Documenting Architecture

DevOps, Maintenance, and Evolution @ ITU

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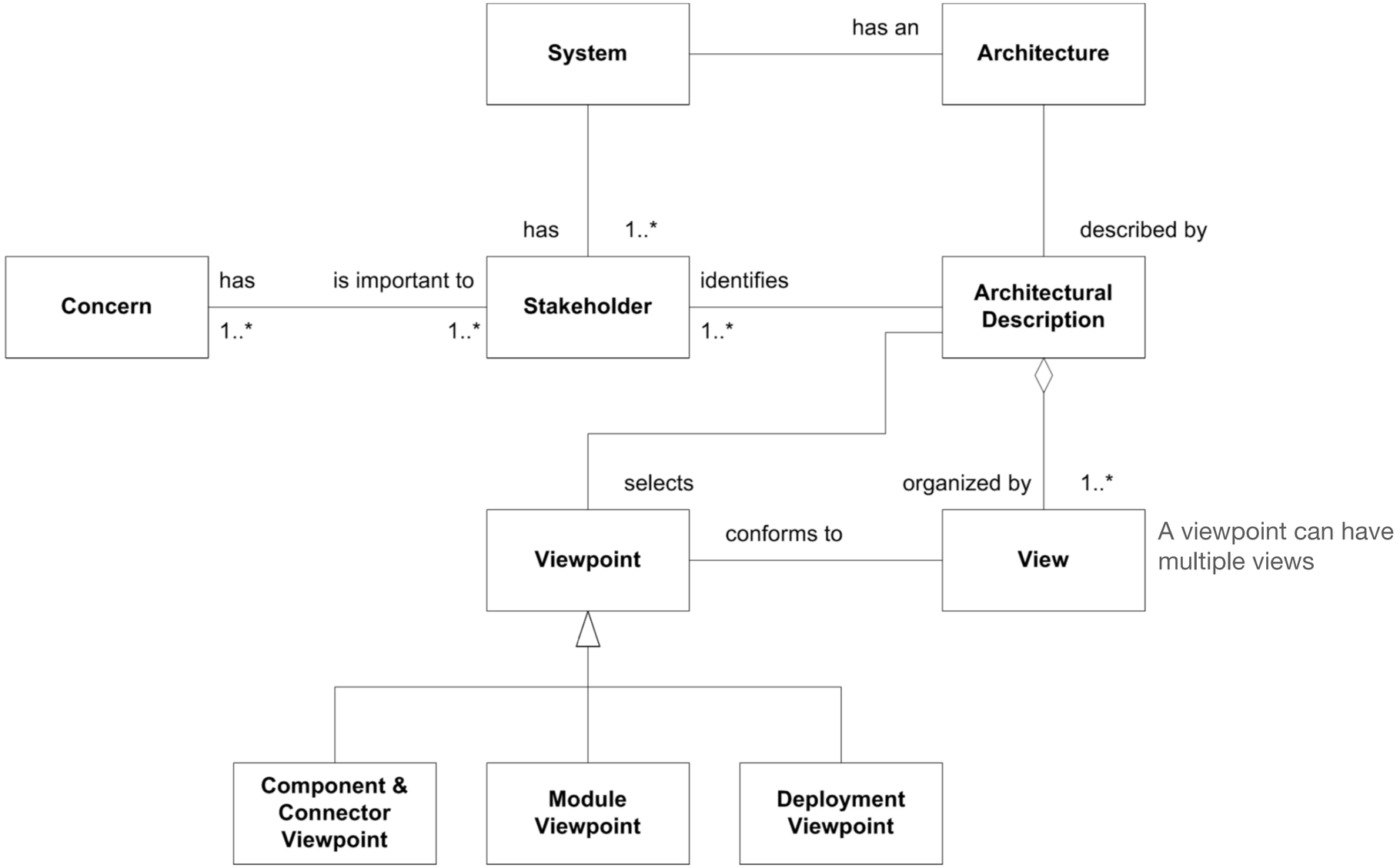
"The ideal development environment is one for which the documentation is available for essentially free with the push of a button” (Len Bass)

- implicitly auto generating the diagrams
- but we have not reached that point…

Architectural Viewpoints

- Perspectives on the system
- Many possible viewpoints
- Popular “catalogues” of viewpoints
  - 4+1 by Kruchten
  - 3+1 by Christensen
  - … 7-minute abs scene

3+1 Metamodel



How is the functionality organized in code?

