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Reading guide

SEMESTER 7 ENTERPRISE SOFTWARE

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Contents

INTRODUCTION

My name is Tsanko Nedelchev, and I am a seventh-semester software engineering student with a specialization in cybersecurity. During my fourth semester, I focused on cybersecurity, which sparked my interest in pursuing a career in this field. To gain further experience before making a decision, I completed a software development internship in my fifth semester. In my sixth semester, I delved back into cybersecurity through an advanced specialization. Now, in semester seven, I decided to immerse myself in focused software development.

My ultimate goal is to become a skilled security/cloud security developer or engineer in the future.

My primary objective for this semester is to achieve nine learning outcomes. They are explained further in the following pages of this document. To accomplish that, I participated in a group project, worked on an individual project, and conducted and documented research on a specific research topic.

Throughout this semester, I tracked my progress towards each of the learning outcomes and documented any feedback and reviews provided by professionals, peers, and mentors from Fontys ICT. Additionally, I provided my own personal reflections and reviews of my work for this semester.

PROJECTS

Individual project

For my individual project, I chose to develop a highly functional application that encompassed all of my learning outcomes. The application focused on organizing workplaces and adopted a microservices architecture similar to that of the popular platform Slack. To accomplish this, I used modern development technologies such as TypeScript, Node.js, Express, MongoDB, and RabbitMQ. These technologies helped enhance the application's performance, security, scalability, and modularity. The microservices within the application covered various essential functionalities, including user authentication and authorization, email notifications, and posts.

I built the application on Google Kubernetes Engine to leverage its infrastructure and services. Furthermore, I introduced horizontal scalability, monitoring and alerting. My development process included a lot of technologies that helped with the automation of different tasks such as GitHub Actions for he CI/CD aspect of this project. I have automated most of the features of this project including the building, the testing, the deployment, the scaling, the monitoring and alerting. I explain all operations in the evidence files in this portfolio as well as in each learning outcome section.

Group project

I was also a part of a group project that focused on requirements given to us by the "DAF Trucks" manufacturing company's engine factory. The project aimed to enhance the functionality of Grafana by providing new and intuitive insights that facilitated the identification of anomalies, thus supporting condition-based or preventative maintenance.

I collaborated inside a team of 5 people to achieve the end goal of the project together in the 6 sprints starting from Sprint 0 where we formed the project plan to sprint 4 where we finished all technical tasks for the project and finally sprint 5 which was focused on delivering the technologies that we had developed to the company.

In this project my role was focused on query and database performance as well as database scalability. As a result, I have produced different results – Database normalization research document that aims to enlighten the reader about Database optimization and normalization for the sake of improved performance, Database aggregation/summary tables research and product including automated updating of the data and the tables, and finally a research document of Database Partitioning and specifically – partitioning by range which is essentially horizontal scaling of MySQL databases.

SELF-ASSESSMENT OVERVIEW

Although it did not look like it recently, I believe I have accomplished a lot this semester. I started a bit confused as to the focus of the semester. Initially I began working heavily on my personal project application trying to refactor code a lot and create complex solutions for simple problems. The problem with that was that it took a lot of my time and what's more, it did not really help me show much in regards to the learning outcomes for this semester at the beginning. Somewhere around sprint 3 I began noticing that I was not really progressing as rapidly as I should. Then I began a more focused work on my personal project and specifically, following the learning outcomes more closely. This came at a good time, however I had to do a lot to gain back the lost time. This is why most of my work was accomplished after sprint 3 of the individual project and specifically sprint 4 and 5. As a result, it turned out that sprint 5 which was the shortest sprint of only 2 weeks was my most productive individual project sprint this semester. I have managed to complete most of the things I had set out to complete however with a bit more focus earlier I believe I could have achieved a lot more.

When it comes to the group project, I believe I was much more consistent there as it was group work and I did my best to always be available to my group and to take part as proactively as possible. In the following chapter I will explain why I believe I have done work at a Proficient level for this semester.

