Research

Research into Docker and different types of Testing

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Year: 2022

Class: S-A-RB-CMK 4

Introduction

This research is focused on learning about Code Testing in C# (Unit testing, System testing, end-to-end testing) and working with Docker. The main driver to conduct this research is that I want to gather knowledge on these topics I have never worked on before to be able to use this information to improve future projects. By learning how to test, I can verify and validate my work of its functionalities. Furthermore, Docker has a lot of benefits, and a lot of people work with the tool nowadays. By getting the acquired experience from this research of working with docker, I can as well take this skill and use it for future projects.

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Research Questions

This research plan is based on a main research question broken down into sub research questions. By answering these sub questions can the main question be answered.

Main research Question

How can I create a mineable viable product during the first half of the current software semester that uses Docker and code testing which includes unit, system and end-to-end testing in C# to learn how to improve the quality of future projects?

Sub Questions

- What is Docker?
- What is Unit Testing?
- What is System Testing?
- What is End-to-End Testing?
- What minimal viable product can be made using Docker and Code Testing?

Dot Framework

What is Docker?

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
Field	Problem Analysis	Making sure the problem is clear to what I would like to find out from answering this research question.	By making sure the question is clear to what problem I want to solve, I can make sure that I don't lose track in the research I am doing.

What is Unit Testing?

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
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What is System Testing?

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
Field	Problem Analysis	Making sure the problem is clear to what I would like to find out from answering this research question.	By making sure the question is clear to what problem I want to solve, I can make sure that I don't lose track in the research I am doing.

What is End-to-End Testing?

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
Field	Problem Analysis	Making sure the problem is clear to what I would like to find out from answering this research question.	By making sure the question is clear to what problem I want to solve, I can make sure that I don't lose track in the research I am doing.

What minimal viable product can be made using Docker and Code Testing?

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	By looking at online sources to other projects will it give me ideas to how the minimal viable product will be made.
Library	Expert Interview	Asking my teachers at Fontys for advice on the minimal viable product I will be making for feedback.	With the advice and feedback from my teachers, it will help me give a clear picture that the to be made product is obtainable.
Workshop	Prototyping	By determining what kind of prototype suits my needs best.	A clear view of what I would like to learn from my prototype.
Showroom	Peer Review	Organizing time for my teachers to look at my prototype during and at the end of creation for feedback.	To make sure I am on the right track with creating the prototype.

What is Docker?

Context

This research question is based on understanding what Docker is. Understanding and answering this question will help us to create a mineable viable product that uses continuous development and continuous integration. I will be answering this question with the help of the dot framework's method and strategies shown below.

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
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Action / Summary

I have followed quite a few of beginner tutorials ranging from articles to YouTube videos where some worked best for me to understanding the general concept of docker and how to use it and others were to no help. Further, I received also available documents from my technical teacher Jacco where I could practice using docker. In this section I will touch down on a few tutorials I have followed to what I learned with a short reflection on each action I took. I also give next steps I will take on what I wish to improve on and how I will do so.

Docker for Beginners: From Docker Desktop to Deployment

Site: [Docker for Beginners: From Docker Desktop to Deployment](#)

Context / Reflection

This video gave me an understanding into Docker (docker image autonomy and containers), learned docker definitions such as commands used and dockerized a react app and a WordPress application with a maria database.

This video has thought me about docker and gave me an understanding to how to dockerize an application. This video has been a great start for me to learning about docker and how to dockerize an app and the anatomy of a docker file.
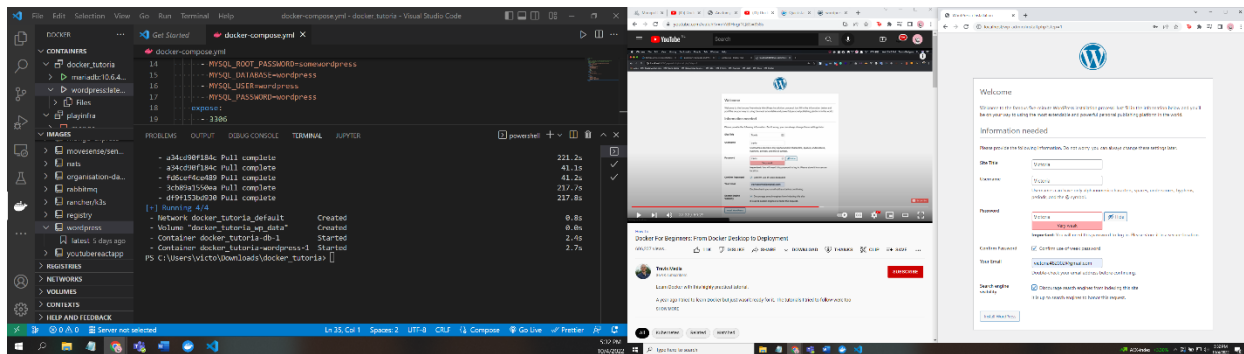
Proof