Module Viewpoint (3+1)

- Elements
  - Packages
  - Classes
  - Interfaces
- Relationships between them

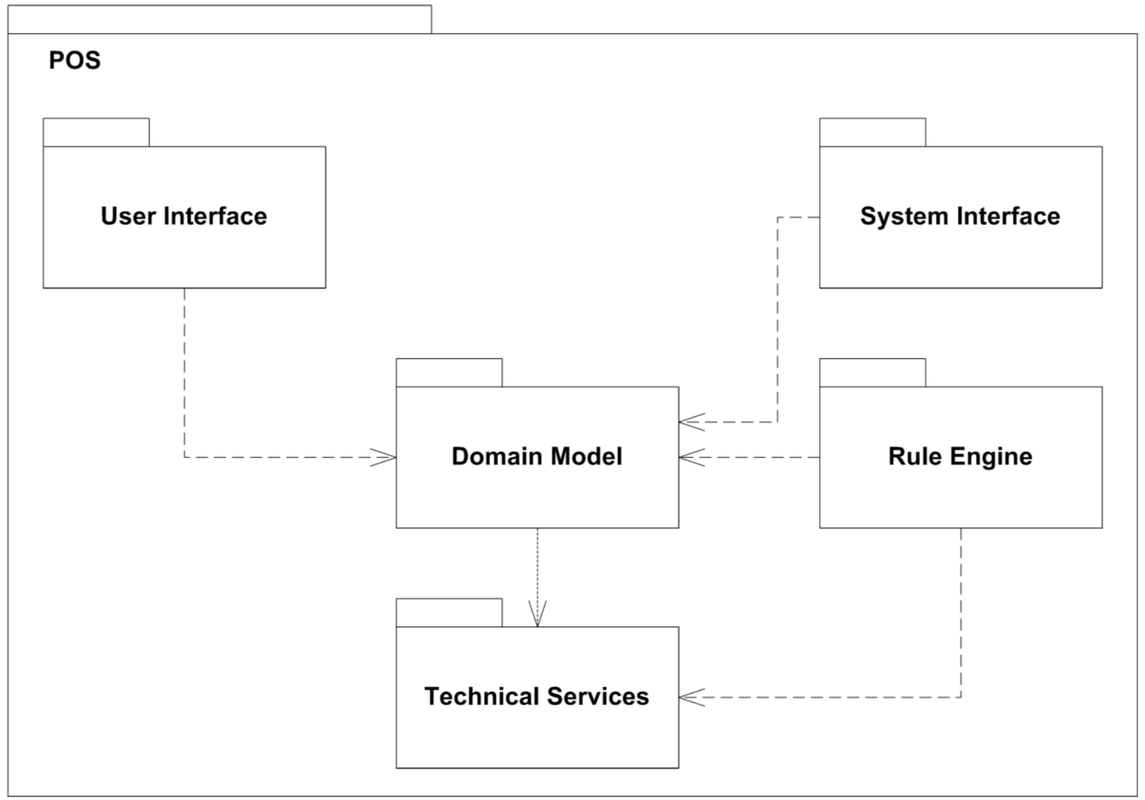


Figure 2: Package overview diagram for the POS system

What Does the System Do?

Component And Connector Viewpoint (3+1)

- Focus: the run-time functionality of the system
- Components = **black-box** units of functionality
- Connectors = **first-class** representations of communication paths between components.