LEARNING OUTCOMES

1. FUTURE ORIENTATION

You develop and deploy enterprise software, both individually and as a team, that fits the current question and needs of your stakeholders. Your final solution is designed with the possibility for future further development.

Personal Project

For my personal project I have defined all Functional, Technical and Non-functional requirements inside my “Analysis Document”. I have deployed my application on Google Cloud which I have specified in my “Infrastructure and Cloud Environment” Document and I have made sure that the development process is fully automated through my pipeline setup which is shown in my “Individual Research Report”

Analysis Document

My Analysis Document shows my initial idea for my individual project, featuring my functional requirements which are structured like user stories, my Technical requirements which specify the tech-stack that I had planned to use for my application, and my non-functional requirements which have acceptance criteria.

I managed to achieve my security non-functional requirement as I have implemented authentication and data encryption in my application however I don’t have role based authorization.

In terms of Scalability I have achieved horizontally scalable microservices inside my cluster however the acceptance criteria defined in my analysis document is not applicable as it specifies concurrent users and operations.

In terms of reliability have handled the error handling requirement.

Infrastructure and Cloud Environment

In my infrastructure document I have explained my Google Kubernetes Engine deployment setup, my Google Artifact Registry image building and storage procedures, My Kubernetes manifest files that deploy my microservices on Kubernetes and pull the images from the Artifact Registry, and finally, my Monitoring and Alerting setup that ensures the safe status of my deployment.

Individual Research Report

My research report is focused on my DevSecOps CI/CD pipeline features which are fully automated and ready for potential future development of the project.

Group Project

Database Partitioning Research

My database partitioning research document features research into database partitioning and features recommendations for range partitioning which would be a good idea for the Product Owner to implement in the future to ensure database scalability and performance as it grows bigger and bigger.

Summary tables Research and Scripts

This evidence contains the research I conducted during my Group Project that specifies the advantages of using Summary Tables to improve query performance along with scripts that will allow the Product Owner to implement the solution into their database seamlessly without interfering with their current setup. Furthermore, it provides scripts for automated updating of the created summary tables that ensures that the Product Owner would not have to setup anything themselves to handle that aspect of the summary tables.

Self-assessment:

Proficient – By defining my Analysis document I have began designing my end application. I have made it so that design is congruent with potential stakeholders' user stories however initially I have defined non-functional requirements that are not applicable to a school project. Nevertheless, I have looked at the Security, Scalability and reliability of my project. I have also specified my Deployment setup and my CI/CD environment that automate the process from start to finish with multiple security, quality and reliability checks along the way. I have also focused on the future of the solutions that I create for my group project by recommending steps and providing automated solutions in my deliverables.

2. INVESTIGATIVE PROBLEM SOLVING

You deliver professional products according to planning, which is the result of solving problems in a structured and methodical approach. You demonstrate a critical view towards your own and other people's work.

Individual Research Report

Inside my individual research report I have defined my research into the topic of DevSecOps CI/CD pipelines security features. I have defined my research questions. Following the DOT methodology I have defined the tasks I will perform in order to answer all research question. I ave made sure my research questions are logical and follow a coherent reasoning. I have documented my research as a result of answering said questions and finally I have presented a demonstration of the knowledge I have acquired.

Group Research Report With highlighted personal work

In this evidence document I have highlighted which questions I have followed in my group project research in order to gain information regarding the deliverables, such as the Database Optimization Research, The Database Partitioning Research and The MySQL Summary Tables and Events Research.

Self-assessment:

Proficient – I have followed the DOT framework methodology as close as possible when conducting my research. I have defined well structured research that is logically sound and useful.

3. PERSONAL LEADERSHIP

You acquire skills required for your future career. You are aware of multiple career paths and can reflect which ones fit best, considering your (potential) skills and ambitions. You are aware of developments in software engineering and can signal trends.

DevSecOps pipeline research and setup report

In the introduction of this Reading Guide I have specified my goals and aspirations for the future. These goals are very much congruent with the research topic I chose for my individual research. In this report I have chosen to investigate the setup and deployment of security, and quality assurance checks inside a DevOps Pipeline thus researching the very thing I would like to do in the future as a career.

