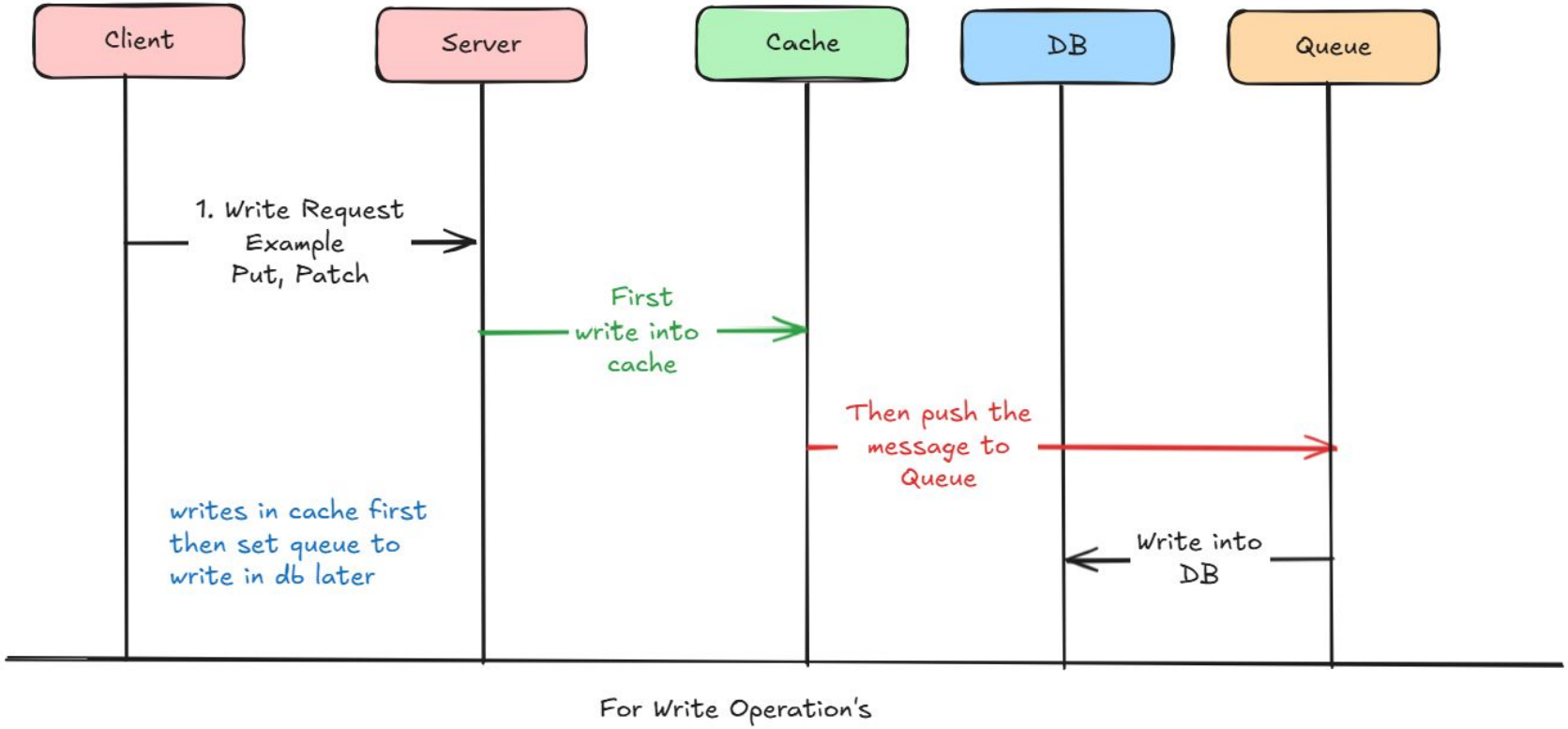

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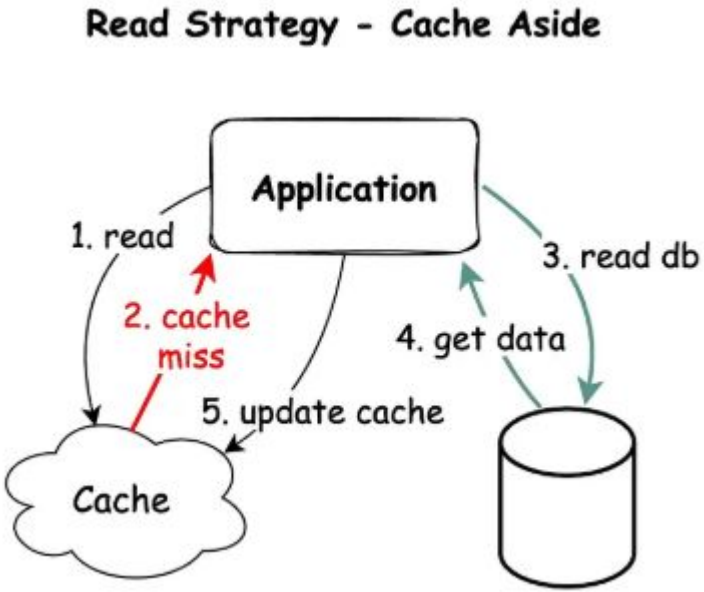

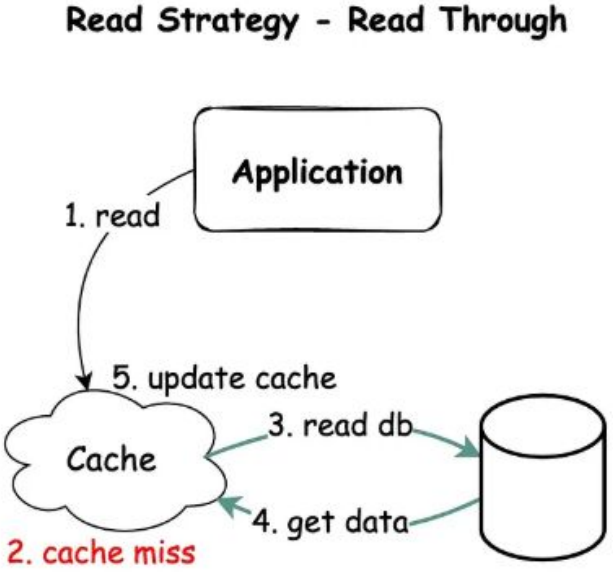

Have to choose a strategy between Cache Aside & Read Through

Write Back : Advantages

- Resolves the inconsistency problem between Cache and DB

- Increase Cache Hit chances : Even if for new data read there is a chance of cache hit

Write Back : Advantages

- Good for Write Heavy Applications
- Improves the write operation latency as writing into DB happens asynchronously
- Even if DB Fails, Write Operation will still works

