Aber Fitness Project

Final Report for SEM5640 Developing Advanced Internet Based Applications

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Declaration of originality

We confirm that:

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- We understand that there are severe penalties for Unacceptable Academic Practice, which can lead to loss of marks or even the withholding of a degree.
- We have read the regulations on Unacceptable Academic Practice from the University's Academic Registry and the relevant sections of the current Student Handbook of the Department of Computer Science.
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Chapter 1

Overview

Aber Fitness is a web application developed using Microsoft's *.NET Core* and Oracle's *Java Enterprise Edition* (henceforth referred to as Java EE). The project aims to provide a service to encourage fitness and promote engagement with sporting activities amongst the users of the application, offering functionality such as graphing fitness data gathered by owners of *Fitbit* devices, the ability to challenge other users to competitions and a sport ladder system with tight integration into a bespoke facility booking system. *Aber Fitness* aims to offer everything that would be needed by a sporty and active person in order to bring their sporting activities into a digital platform and also to enhance their use of devices they already own, such as *Fitbit* devices or smart watches such as the *Apple Watch*.

At launch the system will ingest activity data automatically from *Fitbit*, with the capability of easily implementing other health data provider services at a later date due to the modular nature of the data ingest system. Once normalised this activity data will be used throughout the various subsystems of *Aber Fitness*, providing users with functionality such as a dashboard overview of their activity over the last hour, day, week, etc. as well as integrating tightly into the challenges system to add a competitive aspect to the system in to keep users engaged with both the platform itself and keeping fit in general.

TODO: Possibly add more here? GDPR, Docker, Microservices, Auditing

Chapter 2

Requirements

Chapter 3

Development Methodolgy

TODO: Possibly restructure this, itś a start for now. Not 100% sure what Neilś looking for here.

3.1 Initial Project Plan

Upon starting the project, we met as a group and decided on a standard style of development which would work best between all of us. After some discussion, we concluded that a *Scrumban* [1] style of development would best fit our needs. Due to the relatively short duration of the project, and our team consisting of only eight developers, we decided on adopting this rather hands off development approach which focuses on flexibility and being able to change and adapt the project plan and sprints as the project progresses. The *Scrumban* methodology was also suited to the project as the two technologies we were required to use, Java EE and .NET Core, were new to all of the members of our team, making estimating sprints and velocity quite difficult.

We began the project by breaking the project specification down into disitinct microservices, and deciding which technologies would be best suited to each service. **TODO: Link to figure below**