Self-assessment:

Proficient – I have done extensive research of the security process automation inside a DevOps pipeline including the setup and deployment of security features as well as my whole CI/CD workflow for my individual project. One could say that me joining this semester instead of doing a minor was also proof of my personal leadership and ambitions.

4. TARGETED INTERACTION

You use appropriate communication considering your role in a team, your audience and the medium to convey your message and results of your software development process.

Sprint Delivery Presentations and Sprint Release Notes

During my individual and group projects I have participated in presenting our sprint findings every 3 weeks. After each sprint I have defined the Sprint Release Notes containing the sprint goals, achievements, future goals and retrospective. Furthermore I have had multiple interactions with out group Product Owner over a Teams call and email when conducting delivery of deliverables for testing. Furthermore I have been solely responsible for scheduling group sprint delivery meetings with all stakeholders of the group project and navigating around their availability.

Peer feedback

I have included a PDF file with references from my peer group teammates of how I have conducted myself during the group project times and what I have achieved.

Self-assessment:

Proficient – I have taken part in the communication between the team and the client during our group project and have discussed my personal project with my coaches. I have also interacted with our client via emails and teams calls during sprint delivery times and I have organized group meetings between all stakeholders in out group project.

5. SCALABILITY

Besides functionality, you develop the architecture of enterprise software based on quality attributes. You especially consider attributes most relevant to enterprise contexts with high volume data and events. You design your architecture with future adaptation in mind. Your development environment supports this by being able to independently deploy and monitor the running parts of your application.

Technical Design Document

In my technical design document I have specified the reason for the selected tech stack – the MERN stack and one of the main reasons if it's proclivity to creating scalable APIs and microservices. I have also defined the setup of my own microservices and have explained what each part is responsible for. In the development process I have made sure that each microservice application can run on it's own without having to rely on other external applications and services.

DevSecOps pipeline research and setup report

I have automated my Continuous Integration and Continuous Delivery environment to automatically build, test, deploy and scale the applications on my Kubernetes Cluster.

Infrastructure and Cloud Environment

In this evidence file I have described the Google Kubernetes Engine deployment of my application featuring the Kubernetes manifests that describe the configuration of the autoscaler functionality for each microservice along with the resource pool for each pod and the conditions under which the scaling is automated.

Database Partitioning Research

The database partitioning research describes the partitioning strategy for MySQL databases which enables large databases to be treated as many smaller databases included into one database. This is directly corelated with the scaling process but from a database perspective.

Self-assessment:

Proficient – I have looked at scalability in a few different ways and I understand why it is needed and what it is. I have also implemented multiple features that help with the scalability of technologies in both my individual and group projects.

6. SECURITY BY DESIGN

You investigate how to minimize security risks for your application, and you incorporate best practices in your whole software development process.

DevSecOps pipeline research and setup report

In my research I have looked at different ways to implement security features in order to shift-left the security process inside my DevSecOps pipeline which are: Static code analysis, Software Composition analysis, Docker image security and Dynamic application security testing. I have also implemented a tool for every last one of those inside my CI/CD pipeline and have automated the response to commits depending on the branch. I have also implemented repository secrets in order to pass sensitive environment variables to my applications during the DevOps process.

Technical Design Document

In my technical design document I have specified the security features I have implemented in my Auth microservice when it comes to Authentication and session cookie management. I have added a requirement that only authorized users can log into my application and that the cookies are safe from client side editing and being used from any other domain but the one of my application by using the httpOnly and sameSite tags during the cookie generation process.

Test strategy and Report

In order to ensure the security and robustness of my application I have defined a testing strategy and performed the tests from it. I have recorded the results and changes after the tests inside a Test report.

Self-assessment:

Proficient – I have focused a substantial amount on security this semester since it is also a big interest of mine. Between the security features in the DevOps pipeline, the robustness of my application's design and the testing strategy I believe I have achieved a relatively safe web application.

