Enterprise Software Development Internship

by

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An internship report submitted to
the Department of Computer Science and Engineering
in partial fulfillment of the requirements for the degree of
B.Sc. in Computer Science

Department of Computer Science and Engineering
School of Data and Sciences
Brac University
May 2023

Declaration

It is hereby declared that

1. The internship report submitted is my own original work while completing degree at Brac University.
2. The report does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The report does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

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Abstract

This internship report is based on my interning period at RedDot Digital Limited from September 2022 until the end of January 2023. RedDot Digital Limited is a 100% subsidiary of Robi Axiata Ltd which is a leading giant in the south asian technology industry. This internship is required to graduate from BRACU University's B.Sc. in Computer Science program. This is the final internship report for the completion of the CSE400 course. The key learning objectives, the primary project I worked on, the internship objectives I accomplished, and how I got my first experience in enterprise software development - will all be discussed in depth in this report, in dedicated chapters. By studying this report one can get a primary idea on the industry culture, current trends and found guidelines right from the industry to get started with Enterprise Software Development.

Keywords: Software Development; Back-end; Java; Enterprise Application; Database; Front-end; Software Engineering; Enterprise Software Solutions;

Acknowledgement

Praise be to Allah the Almighty.

Thanks to Mr. Arif Shakil for his kind supervision and guidelines all the time during the making of this report.

This is to appreciate the effort of my parents to make me pass another important phase of my life - all the way from my birth to the end of my under-graduation.

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Nomenclature

The next list describes several symbols & abbreviation that will be later used within the body of the document

AI Artificial Intelligence

API Application Programming Interface

AWS Amazon Web Service

$CRUD$ Create Read Update Delete

GCP Google Cloud Platform

IDE Integrated Development Environment

$JavaEE$ Java Enterprise Edition

$JDBC$ Java Database Connection

$JSON$ JavaScript Object Notation

JSP Java Server Pages

JWT JSON Web Token

OTT Over The Top

QA Quality Assurance

QC Quality Control

Chapter 1

Introduction

1.1 Preamble

In today's world, when almost all the industries and businesses are technology dependent, there is a growing demand for experienced software developers. If one wishes to contribute to this fast increasing technical environment after completing your academic degrees and acquiring the appropriate set of skills, doing an internship at a reputable technology company is the best approach to gain real world industry experience. An Intership program allows students with a Computer Science or relevant field background to set oneself apart from the competition and draw the attention of prospective employers, only if they have the essential practical experience and skill set to deal with challenges to be faced in the real world.

Internships allow final-year students to apply what they've learned in the classroom while also gaining job experience. Students can obtain practical experience in their subject of study. This helps learners transfer from the classroom to the real world of employment. Employers will also be able to assign their new intern to projects where they will be most useful because they will have a better understanding of them. Taking all of this into account, an internship enhances the student's professional experience, which raises the value of the intern's résumé and leads to fantastic employment opportunities.

1.1.1 About The Internship

To get a bachelor's degree in computer science or computer science and engineering from BRAC University, a student must complete a thesis, project, or internship under the course number CSE400. Fewer students choose to participate in an internship with CSE400, but those who do are adequately supported by the organization and driven to learn as much as they can from their work. Students may choose any field for their internship as long as it is related to their degree. To be eligible, students must have a minimum of 72 university credits and complete a six-month internship with a reputable local firm.

1.1.2 About This Report

This internship is needed by the university's curriculum for me to earn my BS in Computer Science degree at BRACU University. This report would be graded in the CSE400 course. This is the course's final internship report. In this piece. In this report, I'll explain the company's history, the working environment, the internship's aims, the training system, and how I became interested in enterprise software development, the objectives and the outcomes. A summary statement will be provided in the concluding chapter.

1.2 Objective

The objective of this report is to provide the main problem statement as well as the key goals that I had planned to accomplish during my internship and what I have achieved.

1.2.1 Goal

The purpose of this report is to highlight my experience and learnings from the Internship program.

1.2.2 Key Focus Area

The key focus areas of this report would be –

- About the Company
- The environment at the workplace
- What the company aims to achieve as an entity
- Goal of the Internship Program
- The Enterprise Software Industry
- Training Experience
- Detailed overview of the skills I learned and the tasks I was assigned

1.3 Methodology

The report focuses on the information I received while working for the company and highlights what I uncovered while doing internship at RedDot Digital Limited. The information I'm about to share is totally based on my own personal experiences and the organization's official website. I gathered data from the following resources:

1.3.1 Primary Source

Personal experience at the workplace

- Information from my Supervisor (Line Manager) and colleagues
- Board meetings and workshop

1.3.2 Secondary Source

RedDot Digital Limited official website - https://www.reddotdigitalit.com/

Chapter 2

Company Profile

2.1 Overview

Red.Digital Limited, a wholly owned subsidiary of Robi Axiata Limited, provides IT and digital solutions. Their corporate offices are located in Uday Tower in the Gulshan commercial region. Red.Digital Limited has launched a branch at Dhaka's Government IT Park in Kaliakoir, Gazipur. They plan to assist the Government of Bangladesh in achieving the country's digital goals by providing cutting-edge, locally produced, cost-effective IT applications, Cloud DC, and IoT solutions, among other things. They presently have a number of platforms that were created entirely in-house and are wholly intellectual property protected. They are committed to conducting ICT business in accordance with all applicable norms and regulations in Bangladesh.

They provide its workers who work on-site at Gulshan with an e-office setting, which is a paperless workplace with no cubicles or permanent workstations. As a result of less constraints in the office setting and greater ease for working freely sitting wherever at any time, employees working here automatically have a 'free' work environment.