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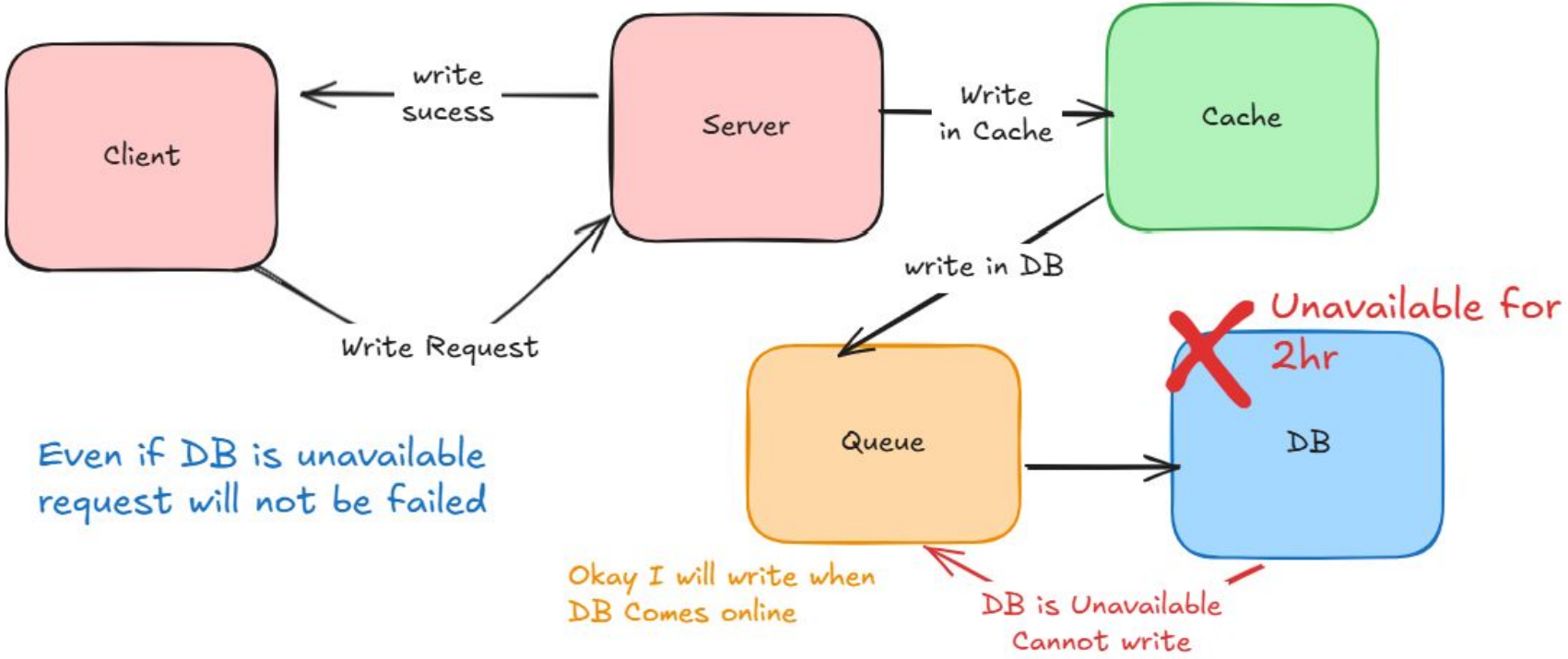

