Student Internship Programme (SIP)

Final Project Report

at

DBS Bank Ltd

Reporting Period:

06 2020 to 07 2020

by

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Department of Computer Science

School of Computing

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Internship Title: DBS Summer Internship (Technology & Operations – Technology Service)

Internship ID: 52339

Company Supervisor: Assistant Vice President Keith Dominic Sibala Katada

Academic Supervisor: Professor Bimlesh Wadhwa

Summary

I was responsible for the development and support of front and backend software for Collaborative User Services (CUS) related application development work. In addition, I was involved in the development and deployment of bots used for performance monitoring of CUS. On top of that, I was also tasked with the integration of static analysis and security plugins for the team's existing repositories.

Subject Descriptors:

•**Computer systems organization~Dependable and fault-tolerant systems and networks**
•**Software and its engineering~Software organization and properties~Contextual software domains~Software infrastructure~Middleware~Message oriented middleware**
•**Software and its engineering~Software creation and management~Software verification and validation~Process validation~Acceptance testing**   •*Software and its engineering~Software organization and properties~Software functional properties~Formal methods~Software verification*   •Software and its engineering~Software creation and management~Software post-development issues~Software version control

Keywords:

End-to-end web development, Deployment testing, Database management

Implementation Software and Hardware:

HP EliteBook 830 G6 Notebook PC, MS-Windows 10, Node.js 12.18.2, React, MongoDB, TinyMCE

Acknowledgement

In light of the COVID-19 global pandemic, many companies have had to cancel their summer internship programmes. I would like to express my sincere gratitude to DBS Bank for continuing the summer internship programme, allowing me to have a fruitful summer break. DBS has also given me the experience of working from home, which could be ubiquitous in the future, and has facilitated this by equipping me with a personal laptop and mobile phone.

In particular, I would like to thank my company supervisors: Senior Vice President Henry Yap Kien Leong, Assistant Vice President Keith Dominic Sibala Katada, Vince Lim Bing Shun and colleagues: Rohi Goh En Mu, Gwendolyn Tan, Dhiya'uddin Dah'alan and Vanessa Loh Shi Hui for their continuous guidance and support during the duration of my internship.

In addition, I would like to thank my academic supervisor: Prof Bimlesh for her advice which helped me to get the most out of my 2 months with DBS.

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Introduction

1.1 Background and Organisational Structure of Host Organisation

DBS Bank Ltd is a Singapore multinational banking and financial services corporation that was established on 16 July 1968 and is headquartered in Marina Bay, Singapore. Over the years, DBS has continued to innovate and adapt to technological disruption, enabling her to be recognised as the World's Best Digital Bank by Euromoney (DBS, 2016), on top of a whole host of other awards and recognitions. Since its establishment, DBS has expanded into 18 markets across the globe with over 280 branches (DBS, 2018). This includes 6 priority markets in Asia, namely Singapore, Hong Kong, China, India, Indonesia and Taiwan (DBS, 2020).

DBS is headed by CEO Piyush Gupta and the Board of Directors, who set DBS' overall strategy and oversees its implementation. The Group Management Committee executes the strategy in the various business functions of DBS, such as Technology & Operations, Human Resources, Capital Markets and more (DBS, 2020).

1.2 Principal Activities of Host Organisation

DBS provides financial services for a myriad of clients. For both local and foreign corporations, DBS provides services such as project financing, financial advisory and bank guarantees for loans (DBS, 2020). As for individuals, DBS provides personal banking, asset management, investment schemes and more (DBS, 2020).

1.3 Training Programme within Host Organisation

Interns were issued a work laptop and mobile phone to facilitate working from home. As part of the onboarding process for interns, we were given an interactive online orientation where we were introduced to DBS' mission and vision, organisation structure and business operations across the various regions.

1.4 Position of Host Unit within Host Organisation

I was attached to the Technology Service department under the Technology and Operations business function. My team was responsible for the development and support for CUS related application development work, which is critical especially during the Covid-19 pandemic, as most employees depend on collaborative services to work with one another while working from home.

During my internship, the team was working on a web application to monitor the availability and performance of CUS such as Microsoft OneDrive and SharePoint, as well as mobile services such as BlackBerry Work. The application relies on the use of bots to test variables such as login time, upload/download speed to determine the availability and performance of the services. In addition, the web application allows different departments to keep track of relevant metrics such as the breakdown of the number of company issued mobile devices by country and application utilisation percentage by displaying the data in the form of graphs and charts.

Training Schedule and Assignments

2.1   Training Schedule by Month for the Entire Training Period

My company supervisor provided me with the tech stack used in their projects for me to pick up in my own time, which I did so by using online tutorials in the form of YouTube tutorial series and written articles.