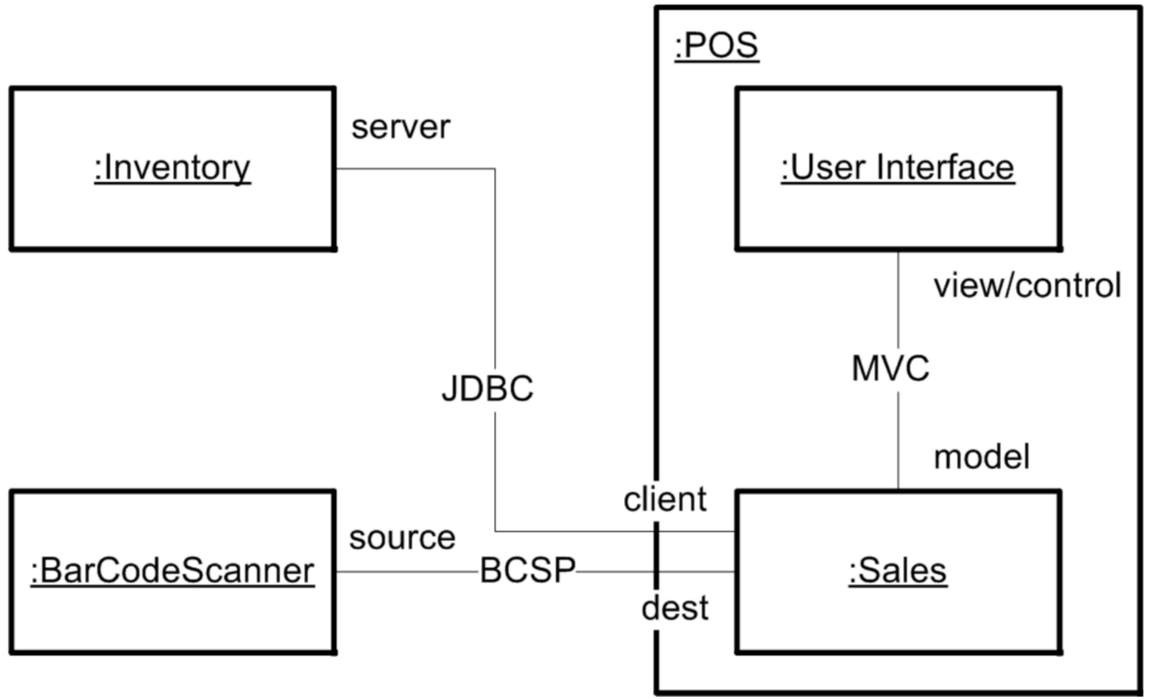


Figure 5: C&C overview of the POS system

Describe properties of both components and connectors in the documentation.

e.g. Group I

How are elements mapped on the infrastructure?

Deployment Viewpoint (3+1)

- Element types
  - Software Elements
  - Infrastructure Elements
    - Execution Environments
- Relations
  - Allocated-to
  - Dependencies
  - Protocol links

