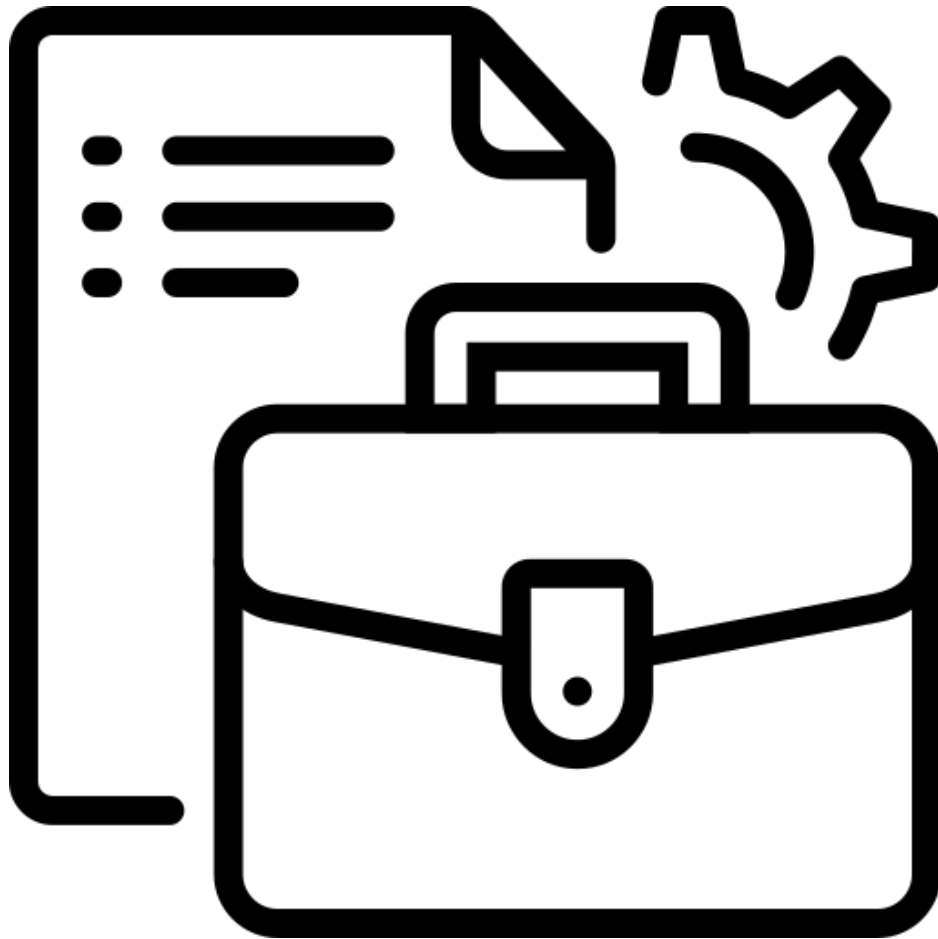


# Portfolio



*Portfolio free icon: Flaticon.com*

Semester: 6 - Software

Created by: Mickey Krekels

Class: RB04

# 1 VERSION MANAGEMENT

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Version	Date	Author(s)	Changes	State
0.1	14-02-2022	Mickey Krekels	Added the main structure of the document.	In progress
0.2	16-03-2022	Mickey Krekels	Added the first Evaluation chapter	In progress
0.3	17-03-2022	Mickey Krekels	Fixed grammar-related issues	In progress
0.4	18-03-2022	Mickey Krekels	Added the feedback from Leon	In progress
0.5	02-04-2022	Mickey Krekels	Added the second Evaluation chapter	In progress
0.6	10-04-2022	Mickey Krekels	Fixed grammar-related issues and added feedback from Freek	In progress
0.7	26-04-2022	Mickey Krekels	Added the Third Evaluation chapter	In progress

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## 3 SHORT INTRODUCTION

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### 3.1 ABOUT ME

My name is Mickey Krekels and I am currently in semester 6 as an IT student at Fontys University of Applied Sciences. Before Fontys however, I studied Game development at the MBO SintLucas, which gave me a good understanding of programming and UX design. During my specialization on Fontys, I studied the subject of AI with the main focus set on neural networks.