Month	Technical Skills Gained
June	• ReactJS, React Bootstrap, Node.js
July	• MongoDB, Jenkins (Groovy script), TinyMCE (WYSIWYG HTML Editor)

2.2   Training Assignments Completed in 1st Month

My first task was to create server API using Node.js for bots developed by my colleagues to upload performance data to the MongoDB database. My API also provided routes for the data to be downloaded to be displayed using Highcharts on the React front-end. My next task was to create another server API using Node.js for the upload and download of metrics data using a MongoDB database.

While developing my RESTful APIs, I used Postman to send HTTP requests to test them before proceeding to integrate it with the front end using axios. After developing the APIs, I assisted by fellow intern with the writing of the documentation for the API.

For both APIs, I adopted the Model-View-Controller design pattern to allow for separation of concerns. This made the code modular and easy for my colleagues to understand. It also made it simple to handover the code to my colleagues for them to update it if required in the future.

2.3   Training Assignments Completed in 2nd Month

My first task of the month was to write scripts to port over large amounts of data from the old to new MongoDB database. I had to also modify the data model based on the new front-end requirements. While not technically demanding, this was a tedious task as the old database contained records from several years.

Once this was done, I was given the task of integrating a WYSIWYG HTML editor onto the React front-end for comments to be added for each chart and graph. This editor would allow users to edit and save text on the front-end and it would instantly be rendered as HTML. I developed several mockups using different components from Froala, SunEditor, CKEditor and TinyMCE for my supervisors to choose from. Eventually, TinyMCE was chosen for its minimalist design and efficiency.

Towards the end of the internship, I helped the team to integrate Nexus IQ (detect security vulnerabilities) and SonarQube (static analysis to detect bugs and vulnerabilities) into the Jenkins pipelines via groovy script.

Knowledge and Experience Gained

3.1   Technical Knowledge Gained from Assignments

As mentioned in the previous section, I picked up modern web development technologies React, Node.js and MongoDB. I am now confident of building a web application from scratch with the skills I have gleaned.

I have also gained some exposure to the continuous integration/continuous deployment process by working with Jenkins, where I integrated Nexus IQ and SonarQube into the development pipelines for the team.

3.2   Organisational/Industry Experience Gained from Assignments

Working from home was an interesting experience, which could even become the norm in the future. I learnt to stay productive using collaborative applications and setting my own schedule to ensure work is delivered on time.

There were also instances of pair programming, which allowed me to work closely with another programmer to develop the same feature.

Finally, I had the opportunity to integrate the front and backend work done by my colleagues, which required me to give clear instructions on what changes I required from their projects. I also had to prepare documentation and handover my completed work to my colleagues, which allowed me to practice some of my soft skills.

3.3 Areas of Applicability of Knowledge and Experience Gained

In terms of technical knowledge, I am confident of contributing effectively to web development teams regardless of frameworks and libraries used. I have gained an insight into the workflow for web development and have also helped with the integration between the front and backend. Furthermore, I was involved in the testing process and have picked up tools such as Postman for automated testing.

As for non-technical knowledge, I am more confident so contributing my ideas to a development team. I am also more comfortable communicating and forming working relationships with my colleagues.

Conclusions

4.1 Summary of Work Completed and Training Received

To summarise, I got to experience end-to-end website development during my internship. I was exposed to both front and backend deployment, and even gained some exposure to the project testing and deployment process.

4.2 Problems Faced

Requiring Remote Access to Verify Program Correctness

Many services, such as server-side API access and viewing software deployment, within DBS were not accessible from home even though the office laptops were using DBS' VPN. These services required users to be on-site to access them.

As a result, I had to control an on-site computer via Microsoft Teams, but this was often subject to availability and I also experienced considerable lag which made the working process inefficient. This was problematic for me as there were times where I had to develop my code without being able to verify if the output is correct.

<u>Working with Well-Developed Brownfield Project</u>

The projects I worked on were brownfield projects that already had large code bases. In comparison to my previous internship experience at a start-up where I mostly worked on greenfield projects, this introduced the challenge of having to go through large amounts of code written by other developers, which was time consuming. To be more productive during work hours, I used my time after work to study the code base so that time during work hours can be spent on implementing new features instead.

4.3 Assessment of Training Experience and Concluding Remarks

In retrospect, my internship experience with DBS has been extremely enriching and interesting. I had the opportunity to get my hands dirty with many of the modern web development technologies in the form of ReactJS, Node.js and MongoDB. I also had to opportunity to perform software testing such as unit testing, stress testing and user acceptance testing. Finally, I also gained insights into the software deployment process on Jenkins and OpenShift web console, where I integrated plugins that performed static and security analysis on our project builds.

As for non-technical takeaways, I learnt to work in a development team. I found ways to contribute during team discussions, as well as take the initiative in sourcing for and proposing alternative solutions whenever another member faces an issue. Knowing that my colleagues were working on the same repositories as me, I made sure that any new code introduced would not result in conflicts which would cause the deployment to crash.

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