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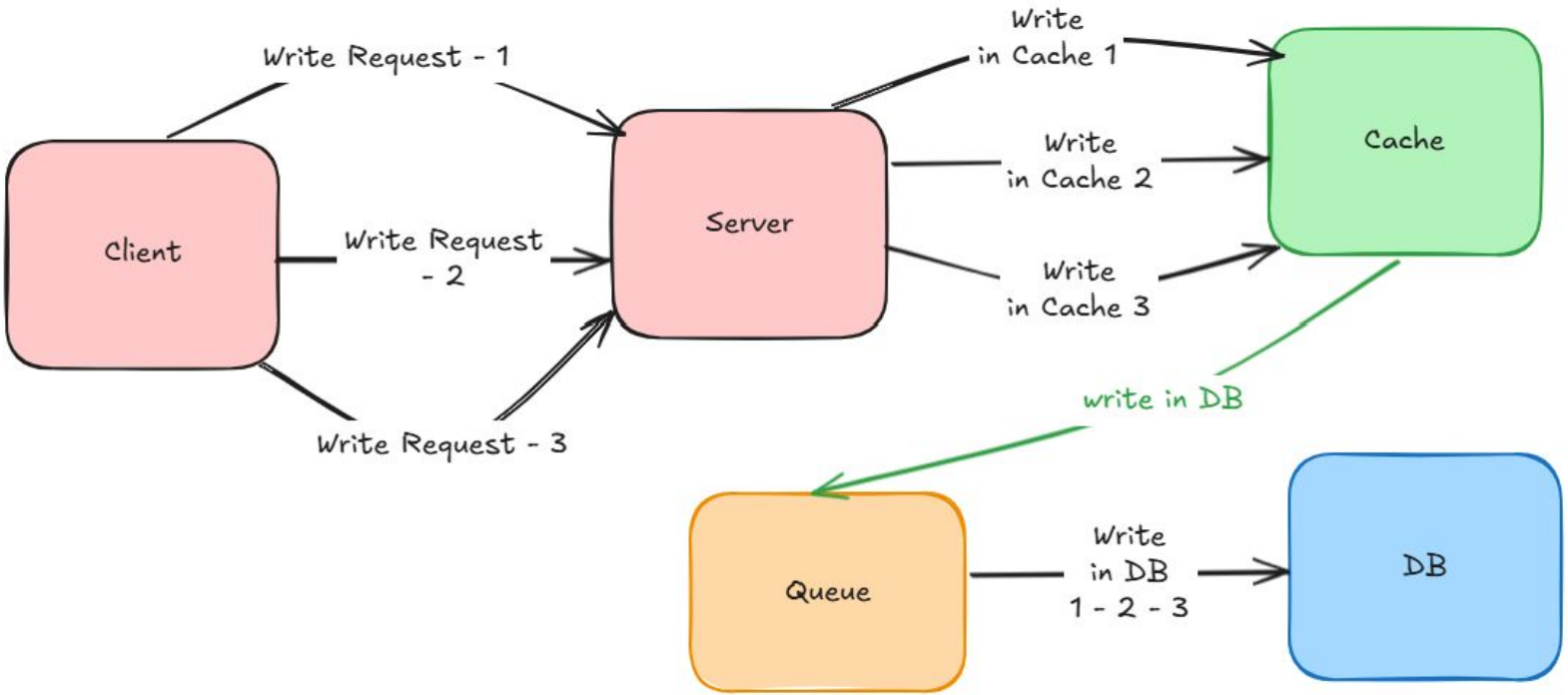
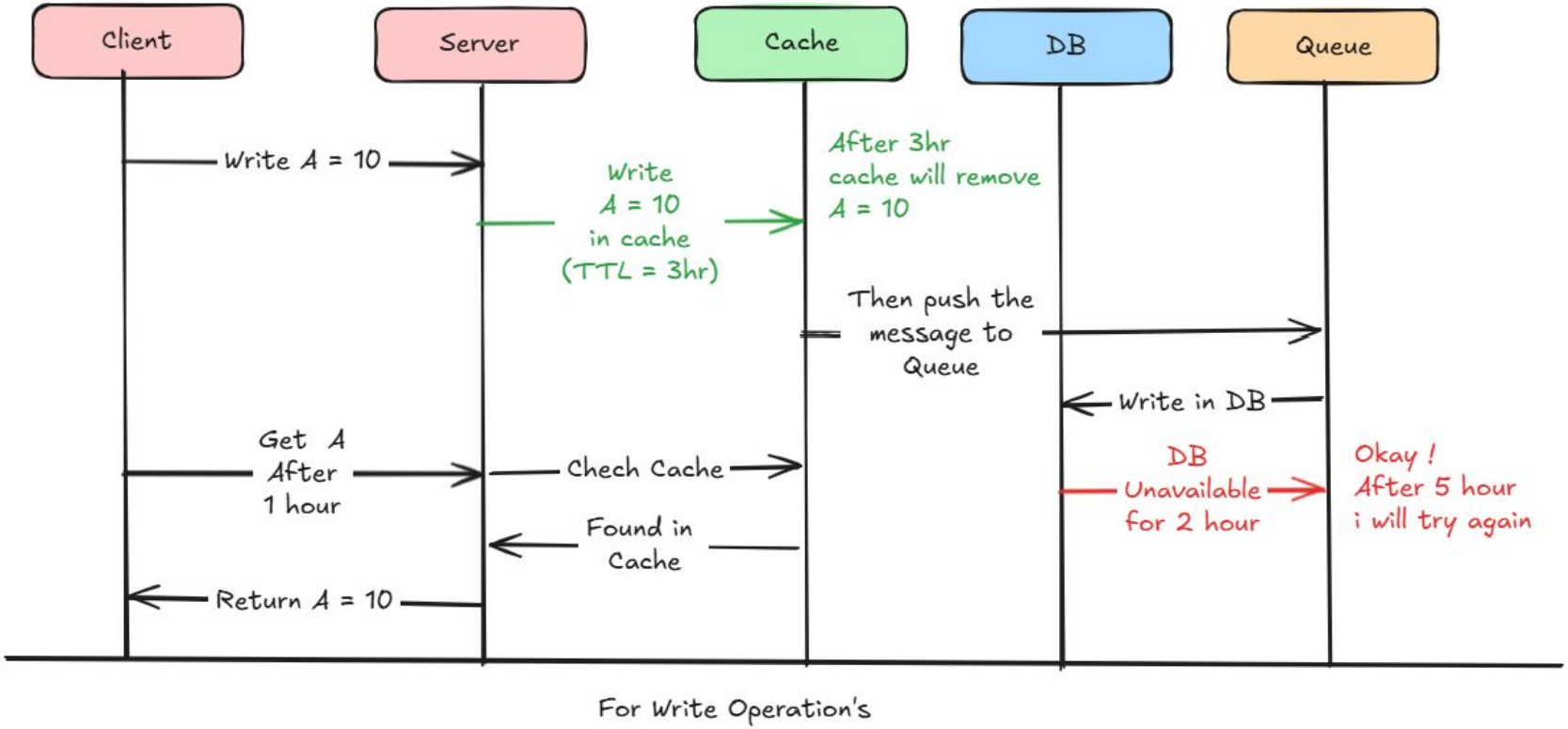


