Building Scalable Backends: A Practical Approach to API Development

Description

This comprehensive 2-month workshop is designed to guide developers in building scalable, robust, and maintainable backend systems through hands-on practice. Participants will gain a deep understanding of backend development, from foundational concepts to advanced topics like monitoring, performance optimization, and CI/CD pipelines.

The workshop includes building a **production-ready, scalable backend for a forum application** from scratch. Instead of WebSockets, the system will use **worker processes** for notifications and data processing. The backend will utilize **MySQL** for database management and Docker for containerization. Participants will also learn to implement advanced monitoring and observability using tools like Grafana, Prometheus, OpenTelemetry, Loki, and Tempo.

Target Audience

Beginner to intermediate developers looking to:

- Build production-grade backend systems.
- Understand and implement scalable architecture.
- Learn advanced backend development techniques hands-on.

Duration: 2 Months (**2 classes per week**)
Course Fee: BDT 10,000
Extras: 1:1 mentorship with the instructor for personalized guidance.

Date: 1 December 2024 - 31 January 2025

What Will You Build?

Participants will develop a **scalable backend for a forum application**, featuring:

- User registration, login, and role-based authentication.
- Forum posts, comments, and replies with structured relationships.
- Asynchronous notifications and data processing using **worker processes**.
- Efficient database management with **MySQL**.
- Monitoring and observability using modern tools (Grafana, Prometheus, etc.).
- CI/CD pipeline for seamless deployment on containerized environments.

Technologies You'll Learn

- **Frameworks and Libraries:** NestJS, TypeScript

- **Database:** MySQL (Schema Design, Indexing, Transactions)
- **Containerization:** Docker for environment consistency and portability
- **Worker Processes:** Asynchronous task handling with tools like RabbitMQ
- **Logging and Monitoring:**
  - **Logging:** Loki
  - **Tracing:** OpenTelemetry, Tempo
  - **Monitoring:** Prometheus, Grafana
- **Authentication:** JWT, Role-Based Access Control (RBAC)
- **DevOps:** CI/CD pipelines with Docker and GitHub Actions

Course Modules

Module 1: Introduction to Scalable Backend Development

- Importance of scalability in modern applications.
- Overview of backend technologies and architectural styles.
- Key concepts: Monolith vs. microservices.

Module 2: Requirement Analysis, Planning, and Designing Architecture

- Understanding application requirements and user stories.
- Creating architecture diagrams and database schemas.
- Designing scalable systems with a focus on modularity and maintainability.

Module 3: Setting Up a Local Development Environment

- Installing and configuring NestJS and TypeScript.
- Setting up MySQL with Docker.
- Managing environment variables and secrets securely.

Module 4: Database Schema Designing

- Designing relational database schemas for MySQL.
- Normalization, relationships, and indexing strategies.
- Implementing migrations and version control for databases.

Module 5: Best Practices in API Development

- Structuring and documenting RESTful APIs using OpenAPI/Swagger.
- Authentication and authorization with JWT and RBAC.
- Error handling, logging, and validation best practices.

Module 6: Worker Processes for Notifications and Data Processing

- Introduction to worker processes for background tasks.
- Setting up and managing task queues with **RabbitMQ**.
- Handling notifications and other asynchronous processes effectively.

Module 7: Monitoring, Logging, and Observability

- Setting up **Prometheus** for metrics collection.
- Integrating **Loki** for centralized logging.
- Distributed tracing with **OpenTelemetry** and **Grafana Tempo**.
- Creating dashboards with **Grafana** for real-time monitoring and analytics.

Module 8: Performance Optimization

- Profiling backend performance and identifying bottlenecks.
- Query optimization and efficient indexing in MySQL.
- Implementing caching strategies to improve response times.

Module 9: Implementing CI/CD Pipelines

- Introduction to CI/CD concepts and tools.
- Automating testing, building, and deployment with GitHub Actions.
- Deploying containerized applications using Docker.

By the end of the course, participants will have built a **production-grade backend API for a forum application**, equipped with advanced features such as worker-based asynchronous processing, robust monitoring, and seamless deployment pipelines. This project will be ready for real-world scalability challenges.

Instructor Profile: Mehedi Hassan Durjoi

About the Instructor
Mehedi Hassan Durjoi is a skilled software engineer with over **6 years of experience** in backend development, specializing in building and optimizing **scalable applications** for diverse industries. His expertise lies in creating robust systems, transforming monolithic architectures into high-performing microservices, and implementing data-driven solutions.

He is currently working as a **Senior Data Engineer at Reverse Retail GmbH**, where he leads data engineering initiatives to optimize pipelines, design scalable solutions, and enable data-driven decision-making for a leading retail solutions provider.

Areas of Expertise

- **Backend Development:** Proficient in developing scalable APIs using NestJS, Node.js, and Laravel.
- **Databases:** Expertise in MySQL, PostgreSQL, MongoDB, and BigQuery for high-performance data storage and processing.
- **Data Engineering:** Experienced in optimizing ETL pipelines and using tools like Apache Airflow and Google Cloud Platform for large-scale data processing.
- **DevOps:** Skilled in Docker, CI/CD pipeline integration, and cloud-native deployments.

- **Performance Optimization:** Adept at improving system performance, reducing latency, and ensuring data consistency.

Key Achievements

- Developed a **dynamic price prediction and similar product finding system** for procurement, enabling better forecasting and cost savings for purchase teams.
- Transitioned a monolithic application to a **microservices architecture**, increasing transaction throughput by 20x and reducing user wait times from over a minute to under 2 seconds.
- Scaled backend systems to handle **3 million daily API requests** for multi-vendor e-commerce platforms.
- Successfully developed **real-time air traffic tracking systems** with high accuracy and low latency using advanced algorithms.
- Built and deployed a **drag-and-drop website and app customization tool**, enhancing development velocity by 40%.

Technologies and Tools

- Programming: Python, JavaScript, TypeScript, PHP
- Frameworks: NestJS, Node.js, Laravel, Next.js, ExpressJS, Django
- Tools: Docker, RabbitMQ, Grafana, Prometheus, OpenTelemetry, Loki, Tempo
- Databases: MySQL, PostgreSQL, BigQuery, MongoDB
- Cloud: AWS, GCP

Teaching Philosophy

Mehedi believes in a **hands-on approach** to learning, encouraging students to work on real-world projects to grasp concepts effectively. His workshops are structured to ensure participants build practical skills and gain confidence in deploying scalable backend systems in production environments.

Join Mehedi Hassan Durjoi in the **Building Scalable Backends** workshop to learn the fundamentals and advanced techniques of backend development, all while working on a production-grade forum application backend!

Registration Link:

https://docs.google.com/forms/d/e/1FAIpQLSdo2_HGbEsyYmab6T8rPyh4s6NB2v0T1d J6CyMmFD8a_jOd9w/viewform?usp=sf_link