Image 1: "Practicing Unit testing"

Docker Tutorial for Beginners (YouTube video)

Site: [Docker Tutorial for Beginners](#)

Context / Reflection

Regardless of this YouTube video being mostly focused Linux with docker, I can say that I did find this video helpful. Besides Linux with docker the video touches down on what docker is, comparison of virtual machines to containers, docker architecture and lastly actually dockerizing a react app. The video was clear and also provided decent visual aids that helped made docker for myself understandable.

I am not a professional, but I do have more of a better understanding of using docker and feel a bit more comfortable with the software.

Next step

My next step is to see how to dockerize an entire application (front, backend and database) where this video was only focused on dockerizing the frontend. By understanding how to dockerize an entire application, I can have an idea what I will need before developing the prototype for this research

Docker Crash Course (YouTube video)

Site: [Docker Crash Course](#)

Context / Reflection

This course gives understanding and hands on work to understanding docker by describing images, containers, parent images, Docker file, starting & stopping containers managing images and containers, volumes, docker compose and lastly dockerizing a react app.

This tutorial is handy for more detail explanation and hands on action. In this tutorial, I dockerized another frontend react app but I learned much more concepts regarding docker such as managing images and volumes and docker compose which I find useful for continuous development.

Next steps

From this tutorial, I have changed my goal from learning to dockerize an entire application to learning how to dockerize a microservice due to the prototype that I will be building is a microservice and not a monolith. With that being said, I find that it will be more efficient for myself to start learning dockerizing a microservice.

What is Unit Testing?

Context

This research question is based on understanding what Unit Testing is. Understanding and answering this question will help us to create a mineable viable product that uses continuous development and continuous integration. I will be answering this question with the help of the dot framework's method and strategies shown below.

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
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Action / Summary

To understanding how to integrate unit testing in code, I first did research into the topic to get a general understanding and look for some sources that could help me.

Before using these sources, I asked my fellow group mates if the sources were a great start and covering the knowledge I should know. As feedback I was informed that following one of the sources is enough to have a general understanding of unit testing where I can use this knowledge to create tests for example for functionalities of a calculator.

The following section touches down on the source I used for understanding and implementing unit testing in code and how it benefitted me.

C# Unit Tests Using NUnit (.NET) (Beginner) (Youtube)

Site: C# Unit Tests Using NUnit (.NET) (Beginner)

Contexts

This course I have learned how to create unit test with the concept (Arrange, Act, Assert) with very basic functions. It gave me the core concept on how to think and program regarding unit testing with using functionalities of a bank application and creating unit tests on these functionalities.

From the knowledge I acquired, of creating unit tests for functions based on functionalities of a calculator, I can use the steps to apply it in other projects.

Next step

Create unit tests for the prototype I will be building based on the knowledge that have been acquired.