### 3.2 THE DOCUMENT CONTENT

In this document, I describe my findings and research results based on the learning outcomes of semester 6. For every result, I depict the meaning of the learning outcome, and based on that information I will show the current state of my progress this will include: self-assessment and learning process description with a personal reflection added. And at the end a short retrospect and conclusion.

## 4 LEARNING OUTCOMES

In this part of this document, I will describe and grade myself for each learning outcome, based on the outcome levels(see picture below). I will also provide proof in the form of pictures and examples of what I have learned so far.

Each of the chapters contains a learning goal **clarification**, this information is provided by the “S-ESE6-CMK” (1) course on Canvas.

LEVEL	DEFAULT DESCRIPTION	PDR DEMONSTRATES
Undefined	You have not yet undertaken activities to demonstrate the learning outcome.	You <b>have not finished</b> a  Basic level activity yet, and/or did not receive or reflect on feedback.
Orienting	You have made a start and explored the possibilities to demonstrate the learning outcome.	You <b>have finished 1 or more</b>  Basic level activities and/or <b>started</b> with  Normal level activities, and your reflection on the received feedback shows that you know how to improve your work and how to progress your studies.
Beginning	You have taken the first steps and carried them out which contribute to demonstrating the learning outcome.	You <b>have finished 1 or more</b>  Normal level activities and the received feedback is leaning to the positive side, your reflection makes it clear that you realise that you are doing fine, yet still see opportunities for improvement in further activities.
Proficient	You have shown several times that you have created a basis to demonstrate the learning outcome. You will demonstrate the learning outcome at a sufficient level, if you continue your development in this way.	You <b>have finished multiple</b>  Normal level activities and the received feedback together with your reflection make a compelling argument of having acquired the knowledge and skills as defined in the learning outcome.
Advanced	You have shown several times that you have been working on this learning outcome with good results. You have performed above expectations and are focused on continuous improvement. You will demonstrate the learning outcome at a more than sufficient level, if you continue your development in this way.	You <b>have finished 1 or more</b>  Expert level activities and the received feedback together with your reflection clearly shows how you progressed beyond the knowledge and skills as defined in the learning outcome.

## 4.1 DEVELOPING ENTERPRISE SOFTWARE AS A TEAM EFFORT

### 4.1.1 Clarification

Enterprise software is used in the context of companies that use large-scale distributed software, with many types of users, and substantial amounts of data. In such a context, you will develop software and software-related products (for instance software design, test setups). All of this should be transferable to the current stakeholders, and software engineers who work on the software after you leave. Together with your team, you agree upon a way of working that is considered professional in a large IT software organization. This software development process should be agile to accommodate future changes (for instance scrum). Your behaviour supports the chosen way of working. You consistently share technical knowledge and experiences of the software development process both inside and outside the team. Besides requirements needed by direct stakeholders, you also take other viewpoints into account which are relevant (for instance GDPR, ethical & legal issues). It is your job that all your results can be verified, validated, and transferred to others

### 4.1.2 First Evaluation

This semester started with the group assignment of Globe-Protocol. The goal of the project is to create a survey management tool where the user has the option of changing their consent. The product owner of this project is Teun Hendriks, we [meet him every week](#) (2) on Teams to discuss our work. Together with our team, we made a project plan document with the functional and non-functional requirements. This knowledge was then used to create the issues, epics and stories on the Jira-Software planning tool. This work was discussed and validated with the product owner.

With these steps done we started working on the product itself, a Github organizations page was created and each of the team members started working on the sprints. My work was mainly done on the “Data-Export-Service” and “Consent-Management-Service” in the back-end of the application.

(The Jira page and the Github repositories are private, therefore here are the screenshots made during the process of the [Jira](#) (3) and the [Github](#) (4) workflow)

Because of these steps made in the group project, I think that I proved that on “Developing Enterprise Software as a Team Effort” I am on the level of **Orienting**!