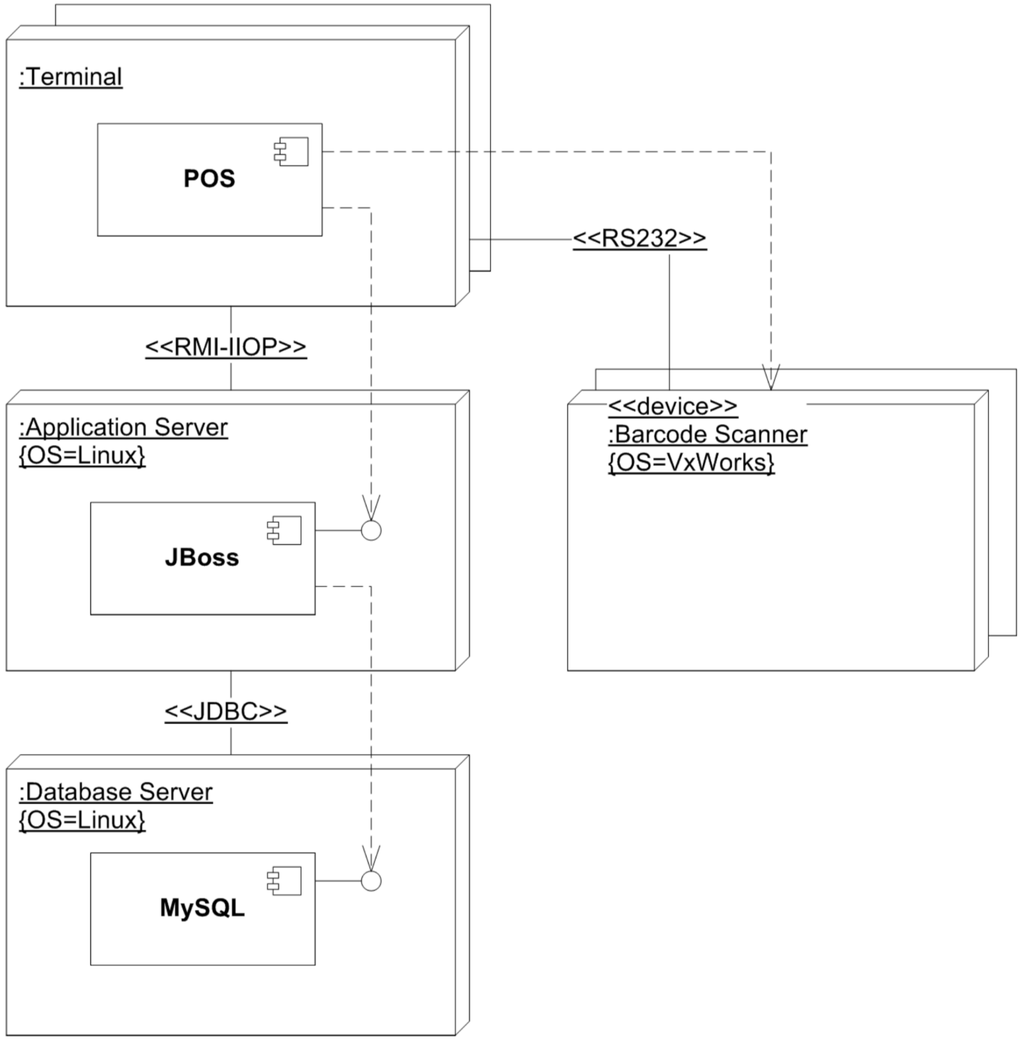
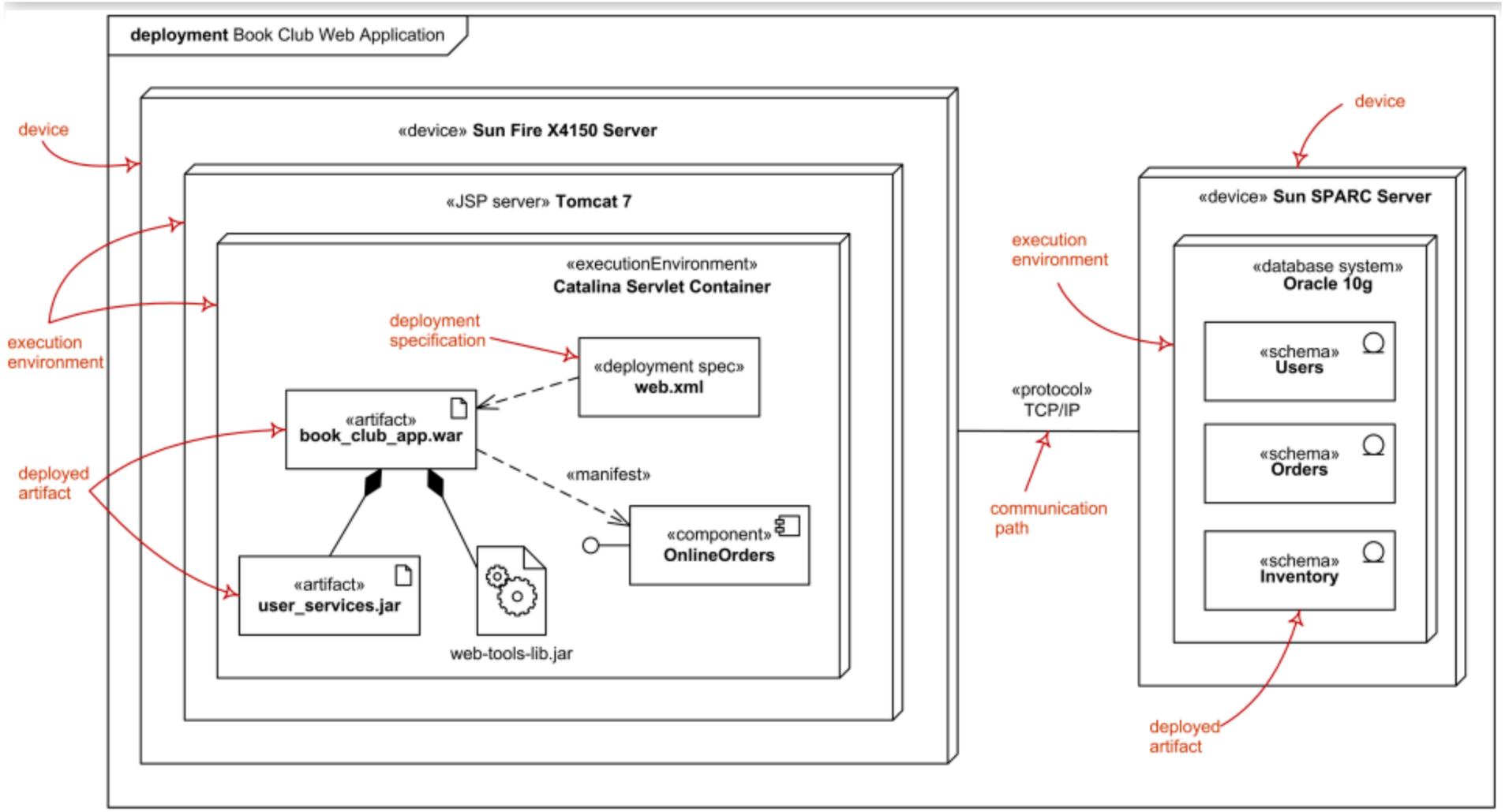


Figure 7: Deployment view of the NextGen POS system

UML Deployment Diagram



e.g. Group I

Visual Language

- UML
  - Deployment Diagrams
  - Component Diagrams
- Your Own Notation - make sure to define things that you are using (e.g. use a legend)
  - what is a box? what is an arrow? what is a color?
- Others?