C# Unit Testsing Using XUnit (.NET) (Beginner) (Youtube)
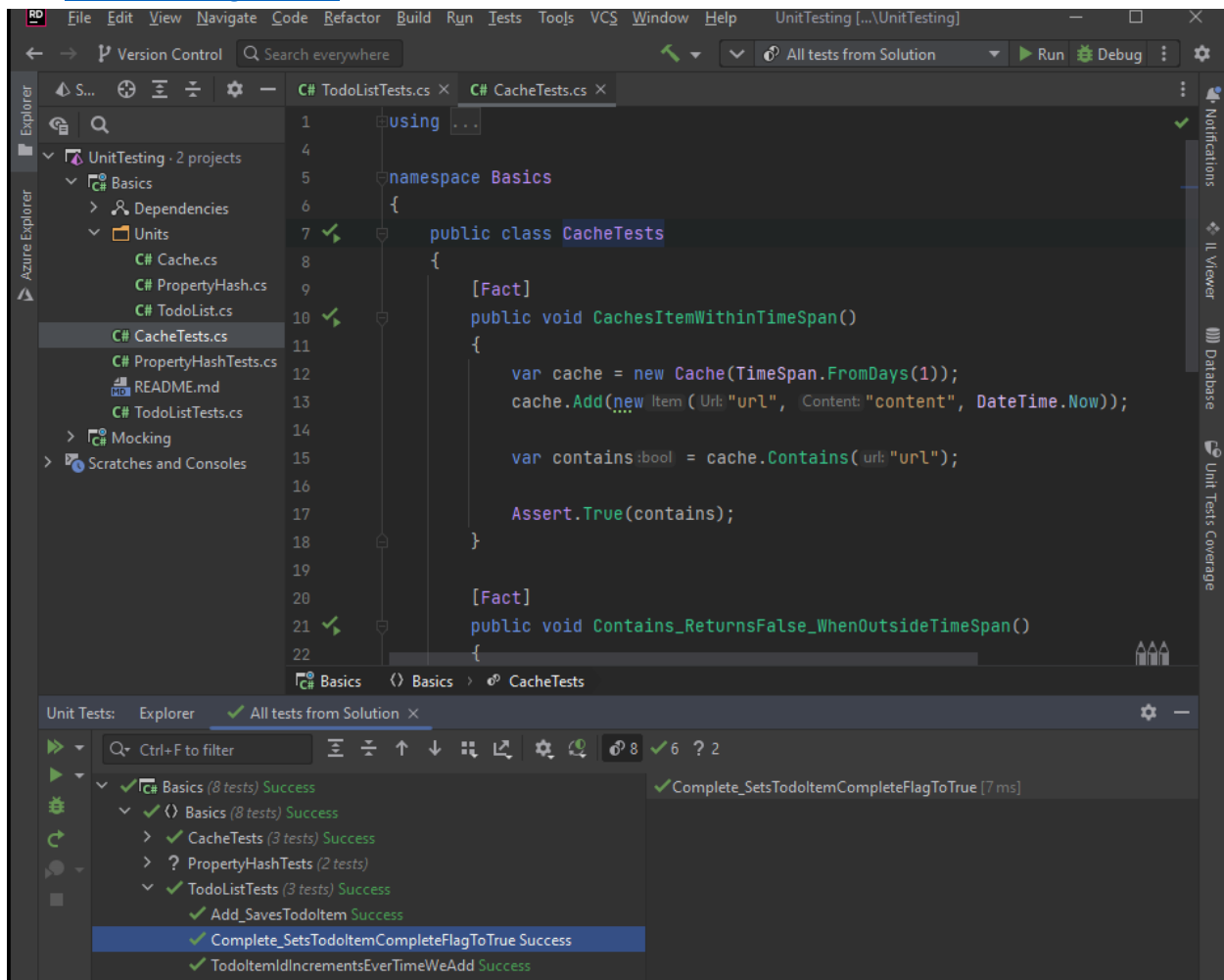
Site: [C# Unit Testing Tutorial](#)

Image 2: "Practicing Unit testing"

Contexts

This tutorial gave me personally an understanding to how to look at unit tests. Thinking in the future to how code can be changed and how it will affect the tests and time to rewrite them is crucial. Being critical with unit tests and not writing something fast to say "it is tested" is bad code practice.

The tutorial gives three example projects to how to implement unit tests which I can use for other projects.

Next step

After creating some unit test for the 3 example projects. The creator has worked on further with these projects to how to implement integration testing which I will be diving into.

What is System Testing?

Context

This research question is based on understanding what System Testing is. Having an understand to what system testing is will help me expand my testing skills and knowledge.

With the help of the dot framework's method, I have set up some strategies shown below to how to answer this question.

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
Field	Problem Analysis	Making sure the problem is clear to what I would like to find out from answering this research question.	By making sure the question is clear to what problem I want to solve, I can make sure that I don't lose track in the research I am doing.

Due to time constraint, I was not able to execute any system tests on my own individual project and trying out tutorials, but I did do research into this topic.