Figure 2.1: RedDot Digital Ltd's E-Office

2.2 Vision of The Company

Through superior products and services, the organization is dedicated to bringing about dynamic developments. Their efforts are focused on providing a high level of

client benefit through ethical and unquestionable procedures.

2.3 Mission of The Company

RedDot Digital Limited intends to expand their business beyond their current boundaries. Their objective is to establish themselves as a recognized company in the software business by providing exclusively dedicated Enterprise level industry standard software solutions to local and overseas clients.

2.4 How does RedDot Digital Limited Work

In order to generate high-quality software, a company needs have the best infrastructure and resources. The firm's core operation is described below -

2.4.1 Partnership and Sponsorship

RedDot Digital Limited is entirely owned by Robi Axiata Ltd. As a result, the company joined the Axiata Group. The funds earned by the company on its own are used to meet internal expenses and are shared with its mother company, Robi Axiata Ltd.

2.4.2 Client Base

Robi Axiata Limited is RedDot Digital Limited's primary client. There are also other businesses, such as British American Tobacco Ltd., which is a multinational firm.

2.4.3 Product Ownership

After receiving the product, the customer becomes the owner, and RedDot provides maintenance services based on the client's needs. There are other goods owned by the corporation that clients may utilize as a service on a subscription basis.

2.4.4 DevOps

The DevOps, meaning "Development & Opeations" combines software development and IT operations. It aims to shorten the systems development life cycle and provide high-quality continuous software delivery. DevOps and agile software development work hand in hand; many aspects of DevOps were inspired by agile approaches. The company is divided into many teams, the majority of which are DevOps teams capable of developing software from the ground up and working on it till deployment, testing, and release, covering all operations necessary.

2.4.5 Quality Assurance

Software testing, often known as quality assurance, is a procedure used by businesses to guarantee that the software products or services they provide to clients are of the

highest quality. Quality assurance aims to improve the dependability and efficiency of the software development process while keeping the high standards set for software products. The term "QA Testing" refers to quality assurance testing. RedDot Digital Limited has a huge dedicated QA staff that ensures the quality of both new and old maintained products.

2.5 Services by RedDot Digital Limited

RedDot Digital Limited provides a wide range of services, including Data Center Solutions and Software Development. Some of the popular services by RedDot Digital Limited are briefly described below.

2.5.1 Data Centre Solutions

Their cutting-edge Modular Data Center solutions safeguard mission-critical data while ensuring the highest levels of security and operational reliability.

2.5.2 Cloud & DevOps

They offer cloud and DevOps consulting to clients, which aids in the automation and standardization of procedures, resulting in enhanced operational efficiency and deployment quality.

2.5.3 IT Security Services

Their extensive threat audits aid us in identifying the most critical vulnerabilities in the client's infrastructure, allowing the business to implement the encryptions and protocols that the customer requires.

2.5.4 AI & Machine Learning

They provide AI and machine learning software development services to help businesses acquire insights and automate processes.

2.5.5 Custom Software Development

Their robust technical staff is dedicated to providing customer-focused software solutions.

2.5.6 App Development

To produce innovative B2B and B2C apps, the company's web and mobile app developers employ cutting-edge technologies. This system supports both concept-to-code and development-to-deployment processes.

2.6 Products

RedDot Digital Limited has created a number of new and profitable products. The popular ones are summarized here.

2.6.1 Mobile Financial Service - MFS

Mobile Financial Service is a mobile financial service app that provides end-to-end mobile financial services across all media.

- Transparent data management
- Smooth cash management
- Digital payment system
- Integrated with machine learning

2.6.2 Electronic Subscriber Acquisition Form

Electronic Subscriber Acquisition Form is a paperless e-registration platform that allows businesses to simply record and manage subscribers' registration progress with QC.

- Customer profile storage
- Account management
- QC process

2.6.3 Customer Relationship Management – CRM

Customer Relationship Management Solution is appropriate for both business and private clients. Maintains a 360-degree view of the customer, handles orders and fulfillment, controls resources, and manages the complaint life cycle. The solution is designed for 100 million bases and is built on a highly flexible architecture with auto scalability. Modularization has been applied to 500 business accounts.

- Single Platform for finite possibilities
- Customer centric solution
- Big data analytics

2.6.4 Video Streaming Solution – VSS

An OTT video streaming platform that provides live TV and VOD. The platform is built with a distributed architecture based on open source and industry-leading technological frameworks.

- Operating System
- Content

- Voice Search
- Adaptive bit rate
- Analytics
- Parental lock
- Flexible subscription plan
- 4k video streaming support

2.6.5 Robi Distribution Management System

Tertiary sales apps enable merchants to do different sales processes as well as manage other apps (as a container app), and are the initial stage of digital distribution via retail.

- Product requisition
- Instant product lifting
- Recharge and sales
- Campaign management
- Commission dashboard
- Subscriber verification system
- Complaint management
- Digital ID card
- App Store

These are some of the popular products that RedDot Digital Limited has developed.

Chapter 3

Enterprise Software Development

3.1 Overview

'Enterprise Software' includes accounting, business intelligence (BI), communication and collaboration, customer relationship management (CRM), and human resources (HR). Traditionally, these technologies have been deployed in on-premise data centers as multi-faceted enterprise resource planning (ERP) suites from software behemoths such as Oracle, SAP, IBM, and Microsoft. Vertical, industry-specific solutions are sometimes referred to as 'enterprise software.' These are often built as unique in-house apps that must then be integrated to traditional corporate applications or suites by IT teams.