Formating Your Reports

Make it as readable as possible

A Report Has a Title and Authors

DevOps, Software Evolution & Software Maintenance

Course code: KSDSESM1KU

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Report #1

System Perspective

In this chapter, we will first present a high-level overview of the system architecture using a simplified version of the 4+1 Architectural model by P.B. Kruchten. Then, we will present the design of some core components of the system, followed by a complete listing of dependencies and tools used for development, maintenance, and monitoring. Next, we will describe our monitoring and logging setup. Lastly, we will comment on the current state of our system.

Architecture

In the following 4+1 Architectural model, we have omitted two views: the *Use Case View* and the *Logical View*. The *Use Case View* is omitted as the use cases for MiniTwit were presented to all students in class and were required to remain unchanged. The *Logical View* is omitted as most of our code is organized as a set of functions and not as objects/classes. The concrete design of the system will, however, be elaborated upon in the *Design* section.

Physical View

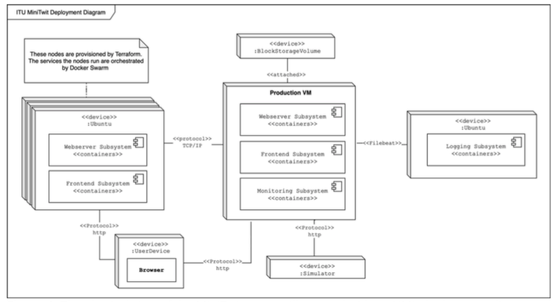

Figure 1: The physical view of the MiniTwit system illustrated with an UML deployment diagram.

Figure 1 illustrates the physical view of the MiniTwit system, i.e., which nodes/virtual machines host which subsystems. We see that the `webserver` and `Frontend` subsystems, which make up the application, have been replicated across several nodes by the cluster management tool, *Docker Swarm*, which we will elaborate on in the *Docker Swarm – Scaling and Load Balancing* section. The nodes themselves are provisioned by *Terraform*. It should be noted that the different components in every subsystem is encapsulated in separate Docker containers.

Report #2

A Report has Structure

DevOps - MinitwitTDB

- Lasse Felskov Agersten, lage@itu.dk
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Systems perspective

Architecture of our system

In this section we will discuss how our MiniTwit implementation works from a high level perspective, including its overall interaction with different systems.

During the initial refactoring of MiniTwit we opted to use TypeScript as the coding language and Node.JS as an environment to execute the written code on a backend. To store data we have opted for a MariaDB database. The reason we opted for TypeScript in this project was due to two reasons. Firstly, most of our groups members haven't used TypeScript before, but found it interesting to learn a new language. Secondly, TypeScript is strongly typed in contrast to regular JavaScript which we believe would help improve our maintainability and allow other developers to more easily understand each others code.

Our application was then dockerized in order to easily deploy our application on different servers based on our needs. Furthermore, to orchestrate our application we have been using Docker Swarm with five replicas.

We are using four different servers hosted on DigitalOcean to run our application, where two of these servers solely function as Worker Nodes (with two replicas each) for our Docker Swarm setup and the third functions as a Manager Node. The final server has been our main server before we introduced our scaling and load-balancing solution, and this is the server that contains our database instance and our logging and monitoring containers.

Please refer to the Deployment diagram below which illustrates the structuring of our system across servers and the overall interactions between different containers.

DevOps

OneDevOps - The Report

Pre-Amble

Team

Group G "OneDevOps" is:

Mathias Høyrup Nielsen, mahn@itu.dk, 3rd year bachelor student

Mark Bredegaard Kragerup, mabk@itu.dk, 3rd year bachelor student

Oliver Schiermer, olsc@itu.dk, 3rd year bachelor student

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Design of ITU-Minitwit system

We agreed to refactor to the MERN stack and the system design looks like the following:

1

System's Perspective

1.1 System Design

Written by Emilie

Our Minitwit application consists of a web app and an API. The web app is a simple version of Twitter where a user can register a profile, log in, and post a message for everyone to see. The users can follow and unfollow each other. The API has endpoints with same functionality as the web app. However the API can only be used with a specific authorization key. The application is developed in JavaScript using Node.js as the run-time environment, Express.js as the web framework and EJS as the view engine.