#### 4.1.2.1 Next steps

The current flow of the project is going well, the client and my team members are happy with the process this far. In the next evaluation, I want to focus more on the initial testing setups of the services. With this addition, I think that the grade can be lifted from **Orienting** to **Beginning**!

#### 4.1.3 Second Evaluation

During the sprint 1 delivery, we presented our group work to the product owner Teun Hendriks. He was very impressed with the initial MVP (Minimum Viable Product). The next step for the second sprint is to continue working on improving the functionalities required for the project.

Because this was our first sprint we provided each other with [peer feedback](#) (5). The group was happy with the work I provided as scrum master and team member.

(The Jira page and the Github repositories are private, therefore here are the screenshots made during the process of the second sprint [Jira](#) (3) and the [Github](#) (4) workflow)

Because of these steps made in the group project, I think that I proved that on “Developing Enterprise Software as a Team Effort” I am on the level of **Beginning**!

##### 4.1.3.1 Next steps:

The client and my team members are happy with the MVP and process this far. In the next evaluation, I want to focus more on helping on the front-end side. With this addition, I think that the grade can be lifted from **Beginning** to **Proficient**!

#### 4.1.1 Third Evaluation

During sprint delivery 2 and 3, we presented our work to the product owner Teun Hendriks. He is overall very happy with the communication between our group and him. My task within this team is helping as a team member and being the scrum master. Until now we have done 2 peer reviews and the [feedback](#) (5) is positive towards me.

From the feedback, I learn that my spelling is sometimes still an issue will coding (for example with miswriting table names in queries). I solved this problem by installing a spell checker package called "LTEx". Therefore the problem of miswriting important parts during coding is solved.

With the feedback provided by Freek, we also now write the sprint retrospectives down in a table format. This is an important step, if we discuss retrospectives only vocally, it could be difficult to see what we improved in previous sprints.

I also help the group by delivering the deadlines on Canvas on time (See Canvas the assignments deliveries group projects: Sprint 1, 2 and 3).

Because of these steps made in the group project, I think that I proved that in "Developing Enterprise Software as a Team Effort" I am on the level of **Proficient**!

##### 4.1.1.1 Next steps:

In the next evaluation, I want to focus more on helping on the Kubernetes and Azure side, and remain my task as a scrum master. With this addition, I think that the grade can be lifted from **Proficient** to **Advanced**!

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022
3	Proficient	26-05-2022



## 4.2 CONTEXT-BASED RESEARCH

### 4.2.1 Clarification

You apply critical thinking in your day-to-day work. In your planning, you can divide your work into questions that need investigation. Each investigation has a goal that can be validated and is relevant and valuable for your specific context. You use a well-known methodology (for instance the DOT framework) to structure your investigation. The result of the investigation is validated by you and shows the quality and value of the result. The result of your investigation can be justified and presented by you, both verbally and in writing. Others can validate the results, making the results transferable to others. One of the ongoing investigations is: keeping an eye on the current state of development of your products (for instance using the Technological Readiness Level).

### 4.2.2 First Evaluation

For the assignment “Emerging Trends Research: Plan” of the canvas course, I chose the topic “Artificial Intelligence and Machine Learning”. In this research, I want to find out how music can be generated using AI and neural network technology. With this document, I make use of the DOT framework structure and use sub-questions to answer the main question.

(this research plan can be found in the canvas course under “Emerging Trends Research: Plan” or at my [public repository](#) (6))

In the next evaluation, a lot of work on the main document will have started, but currently, there is only the research plan. Therefore I believe that I am on the level of **Orienting**!

#### 4.2.2.1 *Next steps*

In the next assessment, I would like to focus more on the main research document. Together with the "Design Oriented Research" report of the group project, I think the grade can be raised to **Beginning**!