Enterprise software development is the creation and deployment of customized programs and systems to meet the needs of major companies. It helps businesses streamline procedures, improve work quality and speed, and make data-driven decisions that support development and success. Enterprise software development aims to create efficient, cost-effective software solutions that integrate smoothly with an organization's current infrastructure, processes, and procedures. Firms may use the development process to automate repetitive operations, decrease manual mistakes, and boost overall efficiency and production.

Data-driven decision-making is the most essential aspect of Enterprise software development since it allows organizations to optimize their strategy, improve client experiences and swiftly adjust to market changes. It also allows for the incorporation of artificial intelligence (AI) and machine learning (ML) algorithms, which enhance data analysis capabilities and automate difficult tasks. Enterprise software solutions are built to scale with a company's needs, which allows the seamless integration of new features and capabilities to meet shifting demands. It creates scopes for flexibility in the face of changing market conditions and technical advancements. Businesses place a premium on security and compliance as enterprise software development focuses on incorporating comprehensive security measures into software solutions to safeguard sensitive data and prevent cybersecurity threats.

Enterprise software development helps firms adhere to industry-specific standards

and compliance regulationsw which reduces the risk of penalties and reputational harm, which is critical for any established business. This subset of Software Development is a powerful tool for helping firms improve their processes, boost efficiency and achieve long-term success.[2]

3.2 Popular Technologies

From creation to implementation, enterprise software development comprises a wide range of technologies. Here are a few common ones used in business software development:

3.2.1 Java EE - Spring Framework

Java EE (Enterprise Edition) is a popular programming language used to develop business applications. It has a large ecosystem that includes frameworks like Spring and Java EE. These provide tools for constructing scalable and adaptable business applications. The Spring Framework is a popular Java framework for creating enterprise-grade applications. It facilitates enterprise software development by providing features like dependency injection, inversion of control and interaction with other technologies.

3.2.2 .NET

Microsoft's .NET framework, which includes languages such as C# and Visual Basic.NET, is extensively used for Windows platform commercial application development. It offers libraries, frameworks (such as ASP.NET), and tools for developing online, desktop, and mobile applications. The new .NET Core framework is a cross-platform, open-source framework that allows developers to create business applications that operate on Windows, Linux, and macOS. It offers a contemporary and modular approach to designing apps using .NET technology.

3.2.3 SQL

Structured Quert Language (SQL) is a mandatory to work with Relational Databases as it is a commonly used technology in Enterprise Softwares. Understanding SQL and database management systems like MySQL, PostgreSQL, and Oracle is required for designing business applications.

3.2.4 Angular

Angular is a popular TypeScript-based frontend framework for constructing dynamic web applications. It is well-suited for enterprise software development. It best matches with .NET and Spring boot applications. It offers a comprehensive set of features such as data binding, component-based design, and powerful tools.

3.2.5 Docker

Docker is a containerization solution that simplifies the deployment and management of enterprise applications. Developers may use it to package applications and their dependencies into lightweight, portable containers for easy deployment across several environments.

3.2.6 Kubernetes

Kubernetes is an open source container orchestration platform. It automates containerized application deployment, scaling, and management, resulting in a scalable and resilient business software infrastructure.

3.2.7 AWS/Azure/GCP

AWS, Microsoft Azure, and Google Cloud Platform (GCP) all provide services for creating and deploying enterprise applications. These platforms offer scalable infrastructure, storage, database services, artificial intelligence, and other benefits.

3.3 RedDot on Enterprise Solutions

RedDot Digital Limited aspires to develop beyond its present bounds. Their goal is to become a known firm in the software market by offering exclusively devoted Enterprise level industry standard software solutions to local and international clients. As a result, they have launched an internship program in order to lead the industry in producing a generation of enterprise-focused software developers. Their employment procedure is equally demanding, and they strive to hire only the most qualified candidates. Before beginning work, all employees must complete a three-month training period. This is how RedDot Digital Limited is trying to improve our country's enterprise software industry.

3.4 Methodology to Learn Enterprise Software Development

Learning enterprise software development necessitates a blend of technical abilities, industry understanding, and hands-on experience, as J. Schiel et al. mentions in his book published in 2009.[1] Here are the steps I've discovered -

1. Creating a strong programming foundation by learning programming languages often used in corporate software development, such as Java, C#, Python, or JavaScript. Discovering the basics of object-oriented programming data structures, algorithms, and design patterns are very important. These are the basics.

2. Getting to know corporate architectural patterns including client-server architecture, service-oriented architecture (SOA), microservices architecture, and event-driven architecture. Understanding the concepts at the heart of these

designs and how they effect the creation of scalable and robust enterprise applications.

3. Learning Relational databases, SQL (Structured Query Language), database management as well as data modeling are all critical topics to comprehend. Understanding how to construct and optimize databases for business applications is critical. Data management is very crucial the creation of corporate software.

4. Understanding how the internet works is very important. Getting familiar with computer networks and web protocols to work in client-side and server-side programming. A thorough understanding is required in this topic.

5. Becoming acquainted with web development technologies such as HTML, CSS, and Spring and gaining proficiency in backend web frameworks and libraries like Spring boot/ ASP.NET as well as Angular, React, or Vue.js.

6. Learning backend technologies such as Java EE,.NET, and Node.js for developing enterprise application server-side components. Learning about web services (SOAP and REST), APIs, server-side frameworks, and security protocols.

7. Enterprise software frequently integrates with other systems, services, or third-party APIs. So it is important to learn about messaging systems (for example, Apache Kafka and RabbitMQ), Enterprise Service Bus (ESB), and API management.