Action / Summary

System testing is used by developers to test how the completed, integrated, system as a whole functions together. System testing is not based on testing one component, or the interaction of two components but all components interacting with one another.

The goal of system testing is to test if the system as a whole, functions based on the set requirements to minimize risks before production. With the help of system testing, it creates confidence in the quality of the system with also aiming to find any defects to prevent these before release time.

Curious regarding more on system testing I will be trying out some system testing in my free time to see what hands-on experience I can do regarding this topic.

What is End-to-End Testing?

Context

This research question is based on understanding what End-To-End Testing is. Understanding and answering this question will give me the understanding of this type of testing.

With the help of the dot framework's method, I have set up some strategies shown below to how to answer this question.

Method	Strategy	approach	expectation
Library	Literature study	Finding general information online with relevant keywords to the question.	Information to answer the research question which also gives understanding to the topic.
Field	Problem Analysis	Making sure the problem is clear to what I would like to find out from answering this research question.	By making sure the question is clear to what problem I want to solve, I can make sure that I don't lose track in the research I am doing.

Due to time constraint, I was not able to execute any system tests on my own individual project and trying out tutorials, but I did do research into this topic.

Action / Summary

End-To-End testing is a method that is used by developers to test the applications or system's workflow from start to finish to verify the functionality of the application and that the system acts as expected. The goal of the test is initializing a real user's scenario of using the system or application to substantiate the systems integration and data integrity. As all tests are made, it is to ensure that the system function and behaves based on the design and requirements set by the developers.

Some tools that I have researched where I am interested into trying are Selenium, Cypress, and Cucumber. The reason for choosing these tools are not only for the recommendations given by my fellow peers but also for the easy to follow documentation into using these tools by the creators themselves.

I will be trying these tools in my free time to have a comparison of which one I find is better suited for my likings and to also to get some hands-on experience into end-to-end testing.

What minimal viable product can be made using Docker and Code Testing?

Context

This research question has been formulated to take the skills and knowledge from the previous questions of working with docker and testing and applying it to a minimal viable product to prove success in learning these new skills.

I will be answering this question with the help of the dot framework's method and strategies shown below.

Method	Strategy	approach	expectation
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Library	Expert Interview	Asking my teachers at Fontys for advice on the minimal viable product I will be making for feedback.	With the advice and feedback from my teachers, it will help me give a clear picture that the to be made product is obtainable.
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Action / Summary

Instead of creating a minimal viable product to apply docker and unit testing on, I have applied it to my individual project which is a .Net microservice web application for giving reminders to users to take their medications. I will be discussing how I have applied docker and unit testing to prove my skills in these fields. I have not applied any system testing and end-to-end testing into the project due to insufficient experience and time constraint.
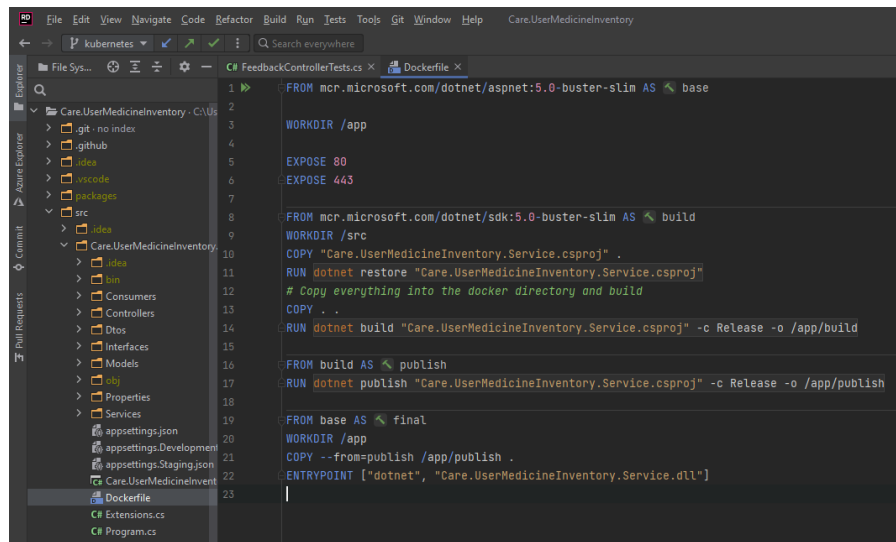
Image 3: "Docker File from one of the services"

To be able to run the web application in an environment everyone can run I have integrated Docker into the project as shown in image 3.