Figure Text Should be of Comparable to Text in Page

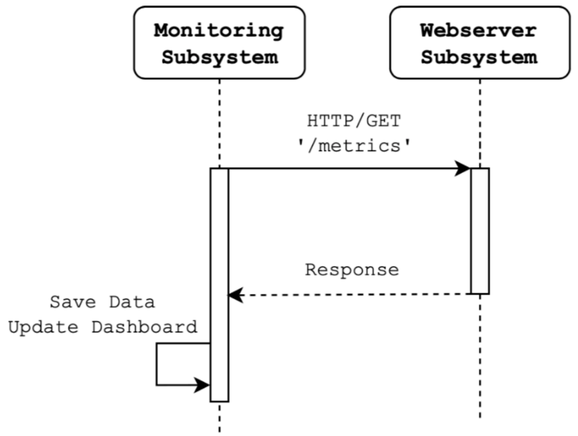

Figure 4: How the subsystems `Monitoring` and `Webserver` interact

While the `Webserver` subsystem serves users, the `Monitoring` subsystem queries the `Webserver` on the `/metrics` endpoint to gather current metrics of the node, namely the Production VM, on which the `Webserver` subsystem is hosted. We elaborate on the monitoring setup in the *Monitoring* section.

Design

The system is a rather standard setup, where each subsystem has its own responsibility and is only loosely coupled to the other subsystems. As presented in *Development View*, the system is divided into `Frontend` subsystem, `Webserver` subsystem, `Logging` subsystem, `Monitoring` subsystem, and `db` component. This section will firstly briefly describe the chosen technologies and then move on to describe the design of our simulator API.

Technologies

React
As we were to develop a web application, we chose to go with the most popular JavaScript (or, *the programming language of the web*, as one team member likes to call it) library for building such: *React*. Coincidentally, this is also a library that multiple of the team members have worked with before and are comfortable developing in, making it an obvious choice.

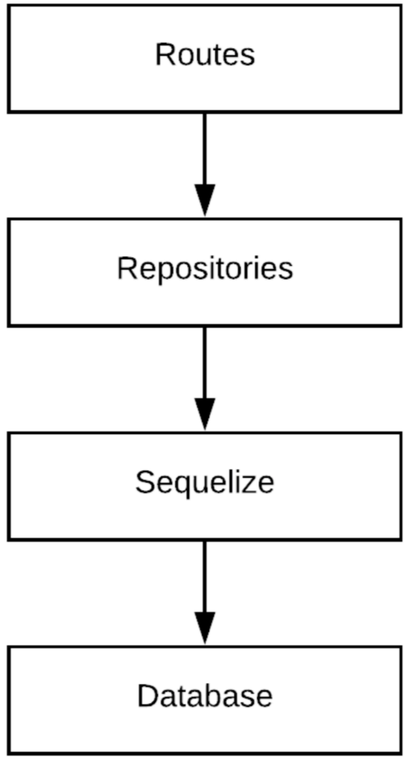

Figure 5: The request flow from routes to the database.

Figure 6 presents the layout of all the internal (i.e., excluding external dependencies) code artifacts that make up the simulator API.

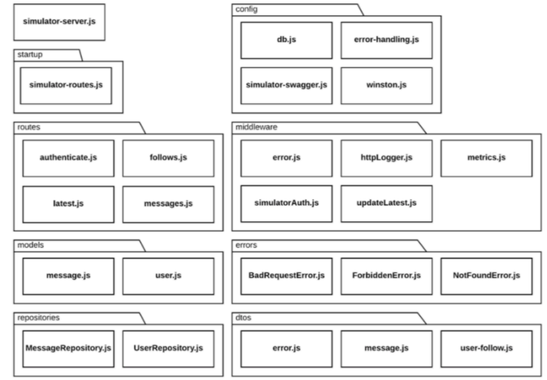

Figure 6: The structure of the code artifacts comprising the simulator API. The package that every file is in corresponds to their folder in the code repository. The `simulator-server.js` is outside of a package, which indicates that it is in the root of the tree.

Figure 7 presents the internal dependency flow from the root of the API, which is `simulator-server.js`, and out. The dependencies of the routes are elaborated upon in Figure 8.

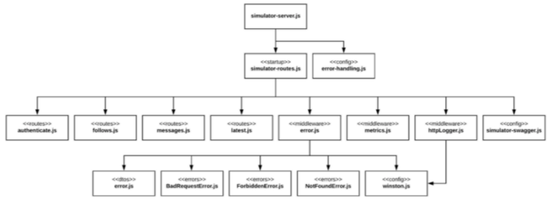

Figure 7: The internal dependencies of the `simulator-server.js`, which is the root of the API. An arrow indicates a `require` relationship. The arrow points at the module that is being required. The stereotypes indicate the file's parent folder.