8. Getting familiar with corporate software frameworks such as Spring (Java),.NET Framework (C#), and Django (Python). These frameworks contain robust tools and libraries for creating scalable and adaptable enterprise applications.

9. Getting acquainted with development tools typically used in enterprise software development. For example, IDEs, Git etc.

All of these processes must be completed in order to understand Enterprise Software Development, which I did throughout my internship. These are not to be taken in the preceding order, but rather some of them are to be run concurrently. For example, knowledge of how the web works and knowledge of how Java works, such as how to build up the Spring framework and a simple server, should be pursued concurrently. After that, after the basic work flow has been grasped, one must go on a project to get real-world experience, meet problems, and learn how to overcome them. Then, gradually, competency in frameworks and libraries, IDEs, and version controls will emerge. In the later chapters, I will share my approach to getting started with Enterprise Software Development.

Following industry blogs, forums, and groups are important to remain up to speed on the latest trends, best practices and new technologies in enterprise software development. Attend conferences and webinars to meet new people and learn from industry leaders. Continuous learning and improvement is very cruicial in this field because enterprise software development is a dynamic profession, it is critical to

embrace continuous learning. Advanced subjects such as cloud computing, containerization (e.g., Docker, Kubernetes), DevOps methods, security concepts, and artificial intelligence (AI) technologies will be covered.

Chapter 4

Internship Objectives

As a Software Engineer intern at RedDot Digital Limited, I can anticipate a complete and rigorous training program that will assist me in developing abilities and gaining practical knowledge in backend heavy development. The training program is designed to provide me with real-world experience and exposure while being led by seasoned mentors and industry leaders. The program exceeded my expectations.

4.1 Technical Training & Hands-on Experience

The internship is designed to provide you hands-on experience in corporate software engineering. Interns would work on real-world projects, communicate with industry experts and learn best practices. This goal guarantees that interns may apply theoretical knowledge from their studies to real-world circumstances. Besides, they will also be laying a firm foundation in backend development while becoming acquainted with front end technologies as well.

4.2 Skill Development

The program is intended to increase technical skills in backend engineering as well as frontend engineering. One would be able to learn and practice programming languages, frameworks, databases and other critical technologies. RedDot Digital Limited want to teach interns how to build solid and scalable backend systems.

4.3 Collaboration and Team Work

The internship at RedDot Digital Limited stresses the value of collaboration and teamwork in the workplace. Someone interning here would work with expert engineers and other cross-functional teams while working directly with the backend development team. This goal is to improve effective communication, teamwork and the capacity to operate in a collaborative context harmoniously.

4.4 Mentorship and Guidance

Throughout the program, RedDot Digital Limited believes in providing interns with assistance and supervision. Each intern will be assigned a mentor who will provide guidance, support, and feedback on a regular basis. The mentor's duty is to help interns develop learning goals, overcome obstacles, and get insight into the sector. This goal guarantees that interns receive customized attention and benefit from their mentors' knowledge and experience.

4.5 Professional Networking

RedDot Digital Limited believes in assisting and supervising interns throughout the program. Each intern will be paired with a mentor who will offer continuing guidance, support, and feedback. The mentor's duty is to help interns set learning objectives, overcome obstacles and get industry perspective. This goal guarantees that interns receive customized attention and benefit from their mentors' knowledge and experience.

4.6 Exposure to Industry Practices

Through the internship program, interns are introduced to industry practices and standards in software engineering. Software development lifecycles (SDLC), code reviews, version control systems like git etc. and other industry best practices would be taught to interns. This aim ensures that interns are familiar with industry best practices and are prepared for employment as quality software engineers in the future.

4.7 Personal & Professional Growth

RedDot Digital Limited's internship program aims to help interns grow both emotionally and professionally. This objective assures that interns leave the program with a wide set of abilities along with a sense of personal and professional accomplishment. Interns would be able to learn and practice not just technical skills. They would also be taught soft skills such as communication, problem-solving and time management.

Chapter 5

Training Experience

5.1 Overview

Getting the opportunity to work in the subsidiary of an MNC is a good start for a fresher like me, I believe. It is impossible to exaggerate the value of internships in the software development industry. Experience in the IT industry is crucial; it is not just a plus. The best method to gain such experience is through an internship.

Generally, internship programs that are especially designed and catered for IT graduates and students, can contribute a lot in the head start of a student's career. A student will be mentored by a team of qualified and experienced industry professionals over the course of the program, learning priceless skills and gaining crucial experience along the way.

At RedDot Digital Limited, I was assigned in the RDMS project enhancement which is the Robi Distribution Management System team. Interns are not allowed to directly work in the live projects but they are given similar practice projects to their actual product where interns are regularly accounted, taken care and guided by a Senior Software Engineer as an mentor to give a industry standard experience to the new comers. At first, I was trained by giving reading theoretical resources and tutorials mostly at the beginning. I will share some of the resources and my experience while going through them. However, due to the company's non-disclosure agreement with me and confidentiality issue I will not be able to mention them all.

5.2 Introduction to the basics of Software Development

I was taken through the basics of software development. I was provided with resources relating to how the web works, practical tools and software to track the flow of data etc. Below I will discuss the main topics I was trained to have knowledge on –

5.2.1 Learning How The Internet Works

As I was more interested in backend development, my mentor suggested me to learn the basic data flow in different layers of networks. So, I was given materials regarding the Network models, HTTP protocol etc. I was mainly asked to learn how HTTP requests are made and what the request contains and how the HTTP response returns and what these requests and response contains. So I focused on the TCP/IP model and later the POSTMAN software was introduced to me where I mainly worked with http- request and responses on a dummy server.