By just running some commands anyone is able to pull and run my project on their system. Each microservice has its own Docker file to build the service where they are also published to my Docker Hub. Here, I have created a docker compose file where I can just pull these images from my private Docker Hub to be able to run the project.
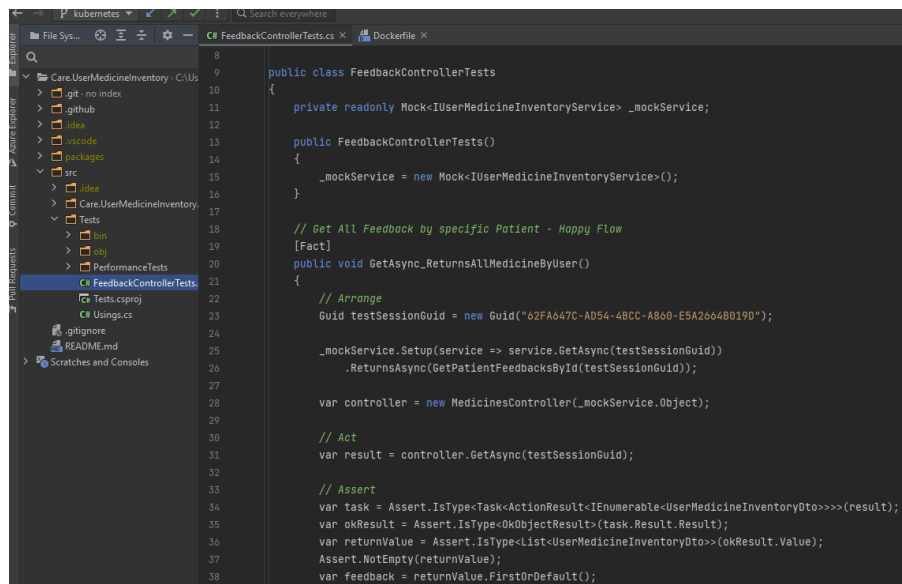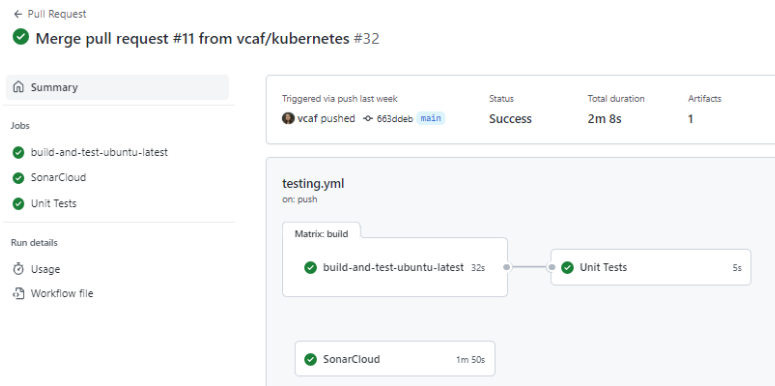

Image 4: "Unit test from one of the services"

Unit testing on a monolith application which I have learned applying is quite different compared to unit testing on a microservice but is the goal the same. From researching, I was able to apply unit testing to the controllers of the different services to test the functionality of each endpoint as shown in image 4.

Image 5: "Integrating docker and unit testing into the pipeline"

Next, I have also added to my GitHub pipeline is creating and building the Docker files with also running the unit tests whenever a pull or merge request has been made as shown in image 5.

For the System Testing and End-to-End testing, I was not able to do any experiential learning due to time constrain but I will be executing this in my free time for self-experience.

To conclude, I was able to apply docker and some testing on a "minimal viable product" to prove the knowledge and skills I have acquired from this research.

Conclusion

To conclude, I was able to learn about Docker, Unit Testing, System Testing and End-to-End Testing where I did some hands-on practices with Docker and Unit Testing. By executing some hands-on experiences, I was able to apply these skills to my individual project which was a Care (microservice) applications to give reminders to users to take their medications.

I was sadly not able to execute any System or End-to-End testing where I could not apply it to the application, but I will be trying these tests out in my free time to get the knowledge and experience needed as a software developer.