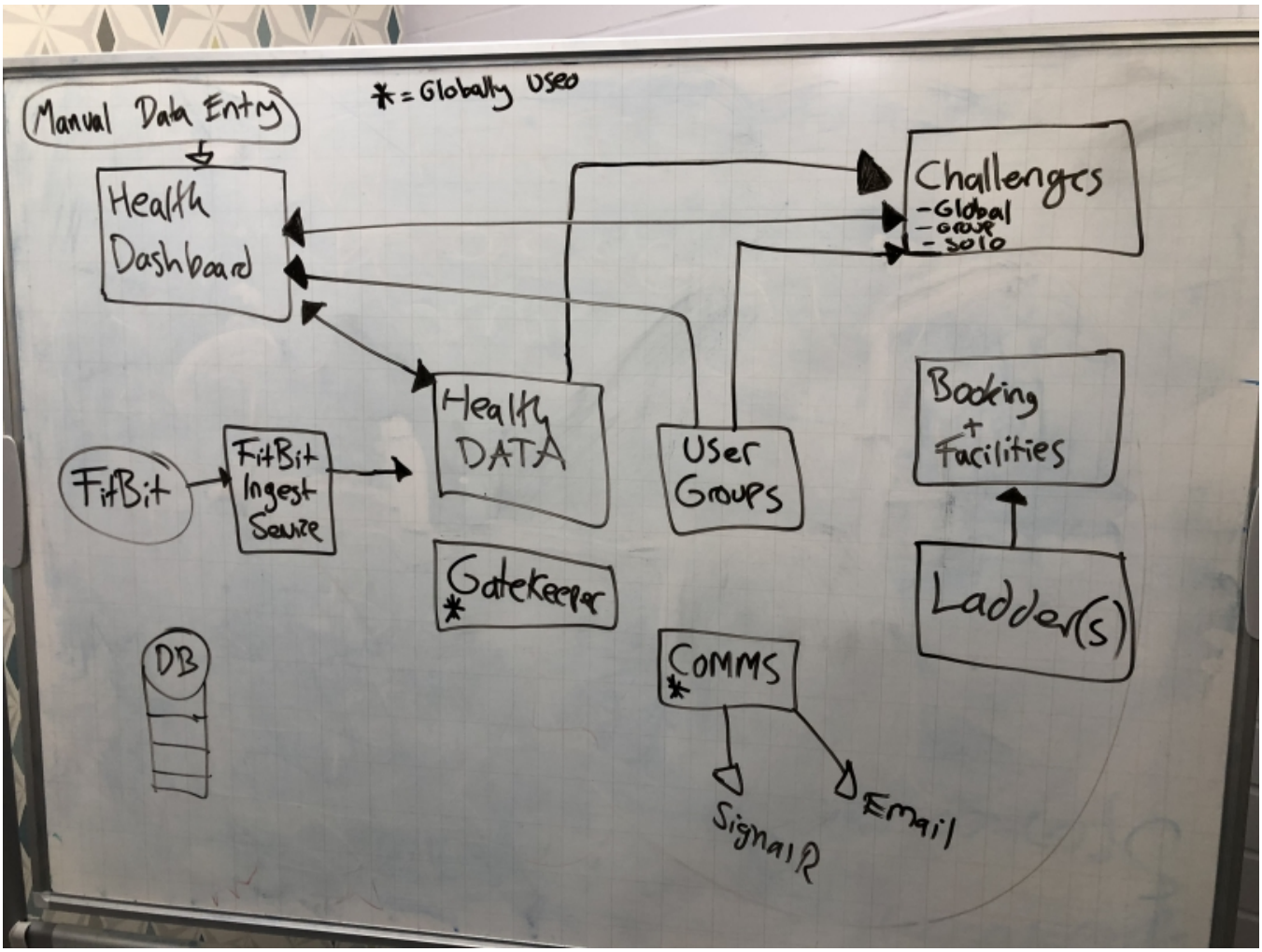

Figure 3.1: An initial design diagram which was used to help break down the project into smaller microservices and gain a rough understanding how each microservice could interact

Once the individual microservices had been decided upon, we set out on allocating each microservice to two members of the team and assinging each service a priority ranking between 1 and 3, depending on how the services depended on one another. Services marked with a priority of 1 were core parts of the *AberFitness* infrastructure on which many other parts of the system relied on their APIs in order to function correctly, such as the *Health Data Repository* microservice. **TODO: Link to figure below**