#### 4.2.1 Second Evaluation

For the group project, we made 2 deliverables for the "Design Oriented Research" assignment. The research plan documents are focused on "Prominent survey tools and open-source survey solutions" and "securing data in Golang". These documents can be found in the canvas course under "Design Oriented Research" or at my public repository (6)

For my own personal research document, I started working on the overall structure. This included the various chapters I am going to add. This research plan can be found in the canvas course under "Emerging Trends Research: Plan" or at my public repository (6)

In the next evaluation, a lot of work on the prototype deliverable will be done. Therefore I think that I am on the level **Beginning!**

##### 4.2.1.1 *Next steps:*

In the next assessment, I would like to focus more on the main research document. Also, I want to start working on the music generating prototype, with these changes I think the grade can be raised to **Proficient!**

#### 4.2.1 Third Evaluation

After the second evaluation, I started working on the Emerging Trends Research report on the topic of generating music with AI. I already showed the basic structure of how the document was formatted, but now the document has all its sub-questions and main question answered. The overall document is now finished and will be graded after the Monday after the portfolio 3 deadline.

(Research report can be found at my public [Github repository](#) (6) or later on Canvas at delivery Emerging Trends Research: Deliverables)

For the group project, we made 2 deliverables for the "Design Oriented Research" assignment. These research reports contain the topics "Prominent survey tools and open-source survey solutions" and "securing data in Golang". The documents have already been looked at by our teachers (Freek, Leon). As feedback, we needed to change the sub-questions structure. But after these improvements, the group research reports will be ready for a second evaluation/delivery.

I am confident that the Emerging Trends Research report will be positively graded. Therefore I think that I proved that in "Developing Enterprise Software as a Team Effort" I am on the level of **Proficient!**

##### 4.2.1.1 Next steps:

The "Design Oriented Research" assignment of the group project, is not yet finished. If we improve the sub-questions and add the feedback from Freek and Leon, I think that the grade can be lifted from **Proficient** to **Advanced!**

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022
3	Proficient	26-05-2022

## 4.3 PREPARATION FOR LIFE-LONG LEARNING

### 4.3.1 Clarification

Career paths within ICT are plenty and will differ per student. To be able to choose a path, you will find out your current skills and ambitions first. Your search for roles and careers that fit you in the future. You can explain which skills you need to develop for these careers, and you can organize the activities needed to develop them (for instance by finding minors or graduation assignments that fit your ambitions). You apply those activities by applying for a minor or finding a graduation project.

### 4.3.2 First Evaluation

In the field of IT, there are lots of topics and branches to learn from. Besides school assignments, I follow courses on varied software subjects. For this, I mainly use LinkedIn-Learning which provides me with information and a certificate on completion. This certificate will be added to a list named "[Licenses & Certifications](#)" (7) where companies can see in what topics I have experience with. The career path I want to take is still a little hard to pinpoint. But by expanding my skills, the options for different paths remain open.

At the moment, my main focus is on "Artificial Intelligence and Machine Learning". Therefore, I would like to find out in these assessments which of the side or final projects fit this description. Because of these reasons, I believe that I am on the level of **Orienting**!

#### 4.3.2.1 Next steps

In the first few weeks of this semester, I have mainly researched the required topic on the learning outcomes. For the next evaluation, I want to learn more about the Emerging Trends Research document topic. With expanding my skills in machine learning, the focus will be more on my own ambitions. By taking this step I think that the outcome grade can be raised to **Beginning**!

#### 4.3.1 Second Evaluation

On the platform LinkedIn learning, I am still following courses about Artificial intelligence. One of these was about how to effectively implement machine learning within a software project (for example a recommendation AI). This could be useful for my Netflix clone personal project.

I also started looking at the specialisation semester “ICT & Artificial Intelligence”, this semester could improve my current skills and understanding of AI. Because of these reasons, I believe that I am on the level of **Beginning!**

##### 4.3.1.1 Next steps

For the next evaluation, I want to focus more on the “Emerging Trends Research document”. The topic of generating music with AI should provide a lot to learn about. With these steps, I think the grade can be raised to **Proficient!**

#### 4.3.1 Third Evaluation

For this learning outcome, I continued to keep up my LinkedIn account. With the addition of Updating my [resume](#) (8) for future internships and job opportunities. I also delivered the assignment “Graduation Preparation - Finding a Suitable Graduation Project” on Canvas where I talk about what type of graduation project is most suited for me. This document also includes a time plan on how I am going to achieve this suitable internship.