Write Back : Cons

- Chance of issues when data is removed from cache and DB write still not happen yet

- Write-back caching improves performance but risks data loss, complexity, and consistency issues



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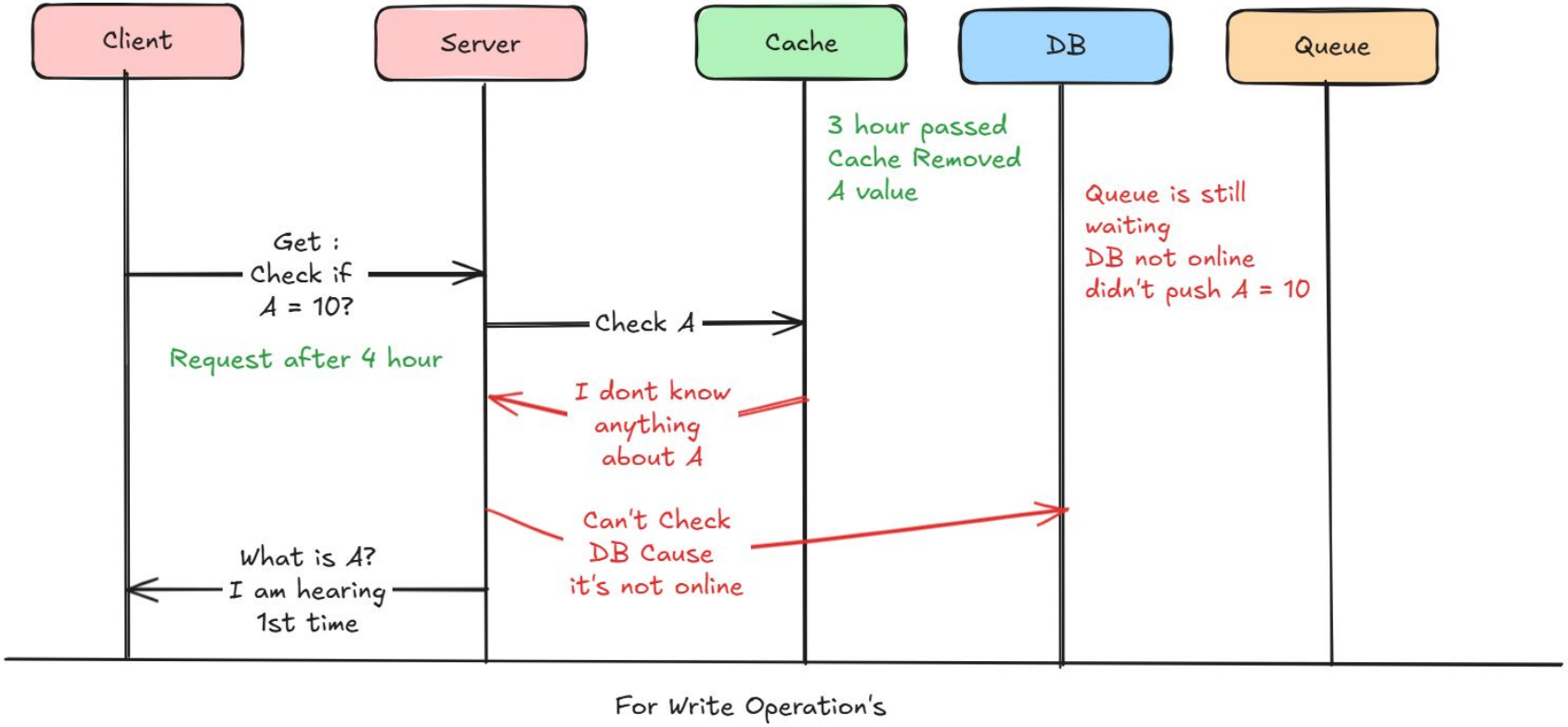