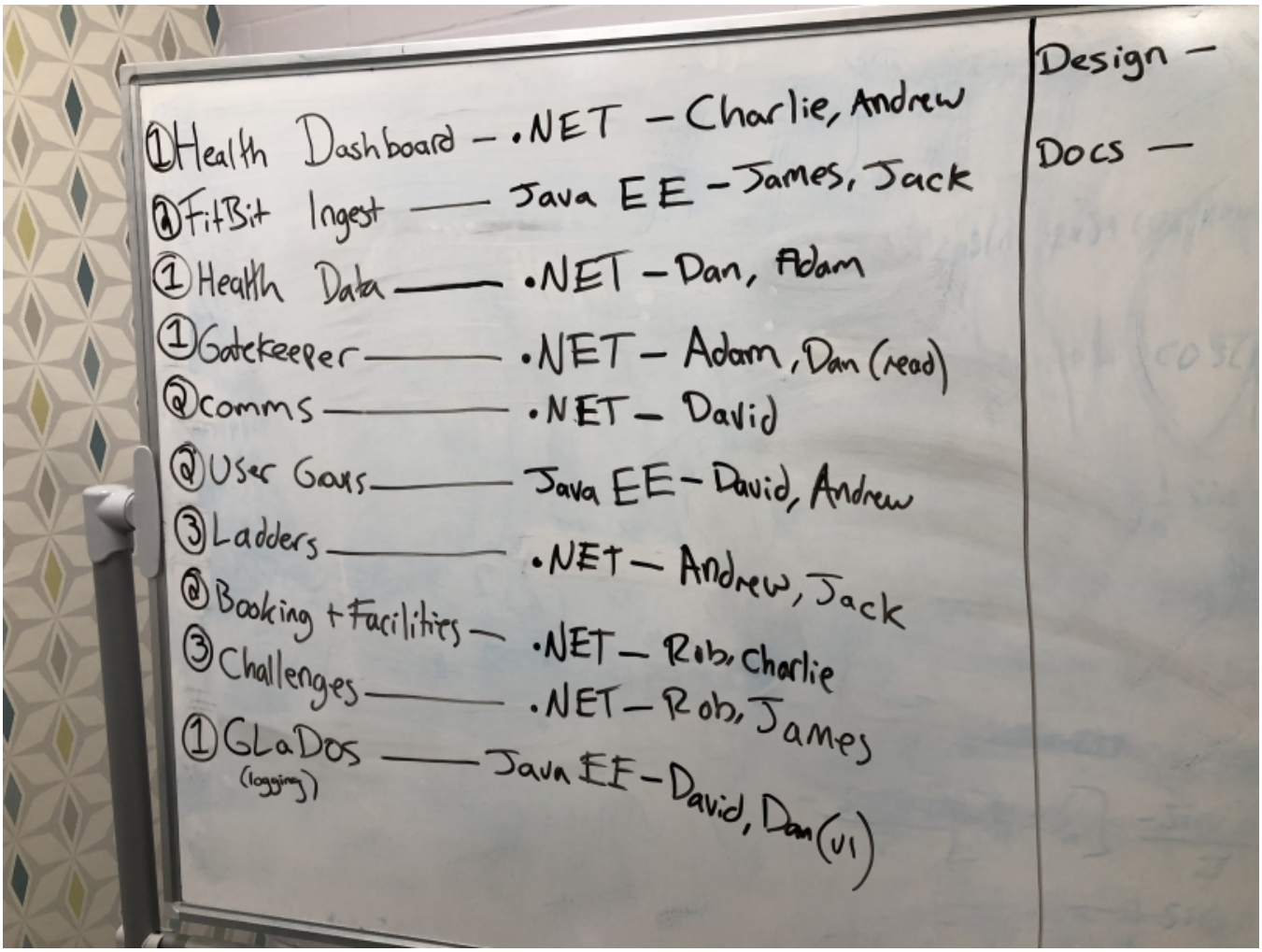

Figure 3.2: Initial plan for ordering microservices in terms of priority and allocating them to members of the team for development

3.2 Supporting Tools

3.2.1 GitHub & TravisCI

Each microservice for *Aber Fitness* was hosted on *GitHub*[1]. *GitHub* provided many features which proved incredibly useful during the development phase, such as tight integration with *Slack* for notifications straight to our chatrooms and integration with *TravisCI* to automatically trigger unit tests and *Docker* image builds. We also developed a development pattern of requiring all code to be peer reviewed through the use of pull requests and branch protection, a collection of settings which require that a series of conditions have been met before a pull request is able to be merged into the *development* or *master* branch. We configured branch protection in order to ensure that only tested, peer reviewed code would be committed into any upstream branch to reduce the likelihood of errors being introduced into the system and so that any issues could be caught early on.