For learning new technologies I use the platform LinkedIn learning provided by the school account. This ensures that the completed courses are shown on [my LinkedIn page](#) (7) under the “Licenses & certifications” list. Therefore companies confirm if I have indeed experience with certain topics like Kubernetes, angular or machine learning for example.

Because of these reasons, for this learning goal, I believe that I am on the level of **Proficient!**

##### 4.3.1.1 Next steps:

For the next evaluation, I want to focus more on finding a suitable internship. There is still a semester between now and the graduation project, but I think that this will help me find a suitable and learn full internship. With these steps, I think the grade can be raised to **Advanced!**

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022
3	Proficient	26-05-2022

## 4.4 SCALABLE ARCHITECTURES

### 4.4.1 Clarification

You investigate architectural patterns and scalable architectures that perform well in enterprise contexts. Your chosen architecture should support relevant quality attributes from this enterprise context (for instance robustness, performance, availability, and responsiveness). Your architecture consists of independently running parts (for instance microservices), which need to be deployed independently and communicate asynchronously (for instance using messaging). You investigate which performance indicators you will need to measure and monitor those independent parts while they are running. You validate that your application automatically scales using your indicators while having realistic loads. Your choice of technologies for the scalable parts should fit the quality requirements of the architecture. You use techniques during analysis and design, which help in creating scalable architectures (for instance Event Storming). Your development process and platform should support the design and deployment of your scalable architecture. You use industry standards (for instance C4 model, UML) to communicate and justify your architectural choices to stakeholders and your own team.

### 4.4.2 First Evaluation

For the group project, architectural diagrams had to be created to ensure that the architectural overview was clear to us and the client. The models were created by myself and a team member (Manoah Somers). The diagrams include the C1 model, C2 model, data flow model and the sequence diagrams of the group project.

(These models can be found on Teams under group 1 files, or at my [public repository](#) (9) on Github)

For my own project “Micflix” (a Netflix clone), I worked on the technical design document. Within this document, the schematics C1 and C2 models are currently available.

(These models can be found on my project [documentation repository](#) (10) on Github)

Because of these reasons, I believe that I am on the level of **Orienting**!

#### 4.4.2.1 Next steps

For the group project, I helped with making the diagrams and models. For the upcoming portfolio assessment, I want to focus more on the architecture of my personal project. With this addition, I think that the grade can be lifted from **Orienting** to **Beginning**!

#### 4.4.1 Second Evaluation

In the period between now and the First evaluation, I worked a lot on the architecture of the personal project. The initial services in the C2 model were not modular, this meant that some services were using the same database. This made them dependent on each other, with the feedback provided by Leon this was changed to a one database per service architecture. I also added a message broker to the project architecture.

(These models can be found on my project [documentation repository](#) (10) on Github)

For the group project we fixed most of the naming of the services, the original naming caused problems when explaining the flow of the project architecture. Together with the addition of the message broker, this was improved in the new C2 model.

(These models can be found on Teams under group 1 files, or at my [public repository](#) (9) on Github)

Because of these improvements focused on architecture, I believe that I am on the level of **Beginning!**

##### 4.4.1.1 Next steps

With the addition of the message broker, the overall architecture starts to be more and more complete. For the next evaluation, I want to focus more on the data distribution within the project. This includes creating dataflow models and events storms. With these steps, I think the grade can be raised to **Proficient!**



#### 4.4.1 Third Evaluation

##### 4.4.1.1 Next steps:

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022

## 4.5 DEVELOPMENT AND OPERATIONS (DEVOps)

### 4.5.1 Clarification

You define how you are going to support all stakeholders' needs in your software development process, especially regarding inevitable changes involving the application (for instance reporting, Service Level Agreements, changes in requirements, releases, end-user wishes). You define environments that will be used by developers in the development and creation of software (for instance test and production environments). These infrastructure environments are defined using 'Infrastructure as code' principles. You make parts of your application independently deployable (for instance using containers). You support automatic testing and measurements which prove the quality of the application (for instance code coverage, security assessment, support for monitoring). You automate all the above as much as possible (for instance using CI/CD principles).

