

# Diaries

Paolo Bettelini

## Contents

<b>1</b>	<b>Diaries</b>	<b>2</b>
1.1	2022-08-29 . . . . .	2
1.2	2022-08-30 . . . . .	2
1.3	2022-08-31 . . . . .	2
1.4	2022-09-01 . . . . .	3
1.5	2022-09-05 . . . . .	3
1.6	2022-09-06 . . . . .	3
1.7	2022-09-07 . . . . .	3
1.8	2022-09-08 . . . . .	4
1.9	2022-09-12 . . . . .	4
1.10	2022-09-13 . . . . .	4
1.11	2022-09-14 . . . . .	4
1.12	2022-09-15 . . . . .	5
1.13	2022-09-20 . . . . .	5
1.14	2022-09-21 . . . . .	5
1.15	2022-09-22 . . . . .	5
1.16	2022-09-26 . . . . .	5
1.17	2022-09-28 . . . . .	6
1.18	2022-09-29 . . . . .	6
1.19	2022-10-04 . . . . .	6
1.20	2022-10-05 . . . . .	6
1.21	2022-10-06 . . . . .	7
1.22	2022-10-10 . . . . .	7
1.23	2022-10-11 . . . . .	7
1.24	2022-10-12 . . . . .	7
1.25	2022-10-13 . . . . .	7
1.26	2022-10-17 . . . . .	7
1.27	2022-10-18 . . . . .	8
1.28	2022-10-19 . . . . .	8
1.29	2022-10-20 . . . . .	8
1.30	2022-10-24 . . . . .	8
1.31	2022-10-25 . . . . .	8
1.32	2022-10-27 . . . . .	8

# 1 Diaries

## 1.1 2022-08-29

Work hours:

**13:15 - 14:45:** Project assignment

**15:00 - 16:30:** Questions about the project / Rust libraries

Today I was assigned the project and received its description. I prepared some questions to ask the manager to clarify my ideas. I have decided to use only Rust as my main programming language, if possible also for the front-end application (compiling Rust to WebAssembly).

I've started to inquire about a couple of libraries that I (might) use

- [amiquip](#) Rust RabbitMQ client
- [log](#) Rust logger
- [another-rust-load-balancer](#) Rust load balancer
- [warp](#) Rust web framework
- [sqlx](#) Rust SQL Toolkit
- [tokio](#) Rust async library
- [yew](#) Rust/WASM frontend framework

I will use the Rust *nightly* channel.

## 1.2 2022-08-30

Work hours:

**08:20 - 09:50:** Setup VM

**10:05 - 11:35:** Requirements and documentation

Today I set up a Linux virtual machine as my main workstation. I installed `cargo`, `texlive-core`, `texlive-latexextra` and `vs code`.

Each server will be on a different machine without GUI.

I then started writing the documentation (information about the project and the requirements). I still need to ask a few questions to the manager to finish the requirements.

The plan for the next work session is to make a Gantt sheet.

## 1.3 2022-08-31

Work hours:

**15:00 - 15:45:** Requirements and documentation

**15:45 - 16:30:** Gantt sheet

Today I finished writing the requirements of the project. I created the `worker` Rust project and I created the Gantt sheet.

## 1.4 2022-09-01

**08:20 - 09:00:** Helped a classmate with Android Studio

**09:00 - 10:00:** Vagrantfile with provisioning

**10:00 - 11:00:** Documentation

**11:00 - 11:35:** Use case

Today I created a virtual machine using Vagrant to host my servers. I spent most of the time setting up the document for the documentation and in the end I wrote the use cases (on paper). I will eventually translate them into a PDF.

The plan for the next work session is to start writing the database DDL and maybe start writing some queries.

## 1.5 2022-09-05

**13:15 - 14:15:** Internal network

**14:15 - 16:15:** Backend worker

Today I set up an internal network within the virtual machines (192.168.1.0/24). This is done via Vagrantfile and I made sure everything was working properly.

I started writing some actual code. After setting up the dependencies needed I implemented command line arguments. The Rust crate `Clap` manages my CLI arguments (errors if invalid args, help page). The only argument so far is the `--config <CONFIG>` or `-c` argument.

The config is a TOML file which so far contains the connection information about the database. My code parses the config file and initializes the config structure.

I haven't really written the SQL for the database as I should have, but I figured it shouldn't be an issue since not many tables are needed and they are quite trivial.

## 1.6 2022-09-06

**08:25 - 09:50:** Error handling and logging

**10:05 - 11:20:** Database connection

Today I handled the errors when reading the configuration files and implemented the logger. I then wrote the script to setup Mariadb used in the Vagrantfile (install, start daemon, create user). I spent the rest of the day trying to make the connection to the database.

However, I'm thinking about dropping the `sqlx` library and using an ORM instead.