5.2.2 TCP/IP

My mentor instructed me to get a good hold on all the layers of the TCP/IP network model. He emphasized because the knowledge of this model is widely requirent while working on both client and server side development.

A group of communication protocols called TCP/IP, or Transmission Control Protocol/Internet Protocol, are used to link network devices on the internet. Additionally, a private computer network uses TCP/IP as its communication mechanism (an intranet or extranet).

TCP/IP is a general term for the complete IP suite, a collection of protocols. Although there are additional protocols in the suite, TCP and IP are the two most common. The TCP/IP protocol suite serves as an abstraction layer between the routing and switching fabric and internet applications. [3]

5.2.3 API and Postman Software

Any two independent programs can transfer and share data with one another, thanks to APIs. They facilitate action execution for users of a program by removing the need for the GUI. From the perspective of the developers, it's a simple method to use some features of their software and test it as well.

Due to the fact that one may need to utilize or test dozens or even hundreds of APIs on a daily basis, using APIs can be challenging. Consequently, it is challenging to remember their precise request's addresses, headers, authorization credentials etc. Additionally, it makes it more difficult to test the API for usability, security, and error handling.

Developers can easily create, distribute, test, and document APIs with Postman, an API client. Users are able to generate straightforward and intricate HTTP/s queries, store them, and examine the results using this open-source application.
Using the free and open-source Postman for API testing has several advantages, including its cloud-based accessibility, user friendluy for collaboration, testing - as one may include test checkpoints in the Postman API calls, such as confirming successful HTTP response statuses, automated testing of APIs, easier bug fixing and many more. The Postman console assists teams in verifying the obtained data. It facilitates API test debugging.

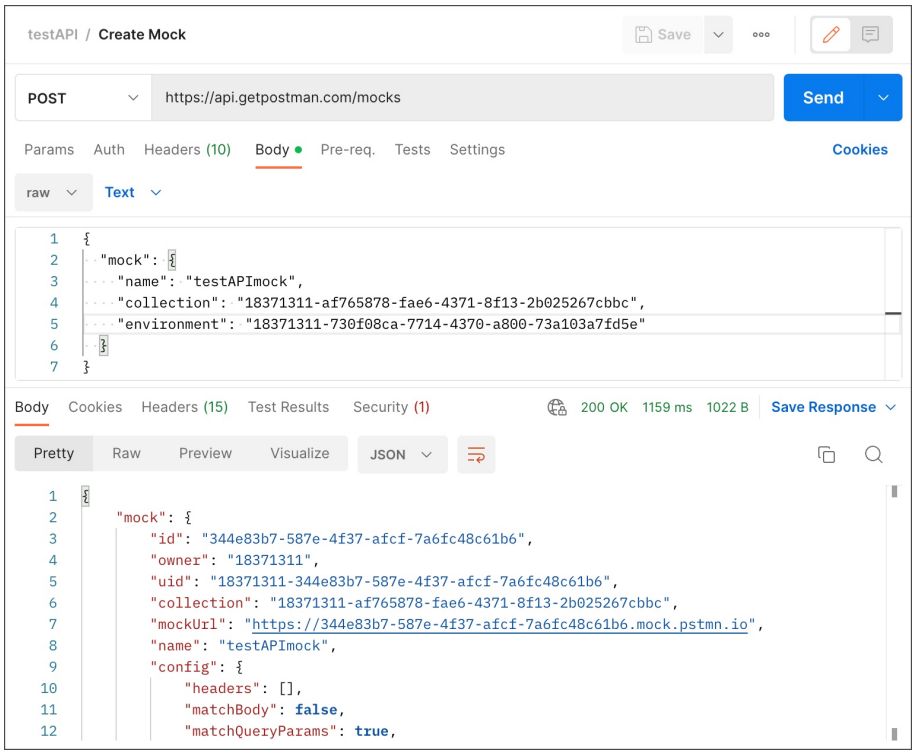

Figure 5.1: Postman API testing using fake JSON server

5.3 First Task

My first task was to build an REST API using JSP and Servlet (Java 17) which is able to perform CRUD operation and then test the APIs using postman.

5.3.1 Technologies Used

- **JSP** - Java Server Pages – A server-side technology, that is. The development of web applications uses it. Web content that is dynamic is produced using it. In this case, JAVA code is added to HTML pages using JSP tags.
- **Servlet** - Servlet is a Java class that is used to enhance the capability of servers that host applications accessible through the request-response programming model. Although servlets may respond to any type of request, they are most commonly employed to extend the capabilities of web server-hosted applications. The javax.servlet and javax.servlet.http packages offer interfaces and classes for developing servlets.
- **JDBC** - Java Database Connectivity - A Java programming interface that describes how a client may connect to a database. It is a data access technique based on Java that is used to link Java programs to databases. It is part of the Java Standard Edition platform from Oracle Corporation.
- **PostgreSQL** - Postgres is a free and open-source relational database management system that stresses flexibility and SQL conformance. It was first named as POSTGRES as a successor for the Ingres database developed at the University of California, Berkeley.

5.3.2 Tools and Software Used

- **IntelliJ IDEA** - While beginning with the task I was instructed to used IntelliJ for development. A Java-based integrated development environment called IntelliJ IDEA is used to create computer programs in the JVM-based languages Java, Kotlin, Groovy, and others. It is created by JetBrains and is offered in both a proprietary commercial edition and an Apache 2 Licensed community edition. I was instructed to use my g-suite email provided by my university to get a free one year lengthy registration.
- **Postman** - An open-source API testing software mentioned in the previous section.