### 4.5.2 First Evaluation

For the Personal project, I am going to use Docker containers in combination with Kubernetes to set up my back-end project structure. To automate this deployment process, Github actions is going to be used as the main CI/CD Pipeline.

The initial research into these topics is already done, the videos "[Building Docker containers with GitHub Actions](#)" (11) and "[Docker Tutorial for Beginners](#)" (12) have given me a basic understanding of the technologies themselves.

Because of this research, I believe that I am on the level of **Orienting**!

#### 4.5.2.1 Next steps

I already hired a server where I can run and test a docker environment. The next step will be looking at creating a pipeline between the repository and the server. With this step, I think the grade can be raised to **Beginning**!

#### 4.5.1 Second Evaluation

For the topic of DevOps, I hired a server where I currently run Docker and Portainer, with Ngnix proxy manager the server endpoints are secured with SSL encryption. For my CI/CD pipeline, I use Github Actions together with Dockerhub and WatchTower. The pipeline is fully functional, and additional testing and code quality test reports can be easily added to the workflow.

For running my project, I created a stack with a [docker-compose file](#) (13). This stack uses a Ngnix network to connect the containers, with this I don't expose the ports to the public.

Because of these steps made, I believe that I am on the level **Beginning!**

##### 4.5.1.1 Next steps

Currently, my website does not use extra DNS protection. Therefore I want to implement Cloudflare, this should protect my project and services from possible ddos-attacks. With the continuation of my compose file and the addition of Cloudflare, I think the grade can be raised to **Proficient!**

#### 4.5.1 Third Evaluation

For the outcome “Development And Operations (DevOps)” I added several new SDLC features to the [pipeline](#) (14). Based on the feedback from Leon I added a dependency checker for the Golang packages. This ensures that when packages need updating It is viewable in Github Action output. Also, I added a unit testing check before the build and publish stage. This ensures that the update does not create new bugs in the previous code.

For analyzing code quality, I added [SonarCloud](#) (15) to the project structure. Currently, the code coverage does not work with my [Go](#) (16) written project(I added the sonar-project.properties file with the needed configuration, but SonarCloud does not include this). Overall It is a great tool to spot code smells.

Because of these steps made, I believe that I am on the level of **Proficient!**

##### 4.5.1.1 Next steps:

Currently, the code coverage does not work within Sonarcloud, therefore I intend to fix this issue before the next evaluation(Or look at another code quality service). There are still some steps missing from the pipeline, for example linking the CI/CD to the Azure Kubernetes service. Therefore it is a good step to link these platforms together, an alternative to this using a Watchtower like service that pulls the latest Dockerhub image. With these steps, I think the grade can be raised to **Advanced!**

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022
3	Proficient	26-05-2022

## 4.6 CLOUD SERVICES

### 4.6.1 Clarification

You can explain the reasons why cloud platform providers exist and demonstrate that you can develop applications that are completely or partially implemented by using cloud services (scalable databases, container management, logging & monitoring, cloud storage, authorization, and autoscaling). You also demonstrate that non-functional requirements of your system are still met when cloud services are used. You explain the impact (the number of cloud resources needed, the best fitting cloud platform provider and the budget needed to host the alternative solution based on cost estimation) of using cloud services as an alternative solution for parts of your application used in your architectural decisions.

### 4.6.2 First Evaluation

As I explained in the previous assessment 4.5.2, I will use Kubernetes for the overall structure of this project. For initial research on this topic, I looked at the playlist "[Kubernetes development guide for beginners](#)" (17) on youtube and the course "[learning Kubernetes](#)" (18) on LinkedIn-Learning. In these tutorials/lessons, I learned how it can be useful for an Enterprise project, and the basics for the implementation.