## 1.7 2022-09-07

**15:00 - 15:30:** Vagrantfile

**15:30 - 16:15:** Diesel documentation

Today I upgraded the Vagrantfile and starting separating the different virtual machines. I decided to drop the `sqlx` library and use `Diesel` instead (ORM). I spent the rest of the work session looking at the Diesel documentation.

The plan for the next work session is to actually integrate this library and work with the database.

## 1.8 2022-09-08

**08:45 - 10:35:** Diesel installation and setup

**10:50 - 11:20:** Diesel integration

Today did not quite turn as I hoped it would. I started by trying to install `diesel_cli` (Diesel command line utility), which is used to generate migrations and schemas. The command `cargo install diesel_cli --no-default-features --features mysql` was not working and in the end I was able to install it via `pacman`. Diesel could not connect to the database (fixed user i Vagrant file). I then spent the rest of the day trying to integrate this library. The migration and schema generation was successful. However, I was having some problems with the Rust crate system and it took a long time to figure out how to make it compile without errors.

My goal for today was to execute some queries but I did not succeed.

## 1.9 2022-09-12

**13:15 - 14:45:** Project separation and restructuring

**15:00 - 16:10:** Diesel integration

Today I separated the *worker* into two separate projects: the database library and the executable. Then, I implemented and tested the database library by inserting a test user.

More specifically,

- Completed the SQL structure of the database
- Updated the database models
- Separated the two projects
- Migrations are run at startup if necessary
- If the database authentication is not specified in the config file, it is read from the `DATABASE_URL` environment variable
- Separated things into their own modules

I am slightly ahead of schedule. I haven't implemented every query and insert that I will need but they are trivial especially since I am using an ORM library. Inserting data to the database and retrieving it works.

## 1.10 2022-09-13

**08:20 - 09:50:** Read documentation

**10:05 - 11:15:** Vagrant

Today I read the [amiquip](#) documentation and their examples to communicate with a RabbitMQ server. In the second half of the work session I setup the RabbitMQ VM using Vagrant. The web dashboard works. I haven't yet started writing code to interact with queues.

## 1.11 2022-09-14

**15:00 - 16:15:** amiquip

Today I continued reading the [amiquip](#) documentation and created the messaging library project (`messaging`). Renamed the project `worker/worker` into `worker/core`.

## 1.12 2022-09-15

08:20 - 09:00: Vagrant

09:00 - 11:10: Implementation

I decided to drop the `amiquip` library and use `lapin` instead. It is a far more developed library and easily supports multi threading. I implemented the configuration for the connection to the RabbitMQ server and started testing the actual connection. My goal was to publish any payload to any channel, but unfortunately, it keeps giving me this error which I am unable to fix `IOError(Kind(ConnectionAborted))`.

## 1.13 2022-09-20

08:20 - 11:20: Pooling and connection

I tried fixing the connection aborted error with no luck. I decided to integrate a pooling system for the connections using `deadpool` and `deadpool-lapin`. The pool works and everything seems to be `async`. The connection aborted error is still thrown when a connecton is taken from the pool.

## 1.14 2022-09-21

15:00 - 15:30: Documentation

15:30 - 16:20: Research

Today I continued the documentation and fixed the problem with the connection to RabbitMQ. The program can establish a connection with the server, declare queues, publish messages and consume them. I feel ashamed to say, the problem was the service port (5672 rather than 15672, which is the web portal).

## 1.15 2022-09-22

08:20 - 9:50: Logging system

10:05 - 10:50: RabbitMQ test

10:50 - 11:25: Read documentation

Today I fixed the logging system (logging configuration file) and refactored some code. I continued testing the RabbitMQ connection (publishing messages and consuming them). I then spent the rest of the time by reading the documentation of `Yew` (frontend framework) and `Warp` (web framework). The next logical step is to implement the `Request/Reply` pattern in messaging.

## 1.16 2022-09-26

13:15 - 15:30: RabbitMQ Request/Reply

15:30 - 16:15: WebServer

Today I restructured the projects folders tree and created the webserver project.

- `common/`
  - `messaging/`
  - `database/`
- `worker/`
- `webserver/`

I tried to implement the request/reply pattern with RabbitMQ but it does not work yet. The idea is to set the `correlation_id` property of the messages that are published with a random UUID. Then, wait for a

reply in the `reply_to` queue with the same correlation ID. I spent the rest of the time looking at how to make a WebSocket between `yew` and `warp`.

## 1.17 2022-09-28

15:15 - 16:10: RabbitMQ Request/Reply

The `Request/Reply` pattern works. The only thing left to do with my messaging API is to structure the functions in order to make it usable and more generic. The basic operations needed are

- Publish message
- Publish message and await response
- Publish message and await multiple responses

## 1.18 2022-09-29

08:20 - 09:00: Rust Async

09:00 - 11:10: Messaging and structure

Today I read a tutorial about the `async` features of Rust. I then proceeded to structure my messaging API to make it usable. The functions created are: `publish`, `public_and_await_reply` and `consume_messages`. Throughout this work session I also cleaned the code, fixed the formatting, separated things into their own containers and such.