The beginning first two weeks with the first task went great as I successfully submitted the mini project in time. The takeaways from this training phase were –

- Understanding how API works
- Understanding HTTP request and response clearly
- Getting familiar with development tools and software
- Getting familiar with Java Enterprise Edition through Servlet and JSP
- Getting to know how a whole full stack enterprise standard software works

5.4 Getting Introduced to Enterprise Software Development

5.4.1 The Beginning

The starting was through introducing me to the java framework called Spring Boot which is based on Servlet and java J2EE. My mentor handed me over a book called "Learning Spring Boot" written by Greg Al. Turnquist and suggested me a few free tutorials to practice and begin my journey with Spring Boot. This is a framework which was used in the majority of the projects in RedDot Digital Limited.

5.4.2 The First Big Project

I was assigned to build a Student Management System with a given list of features and specific tech stack. The goal was to learn how to build a real world project that provides real life solution using Java Enterprise Edition. I as initially asked to build the server side, i.e, the backend of the system with a relational database management system integrated. The front end part has to be done after the backend, i.e, the server-side is complete.

5.5 Web Application: SMS - Student Management System

Most colleges and universities rely on a complicated piece of software known as a "Student Management System (SMS)" to manage all of their student information and administrative activities, such as examinations, attendance, and other responsibilities.

The adoption of the Student Management System has lately improved the performance and efficacy of the education sector. With its well-organized, user-friendly, and dependable online school management software, this application has successfully replaced the administration department's functions.

5.5.1 Project Requirements

The student management system may help both students and school administration. Under the present method, everything is done by hand. It is both expensive and time consuming. Our student management system handles a variety of student-related responsibilities. This application's three key components are user, student, and mark management. Administrators and students are the only two categories of users that can use the system. The administrator has the power to alter, add, and remove users, which is also known as the CRUD operation (create, read, update, delete - the core elements of a RESTful API). A student has the power to create, amend, and delete accounts. The administrator can add, update, and delete items. The basic features of this system is enlisted below:

1. User Registration and Authentication:
    - User registration with basic details like name, email address, password, and role (student, admin).
    - Secure authentication mechanism to verify user credentials during login.
2. Student Profile Management:
    - Ability for students to manage their profile information, such as name, contact details, profile picture, etc.
    - Option to update and modify personal information.
3. Admin Dashboard:
    - An administrative dashboard for authorized administrators to manage student data.
    - Access to view, add, update, and delete student records.
    - Search functionality to find specific students based on criteria like name, email, or ID.
4. Security and Data Privacy:
    - Implement appropriate security measures to protect user data and ensure data privacy.

- login and logout features must be excessively secured in order to prevent any unauthorized access
- Use encryption for sensitive data and adhere to data protection regulations.

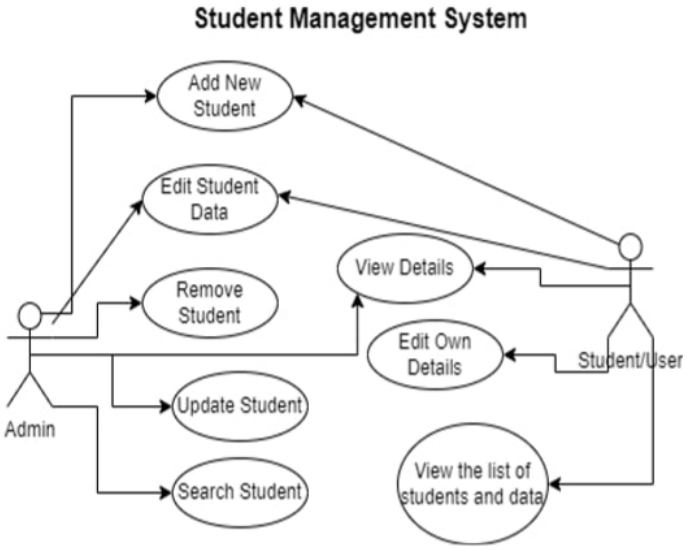

Figure 2 – UML diagram for Student Management System

Figure 5.2: UML diagram for SMS

5.5.2 Tools and Technology Stack

1. Spring Boot 2.7
2. React.js
3. Hibernate - JPQL
4. PostgreSQL
5. IntelliJ IDEa
6. Postman
7. Local Server (Apache Tomcat)

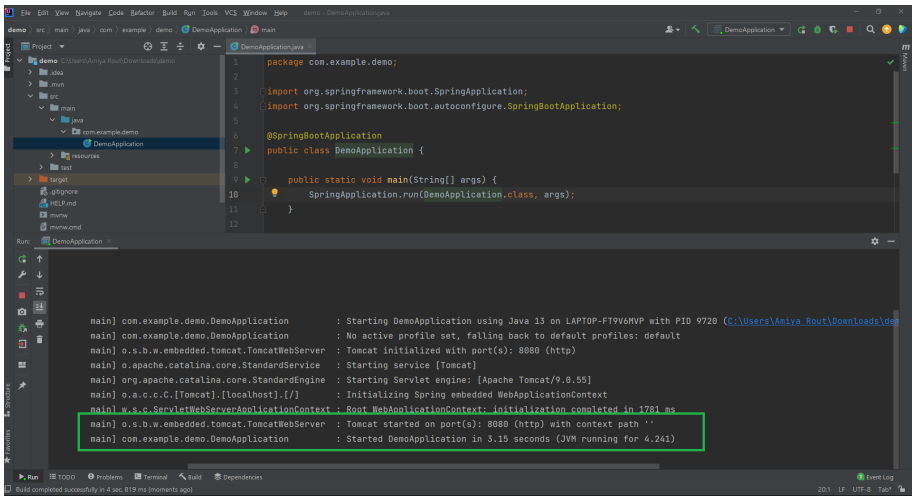

Figure 5.3: Apache Tomcat Server Running- IntelliJ & Spring Boot

5.5.3 Project Architecture

The project followed some specific architecture as per the instructions. I was dictated to use the Layered Architecture and the MVC pattern in the serverside/back-end development.