Because of this research, I believe that I am on the level of **Orienting!**

#### 4.6.2.1 Next steps

For my project, I want to use RabbitMQ as a message broker. Connecting the different services manually is not ideal, because of this issue, I want to create a testing setup with a Kubernetes environment. This will make the initial steps of working with Kubernetes easier, therefore I think with this addition the grade can be raised to **Beginning!**

#### 4.6.1 Second Evaluation

For my personal project, I tried to install KubeCtl on my public server. This sadly did not work, there were some problems with the configuration files. Therefore I have decided to run Minecube on my local device, these files can then be uploaded to a cloud platform such as Azure or DigitalOcean.

Because of this research, I believe that I am on the level of **Beginning!**

##### 4.6.1.1 Next steps

Currently, my services are running on docker. For my next evaluation, I want to create a local Kubernetes version of my project. With this addition, the grade can be raised to **Proficient!**

#### 4.6.1 Third Evaluation

For the outcome of “cloud services” I use the container orchestration Kubernetes. In the sprint 3 presentation, I already showed my working local version of the Kubernetes version. For deploying on the project I have chosen the platform, Azure. I have worked with other cloud providers such as Amazon Web Services (AWS) during my internship, and because of that, I can personally say that using the Azure environment is a lot easier to manage.

Currently, most of the deployment is complete, but there are still some problems with the ingress routing. But I am confident that this issue will be solved before the next evaluation. The load balancing already works locally, I tested this with the logging service “[Elasticsearch](#)” (19). But this needs to be also tested on the Azure platform.

Because of these steps made, I believe that I am on the level of **Proficient!**

##### 4.6.1.1 Next steps:

Fixing the ingress routing on Azure and testing the load balancing not only locally but also on in the cloud. With these steps completed the project will be fully deployed on the cloud, and therefore the overall grade can be raised to **Advanced!**

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022
3	Proficient	26-05-2022

## 4.7 SECURITY BY DESIGN

### 4.7.1 Clarification

You investigate which security risks are most common (for instance OWASP top 10) and you investigate which best practices are used to prevent security risks for all steps in your software development process. You use common techniques (for instance misuse cases, trust boundaries) in the analysis and design of your architecture. You implement common techniques (for instance authentication and authorization) which prevent common security breaches. You also design for, and test steps to mitigate breaches when they still occur.

### 4.7.2 First Evaluation

To research this topic, I visited the official [OWASP website](#) (20) and their [youtube channel](#) (21). This provided me with information that could be used to improve the overall security of my personal project. For example, the topic “A07:2021 – Identification and Authentication Failures” suggest *Limiting or increasingly delaying failed login attempts* (22) , with this addition in my project a brute force attack can be easier detected.

Because of this research, I believe that I am on the level of **Orienting!**

#### 4.7.2.1 Next steps:

During this stage of my personal project, the focus was on researching the learning outcome topics. The security issues explained by OWASP, made me realize what needed to be added to improve the overall security. By addressing these issues I think the outcome grade can be raised to **Beginning!**

### 4.7.1 Second Evaluation

The walking skeleton I made in sprint 2 uses a Keycloak service to secure the authorization of pages and data. It includes many different options for extra security such as mail verification and limiting the number of login attempts allowed.

Because of these steps used, I believe that I am on the level of **Beginning!**

#### 4.7.1.1 Next steps

Currently, only the front end is protected with Keycloak. For the next evaluation, I want to intergrade Keycloak into all services, this would greatly improve the project security. With this addition, the grade can be raised to **Proficient!**



#### 4.7.1 Third Evaluation

For the subject “Security and design”, I created an OWASP analysis. Where each of the top 10 OWASP issues was explained and graded based on the project security state. The security application was overall good, but there were some points of improvement in Insecure Design and Security Logging and Monitoring Failures. This was mainly because the project code did not contain much unit testing and logging. To improve upon this problem I added Unit testing using mock data. And for Centralized logging, I added the “[Elasticsearch](#)” (19) service to my main Kubernetes cluster.