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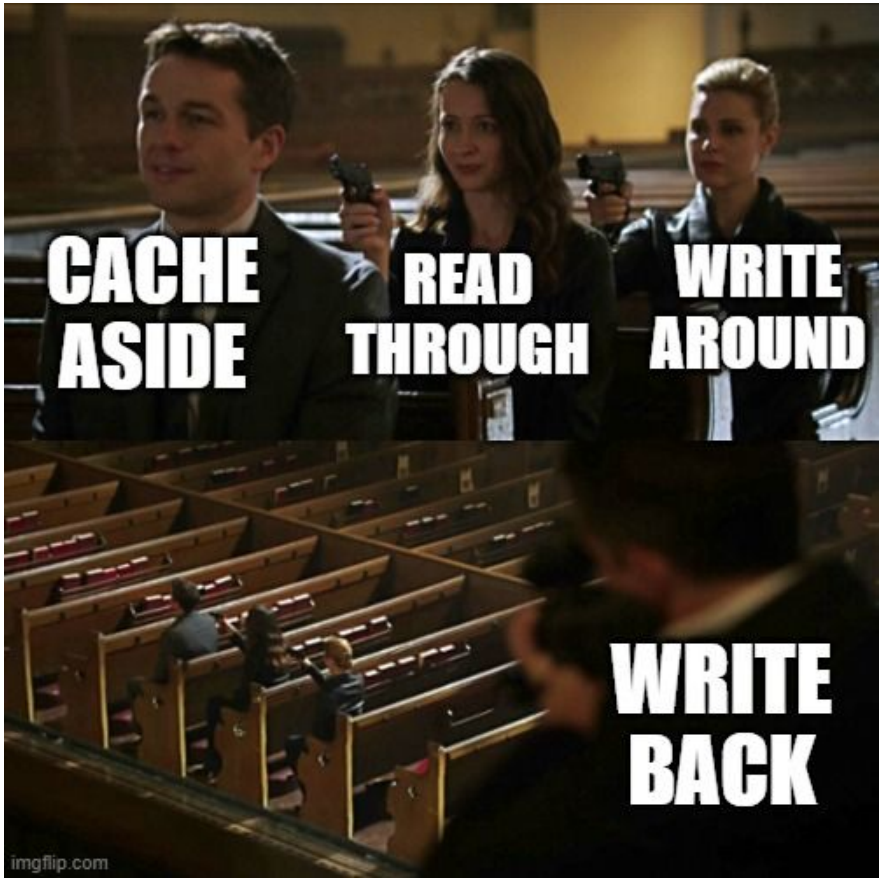
CACHE ASIDE
READ THROUGH
WRITE AROUND
WRITE BACK
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