There were multiple layers through which data travelled throughout the project. Spring Boot web application best goes with this architecture and this is one of the best industry practices as well, as I was informed by my supervisor at RedDot Digital Ltd. The following were the layers in the "Student Management System" project.

1. Presentation
2. Business
3. Persistence
4. Database

I was told to use the MVC design pattern where there were Models - which build the project basement, View- which processed the final output to be sent to the server-side, and Controller - which sets the flow of data and implements the logics. The file structure in the IntelliJ IDEA is as shown in the snapshots next page.

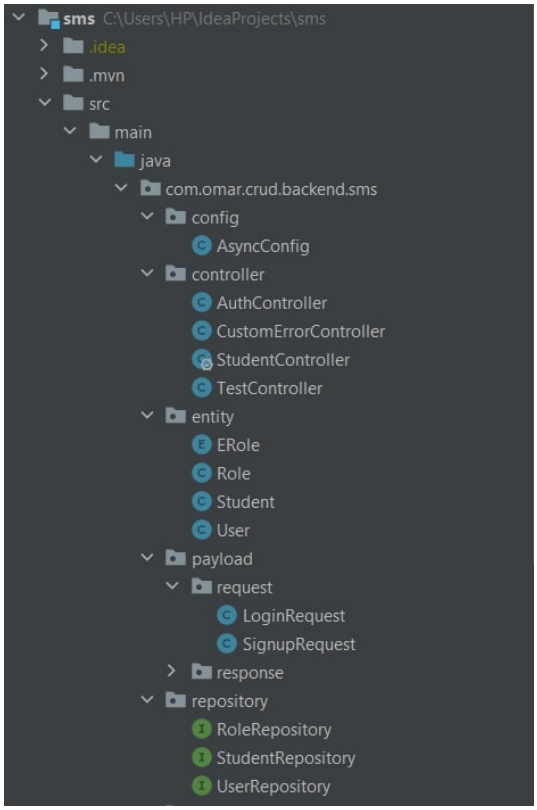

Figure 5.4: File arrangement denoting the project architecture - Part 1

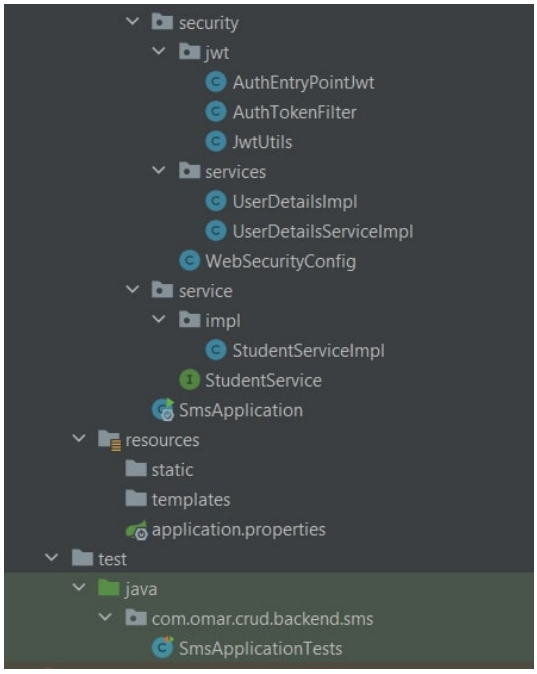

Figure 5.5: File arrangement denoting the project architecture - Part 2

5.5.4 Challenges

- Technology Integration was a big challenge. Integrating Spring Boot, a backend Java framework, with React, a frontend JavaScript library is a bit difficult. So I could start off smoothly.
- Understanding the underlying principles,took considerable time and effort in my case.
- React applications rely significantly on state management, particularly when handling user interactions and component changes. The process of synchronizing the state of React components with the Spring Boot backend is sometimes complicated. I had to learn Redux to solve the issues relevant to state management.
- To retrieve and update data, React apps often communicate with a backend API. For me it was a challenge to provide smooth communication between the frontend React components and the Spring Boot backend APIs, including managing authentication, data validation, and error management.
- Ensuring security of the system was a huge challenge. I had to learn through Spring Security which was a big thing as a beginner to begin with.So, it indeed was quite challenging to implement suitable security procedures, such as authentication and authorisation, for both the frontend and backend. The snapshot below shows the Spring Security configuration code for the Student Management System Project -

```
spring.datasource.url=jdbc:postgresql://localhost:5432/crudDB
spring.datasource.username=postgres
spring.datasource.password=admin123
spring.jpa.hibernate.ddl-auto= update
spring.jpa.show-sql= true
spring.jpa.properties.hibernate.jdbc.lob.non_contextual_creation= true
spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.PostgreSQLDialect
spring.jpa.properties.hibernate.format_sql=true

server.error.include-message=always

omar.app.jwtSecret= omarSecretKey
omar.app.jwtExpirationMs= 86400000
```

Figure 5.6: Spring Security Configuration Code

- Configuring CORS settings on the Spring Boot server to allow cross-origin requests from the React front-end was difficult at times. When I had first faced the CORS error I had to work for three days trying to detect the origin of the error, though these three days was a lesson indeed.
- Testing was a challenge for me. Creating testing frameworks, creating unit tests, and doing integration testing throughout the stack all need meticulous preparation and attention to detail.