(The [OWASP analysis](#) (10) can be found in the “Analysis\_Micflix” document on the project repository)

Because of these steps made, I believe that I am on the level of **Proficient!**

##### 4.7.1.1 Next steps:

Currently, there are still security improvements to be made. For example, improving the current logs that are collected and displayed in the Elasticsearch service. This would make debugging problems much easier. Also, the Keycloak protection could be more refined. The service offers more than only simple logging in and registering, it also provides 2-factor authentication and controls the amount of login tries for brute force attack protection. Therefore this would be a great improvement for the overall security. With these additions, the learning goal grade can be raised to **Advanced!**

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022
3	Proficient	26-05-2022

## 4.8 DISTRIBUTED DATA

### 4.8.1 Clarification

You apply best practices in translating non-functional and functional requirements into specific data requirements. You investigate which solutions are suitable for real-time and persistent data storage, and which solutions fit your architecture. You apply legal requirements in your design and implementation (for instance GDPR), and you are aware of ethical issues of your data design. Steps needed for developing with distributed data in mind will be incorporated by you in your current software development process.

### 4.8.2 First Evaluation

For my project, I want to use MySQL and MongoDB as the data storage. Currently, the decision justification is not yet described in the technical design document. But this will be updated in the next evaluation.

To research the topic of GDPR, I visited the official "[Data protection in the EU](#)" (23) page on the European Commission website. Where I read most of the general laws on data protection. This information is going to be applied on the user side of my application.

Because of this research, I believe that I am on the level of **Orienting**!

#### 4.8.2.1 Next steps

The technical design document does not contain a decision justification chapter yet. With this addition to the document, I can explain why this data storage solution fits my architecture. I think that with this document update, the outcome grade can be lifted from **Orienting** to **Beginning**!

#### 4.8.1 Second Evaluation

During sprint 2 of the group project, we created an ethical design document (24). This document included a scan from the Technology Impact Cycle Tool and an explanation of what part should be improved.

For my personal project, I added real-time and persistent data storage. I use Volumes mounted to my containers to keep the data persistent after removal or reset.

Because of these steps used, I believe that I am on the level **Beginning**!

##### 4.8.1.1 Next steps

I already have persistent data storage for my docker environment. But the final result will be run within a Kubernetes cluster, therefore I need to research how to persistent data storage in Kubernetes. With this additional step, I think that the outcome grade can be lifted from **Beginning** to **Proficient**!

#### 4.8.1 Third Evaluation

For this learning outcome, I created a “data complexity analysis”. I researched the CAP theorem, This concluded that Consistency and Partition tolerance are the must-have guarantees for my application. For here a table was made with the databases that fall within this category. Each of the rows contained the name, Data model, and Pros/Cons. Because of the Pros and previous experience with MongoDB, this became my preferred choice.

(This [Data Complexity Analysis](#) (10) can be found in the “Analysis\_Micflix” document on the project repository)

For the General Data Protection Regulation part, I added a chapter GDPR. Where I explain the proof of the main rules/essentials.

(This [GDPR Chapter](#) (10) can be found in the “Analysis\_Micflix” document on the project repository)

For the Kubernetes side of the data, I used statefulsets with volumeClaimTemplates. This ensures that the data is persistent even after a container is stopped or removed.

(The [Kubernetes files](#) (25) can be found on the project repository)

Because of these steps made, I believe that I am on the level of **Proficient!**

##### 4.8.1.1 Next steps:

For the evaluation, I want to look at creating my own VolumeClaims and DataStorage in Kubernetes. The current volumeClaimTemplates work, but I think it could be informative to write these steps from scratch. With these additions, the learning goal grade can be raised to **Advanced!**

Self-evaluation table		
Evaluation version	Grade	Date
1	Orienting	16-03-2022
2	Beginning	02-04-2022
3	Proficient	26-05-2022

## 5 RETROSPECT

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(this chapter will be added at a later date)

## 6 CONCLUSION

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(this chapter will be added at a later date)

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