The next step is to start implementing the web page using `yew`.

## 1.19 2022-10-04

08:20 - 09:50: Yew testing

10:05 - 11:05: Websocket research

11:05 - 11:20: Documentation

Today I started implementing the frontend using WebAssembly. I was able to create a test page using the Yew framework that print "Hello" (a string that is not written in HTML but rather embedded in the `wasm`).

I then wanted to start testing a websocket connection, however, I found that that the websocket layer in the Yew framework has been completely removed from version 0.18.0 to 0.19.0 (I am using version 0.19.0). This implies that I will need to use another library for the websocket connection. The desirable thing would be to use the same library both for the browser and for the webserver, such that the binary interpretation of the messages uses the same structures. If this cannot be achieve I need to use another external library to interpret the binary messages between the endpoints. I haven't yet decided which technology to use.

I also added the `implement/frontend` subsection in the documentation.

## 1.20 2022-10-05

15:00 - 16:15: Documentation

Today I only focused on the documentation. I separated the various sections into their own files, implemented the reference system, refactored some code and added some sections. I haven't really added any content worth mentioning.

## 1.21 2022-10-06

**08:30 - 11:20:** Web application

Today I continued to refactor the web application code. I separated the frontend and webserver into their own projects (`webapp/` is a cargo workspace containing `frontend/` and `webserver/`). I set up the log and config system for the webserver.

## 1.22 2022-10-10

**13:15 - 16:15:** Frontend

Today I focused on making the frontend work. The frontend is separated from the webserver. The webserver serves the index, the index then sends a request to the frontend server to ask for its content. I followed [this](#) tutorial.

For the next working session I'm going to start implementing the RabbitMQ messages, and if possible make the RabbitMQ cluster.

## 1.23 2022-10-11

**08:20 - 09:50:** Read documentation

**10:05 - 11:20:** RabbitMQ messages

Today I read the documentation of various Rust crates. In the second half of the working session I created the structures that represent the messages sent over the RabbitMQ network. I used the [protocol](#) crate to create structures that can be serialized and deserialized into binary data. All the structures used in the protocol are defined in the project `common/protocol`.

## 1.24 2022-10-12

**15:15 - 16:15:** Messaging test

Today I tested the messaging system by serializing my payloads into binary data, putting them in a RabbitMQ queue and consuming them. Everything works fine. I also refactored some code.

## 1.25 2022-10-13

**08:20 - 09:50:** RabbitMQ Cluster

**10:05 - 11:20:** Code and config

Today I read the documentation about RabbitMQ clusters. I spoke with my supervisor and we agreed on slightly changing the infrastructure of the network. The backend servers connect to a load balancer instead of multiple messaging brokers. The webserver also connect to the same load balancer which is behind every message broker. I then continued to add some boilerplate to my code.

## 1.26 2022-10-17

**13:15 - 14:45:** Design

**15:00 - 16:15:** Logic

Today I started by designing a bit of the website (Login Form, Register Form). In the second half of the working session I continued the logic of my program, refactored some code and implemented the image resizing.

## 1.27 2022-10-18

08:20 - 11:20 Logic

Today I only focused on implementing the logic for the backend worker. I had lots of problems with the Rust syntax but I managed to advance the code a bit. The backend server is now able to consume a **Register Request** message. I still have problems with the Rust borrow checker and don't know how to fix them.

## 1.28 2022-10-19

15:00 - 15:30 Logic

16:00 - 16:20 Logic

Today I kept implementing the backend logic. The backend is able to handle a **RequestLogin** message. I'm working on handling the **GetTotalImages** (amount) message.

## 1.29 2022-10-20

08:20 - 09:50 Logic

10:05 - 11:15 Logic

Even today I continued the logic for the worker backend. I implemented the necessary database queries with Diesel and continued the code which consumes messages. This section is almost done and I should finish it within the next working session.

## 1.30 2022-10-24

15:00 - 15:30 Frontend WASM

16:00 - 16:20 Frontend WASM

I dropped the Yew framework because I realized that I couldn't do the website like I wanted to. Not using a framework such as Yew means that I have to separate HTML templating and WASM execution. The **frontend** crate compiles to a WASM module. The **frontend/website** contains the HTML website with the **webpack** files. By using **npm** and **webpack** I can include the WASM module into the HTML files. I tested a WebSocket connection and everything works fine.

## 1.31 2022-10-25

08:20 - 09:50 Webserver

10:05 - 11:15 Webserver

Today I implemented the templating system using **warp**. I am able to serve static website files from a directory and override some of the files (such as **login.html**, **index.html**) with the server template rendering. I am still having for problems with Rust lifetimes.

## 1.32 2022-10-27

08:20 - 09:50 Documentation

10:05 - 11:20 Documentation

Today I wrote some documentation.

- **Infrastructure** Added network diagram
- **Technologies** Added Rust and RabbitMQ
- **Implementation/Messaging/Messages** Started writing the message protocol