Multiple Views for the Same Viewpoint

They Make Complexity More Manageable

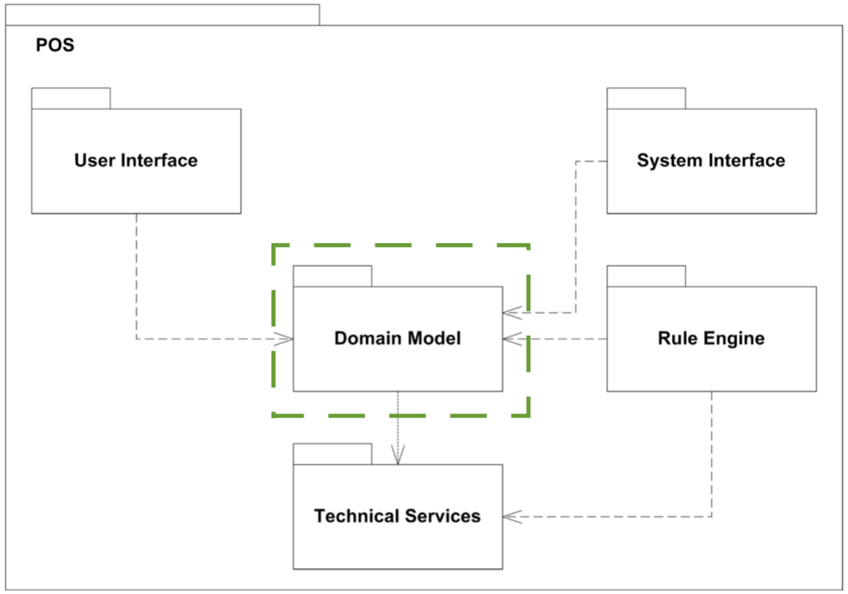

Figure 2: Package overview diagram for the POS system

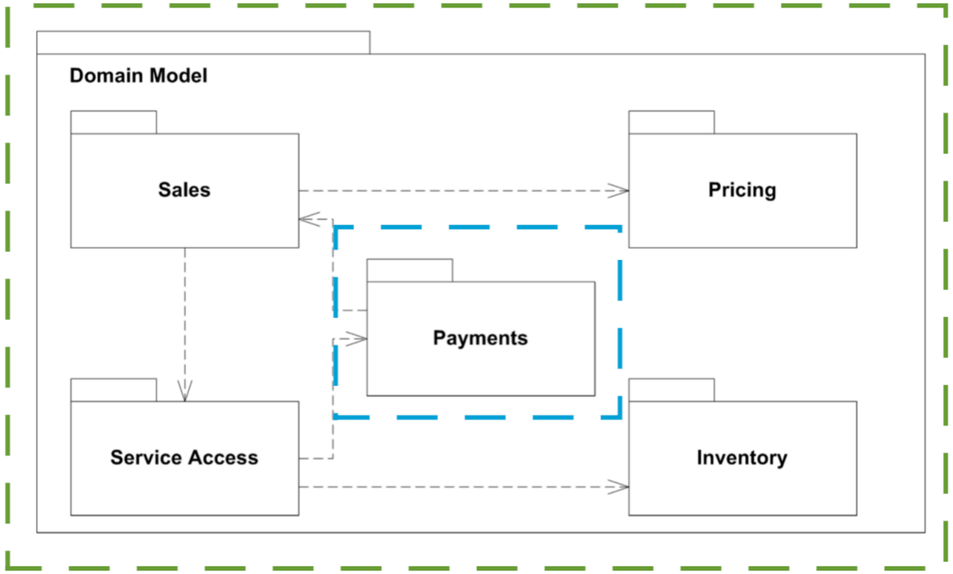

Figure 3: Decomposition of the Domain Model package of the POS system

Multiple Views for the Same Viewpoint

They can eve be of different kinds

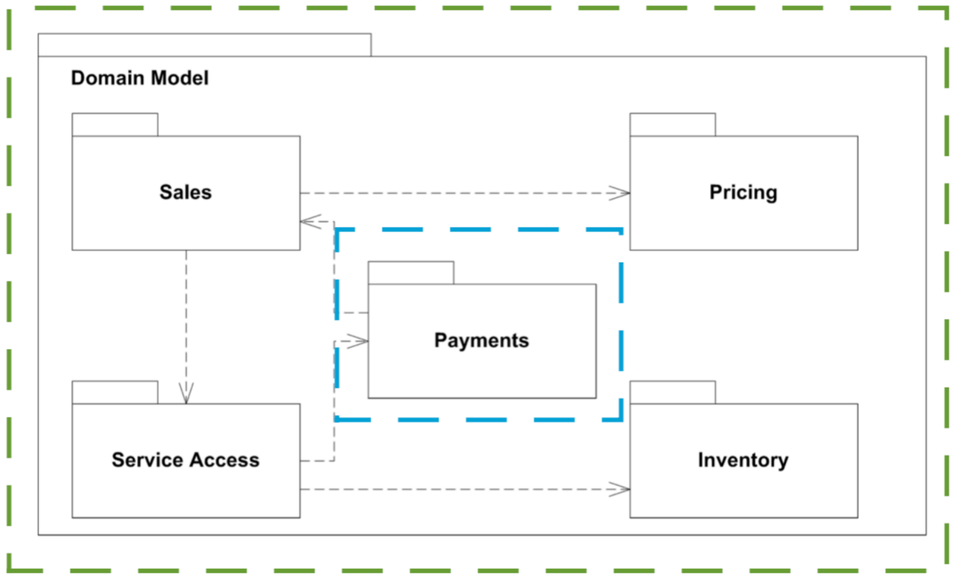

Figure 3: Decomposition of the Domain Model package of the

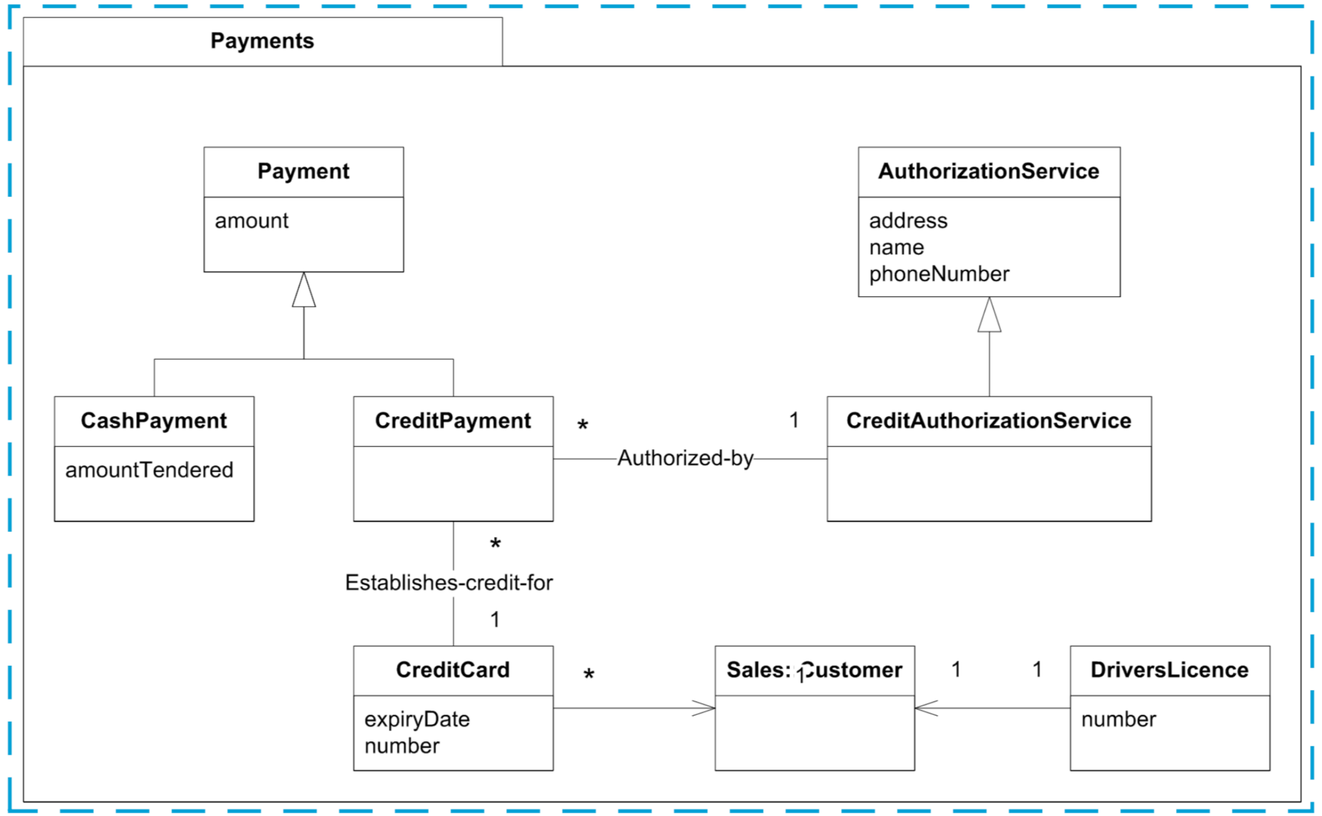

Figure 4: Decomposition of the Payments package of the POS system

However, if you end up showing class diagrams you should only show the essential ones to make your point. It's architecture after all!

References

An Approach to Software Architecture Description Using UML Revision 2.0. Henrik Bærbak Christensen, Aino Corry, and Klaus Marius Hansen

Architectural Blueprints—The “4+1” View Model of Software Architecture. Philippe Kruchten

Deployment Diagrams. https://www.uml-diagrams.org/deployment-diagrams-overview.html