5.5.5 API Testing

After finishing the development, my job was to test the APIs I had created with dynamic data types using postman. Initially it was challenging, but once I could make my own built system work and I could really see the data flow from client-side to server-side, it was a great milestone for me.

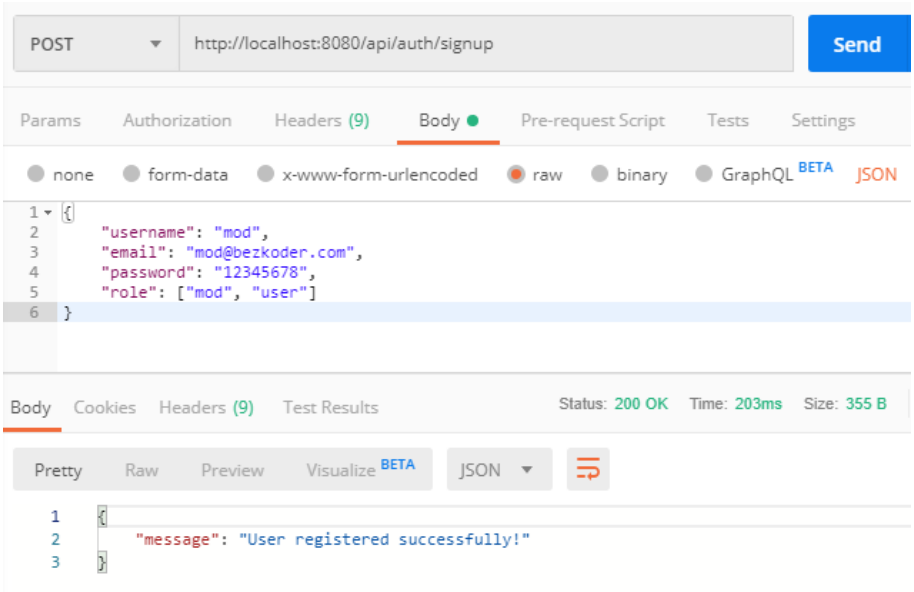

Figure 5.7: API Testing - JWT Authentication

Chapter 6

Internship Outcomes and Takeaways

6.1 Learning

The internship allowed me to apply theoretical information from my studies to real-world circumstances while also developing practical skills in Enterprise Software Development. Below discussed are some highlights from my internship journey:

6.2 Understanding Enterprise Software Development

One of the internship's key goals was to acquaint myself with the ideas and practices of enterprise software development. I learned about the various problems and concerns that go into developing large-scale, resilient, and scalable software systems. Understanding the significance of modular architecture, effective data management, security standards, and interaction with current corporate systems were all part of this.

6.3 Hands-on Experience with Cutting-Edge Technologies

The internship provided me with exposure to a variety of cutting-edge technologies and techniques utilized in corporate software development. I was able to work with cutting-edge frameworks, databases, and development environments. This hands-on experience helped me to hone my technical abilities and obtain competency in enterprise software development technologies such as Java,.NET, Spring, Hibernate, Oracle, and others.

6.4 Collaborating in Cross-functional teams

Working on an enterprise software development project needed strong coordination with cross-functional teams. I got the opportunity to collaborate with product man-

agers, business analysts, UX/UI designers, and quality assurance engineers. This collaborative setting deepened my awareness of the value of good communication, cooperation, and the ability to connect technical solutions with business needs.

6.5 Agile Development Methodologies

During my internship, I was exposed to agile development approaches such as Scrum and Kanban. This experience taught me about iterative development, continuous integration and deployment, and project management tools like JIRA or Trello. I learnt to react rapidly to changing needs and to work in sprints while maintaining constant communication and adding additional value to the project.

6.6 Problem-solving and Troubleshooting

The internship gave several opportunity to tackle challenging technical challenges and troubleshoot issues that developed throughout the software development process. I learnt how to approach problems methodically, do root cause analysis, and identify effective answers. This problem-solving experience helped me improve my critical thinking skills and troubleshooting talents.

6.7 Continuous Learning and Personal Development

The internship highlighted the importance of lifelong learning and personal growth. I aggressively pursued self-directed learning by investigating other resources, online lessons, and pertinent publications. I solicited comments from top engineers, attended tech lectures, and took part in the company's seminars or training sessions. This dedication to lifelong learning guaranteed that I continue my journey to developing technology and industry trends.

Chapter 7

Conclusion

My experience in the software industry has only recently begun, thanks to an internship at RedDot Digital Limited. I had fairly adapted to the work atmosphere after long two months, sitting in front of the computer most of the time during office hours and not being bored. I believe I've mastered the foundations of software development and am now confident in taking on new challenges and working with more sophisticated software systems.

Building the habit of problem solving, of looking at the same problem statement from many angles, has taught me a lot. I've realized that thinking about the same topic in different ways allows me to look at it from other angles. It was also pointed out to me that one should never cease testing a feature simply because it worked as intended, because this does not imply that it is error-free. I have realized this because even the most obvious and little mistakes are frequently disregarded. Nothing should be hurried since patience is essential for success in the industry.

The projects I've been assigned are largely practice projects. Looking at other projects that seniors in my team are working on, I realized that software development is not a simple profession. Enterprise level industry standard software product development, in particular, needs boldness, consistency, concentration, and patience. If one isn't always looking forward to self-growth and development, a minor problem can take days to rectify, not to mention the competitive climate I've been experiencing since the first day of my internship at this organization.

My internship began in the first week of September 2022 ending in January 2023. In order to complete the requirement of the CSE400 course module, I have presented the experience and knowledge of the program in this report.

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