7. DEV OPS

You set up environments and tools which support your chosen software development process. You provide governance for all stakeholders' goals. You aim for as much automation as possible, to enable short release times and high software quality.

DevSecOps pipeline research and setup report

I have a pretty high level of automation in my GitHub repository and pipelines. I have described the setup in my individual research report. Furthermore, I have implemented Google Cloud development using scaffold for development on the cloud. Moreover, the automated deployment from GitHub is another part of the DevOps process that is fairly streamlined making use of Artifact Registry to store my Docker images away from the outside world, only accessible to my Kubernetes cluster.

Summary Tables research and scripts

Summary tables are by themselves not an automated part of the DevOps process however the solution that I developed for my group project is an automated updating algorithm inside the MySQL server itself that uses events in order to automate Aggregation tables updating.

Self-assessment:

Proficient – My DevOps process is fairly streamlined with every part of it being automated. I have also introduced different scanners to ensure the quality and security of my application is as high as it can be every time. Furthermore I have looked into different types of automation inside my group project – focusing on summary tables and their custom updating algorithms.

8. CLOUD SERVICES

You can explain what a cloud platform provider is and can deploy (parts of) your application to a cloud platform. You integrate cloud services (for example: Serverless computing, cloud storage, container management) into your enterprise application, and can explain the added value of these cloud services for your application.

Infrastructure and Cloud Environment

In this evidence file I have described my Google Kubernetes Engine setup along with a description of the Artifact registry, The container build workflow and deployment, the Kubernetes manifest files with their different stages and automated variable setting, autoscaler metrics and resource management, monitoring and alerting functionalities inside Google Cloud Platform, and finally, dynamic application security testing with OWASP ZAP as well as billing information. During my Cloud setup process I also looked into Digital Ocean even though I haven't documented it as I gave up on that Idea because, although cheaper, it requires way more manual setup of things like monitoring, autoscaling, load balancing and domain names. Furthermore, I had initially planned to use Azure Cloud for my deployment but my credits ran out and I couldn't upload the whole Kubernetes Cluster on it. I used it however to host my SonarQube VM on Ubuntu for automated scans inside the CI/Cd pipeline.

Self-assessment:

Proficient – I haven't yet worked with cloud computing and architecture in order to deploy and host my application.

9. DISTRIBUTED DATA

You are aware of specific data requirements for enterprise systems. You apply best practices for distributed data during your whole development process, both for non-functional and functional requirements. You especially take legal and ethical issues into consideration.

Technical Design Document

In my Technical Design Document I have defined the database strategy I am using for my microservices – each microservice is using their own MongoBD database on the same cluster. It would. Furthermore, sensitive data like passwords are encrypted in the database and I am not saving any unnecessary user data on my application's database.

If I had more time I would have liked to implement legal solutions like the right for users to delete their accounts completely from my database and all data that is connected to that account as well as a prompt that is transparent about what part of my users' data I keep in storage. Furthermore another nice idea would be to research MongoBD cluster autoscaling and data backup and implement it .

Self-assessment:

Proficient – I have made some decisions about data storage and distribution for my individual project and looked over different requirements and nice ideas about features to implement. Sadly, however, I ran out of development time before I could implement those features.

CONCLUSION AND SEMESTER REFLECTION

In conclusion, this semester was pretty good, however I wish I had taken my time more seriously in the beginning so I didn't have to finish everything in the last minute at the end. Despite it all I am rather impressed by the work I managed to complete inside a period of 2 weeks during the final sprint and I hope to never have to do that again.

I wish I had taken a bit more time to document everything throughout the semester. It would have been much better than documenting everything at once in the end.

Regarding the group project, it started out rather on the disappointing side and as time went by I found a strong interest in MySQL operations. I had never gone this deep into MySQL functionality before and had no idea about the level of complexity MySQL offered.

Working with deployments was very interesting for me as this semester was the first automated cloud deployment that I have orchestrated from a CI/Cd pipeline.