Science&Tech + Backend

Base Your Database

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Ramadan Camp!

Introduction

This document outlines the complete plan for **"Base Your Database"**, a collaborative event between the Backend and Science & Technology Committees.

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Event Overview

Event Name: Base Your Database
Goal: Build strong database foundations, move into real-world implementation, and explore advanced backend concepts (ORM, Caching, Scaling).

Target Audience:

- Beginners who want solid database fundamentals
- Backend learners ready to connect databases with applications
- Intermediate members interested in performance & scalability

Event Philosophy:
Start with the "WHY", move to the "HOW", then master the "OPTIMIZATION".

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Learning Journey Structure

The event is divided into 7 Sessions

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Session 1: Introduction to Databases + NoSQL (MongoDB)
Part 1 – Database Foundations
- What is a Database?
- Why do we need databases?
- File Systems vs DBMS
- Types of Databases (Relational vs Non-Relational)
- Database roles (DBA, Backend Dev, etc.)

Part 2 – Introduction to NoSQL & MongoDB
- What is NoSQL?
- Why MongoDB?
- MongoDB core concepts (Document, Collection, BSON)
- Schema: SQL vs MongoDB
- Basic CRUD in MongoDB
- Real-world use cases
- Common mistakes & When NOT to use MongoDB

Outcome:

Students understand both the *foundation of databases* and the *modern NoSQL approach*.

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Session 2: DB Design
Focus: Structuring data correctly before coding.
- ER Modeling (Entities, Attributes, Relationships)
- 1:1, 1:M, M:N
- Mapping ERD → Relational Schema
- Normalization (1NF, 2NF, 3NF, BCNF optional)
- Designing real-world schema case study

Outcome:

Students can design a database from scratch properly.

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Session 3: PostgreSQL
Focus: SQL mastery using Postgres.

- PostgreSQL overview
- DDL (CREATE, ALTER, DROP)
- DML (INSERT, UPDATE, DELETE)
- DQL (SELECT)
- Joins (Inner, Left, Right, Full, Cross)
- Subqueries & CTEs
- Aggregations & GROUP BY
- Window Functions

Outcome:

Students can write advanced SQL queries confidently.

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Session 4: Indexing & Query Optimization
Focus: Performance tuning.

- What is indexing?
- B-Tree & Hash indexes
- When to create indexes
- Query cost basics
- Common performance mistakes
- Index trade-offs

Outcome:

Students understand how to make queries fast.

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Session 5: Transactions & ACID
Focus: Data consistency & concurrency.

- What is a transaction?

- ACID properties

- Concurrency control

- Locking (Optimistic vs Pessimistic)

- Isolation levels

- Real-world consistency examples

Outcome:

Students understand how databases maintain reliability under heavy usage.

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Session 6: ORM
Focus: Abstraction layer over SQL.

- Why ORMs exist

- In-memory data vs database

- Raw SQL vs ORM comparison

- Popular ORMs (Prisma, TypeORM, Hibernate…)

- Migrations & schema management

- N+1 problem

- ORM implementation demo

⚠ **Important:**

Clarify that ORM is an **advanced step after understanding SQL**.
Outcome:

Students know when and how to use ORMs properly.

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Session 7: Caching
Focus: Scalability & speed.

- What is caching? (OS + real-life analogy)
- CDN analogy
- Why caching improves performance
- Caching strategies (Cache-aside, Write-through...)
- Redis as caching database
- Caching in NestJS
- When NOT to use caching

Outcome:

Students understand real-world backend performance enhancement.

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Final Flow Logic

The journey now becomes:

1. Why databases exist
2. How to design them
3. How to implement them
4. How to optimize them
5. How to make them reliable
6. How to abstract them
7. How to scale them

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Expected Final Outcome

By the end of the event, participants should be able to:

- Design databases from scratch
- Implement them using PostgreSQL
- Connect them to backend applications
- Optimize performance
- Understand scaling strategies
- Use ORMs properly
- Apply caching effectively

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Deliverables

- Slides for each module
- Hands-on exercises
- Mini project
- Final challenge project

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زكاة العلم تعليمه

- اللهم إنك آتيتني علماً، فارزقني العمل به، وعلمني إياه لغيري، ولا تجعلني من الكاتمين له.
- اللهم انفعنا بما علمتنا، وعلمنا ما ينفعنا، وزدنا علماً وبارك لنا فيه.
- اللهم إني أسألك علماً نافعاً، ورزقاً طيباً، وعملاً متقبلاً

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