[1] https://github.com/sem5640-2018

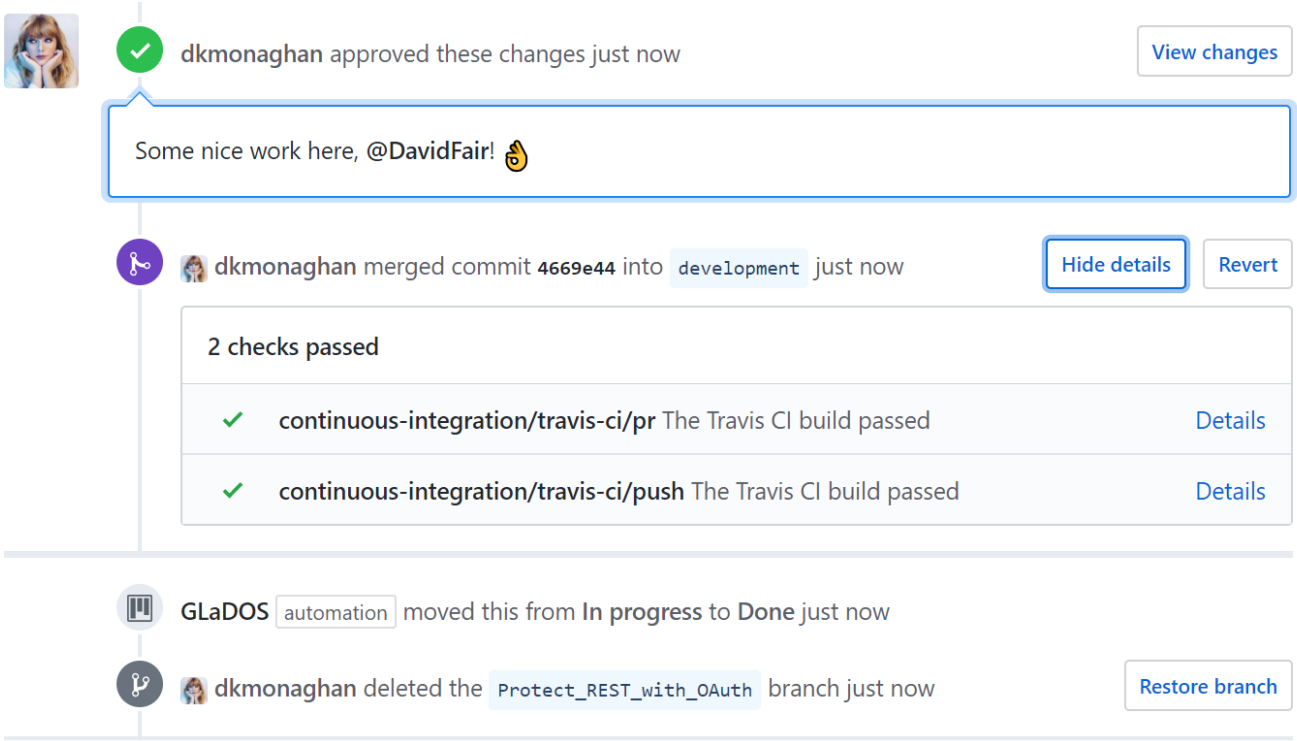

Figure 3.3: A screenshot from *GitHub* showing a pull request on the *GLaDOS* repository being peer reviewed and also checks from *TravisCI* passing before being merged into an upstream branch.

Once a pull request had been approved and merged, *TravisCI* would then be responsible for building and pushing the *Docker* image to *Docker Hub*.

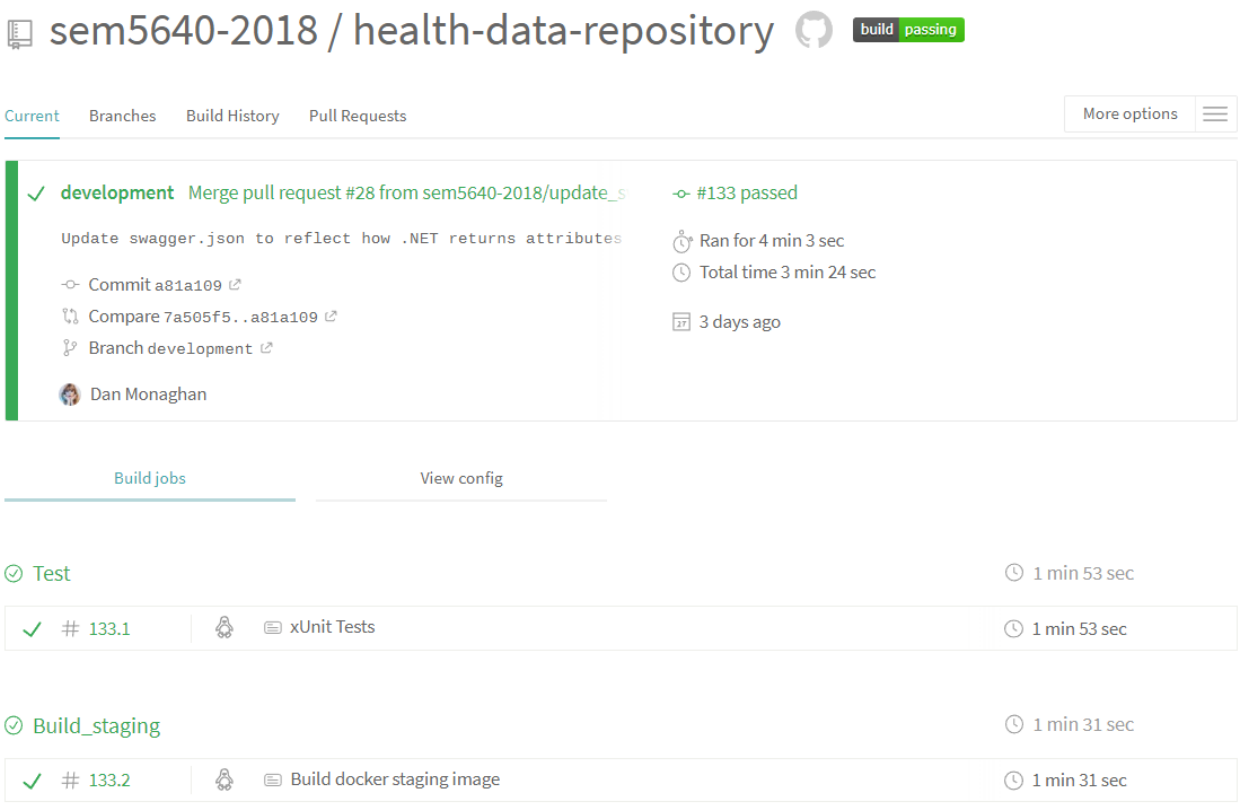

Figure 3.4: A screenshot from *TravisCI* demonstrating a pull request being merged into the *development* branch, re-passing unit tests once merged and then building the *Docker* image

3.2.2 Swagger

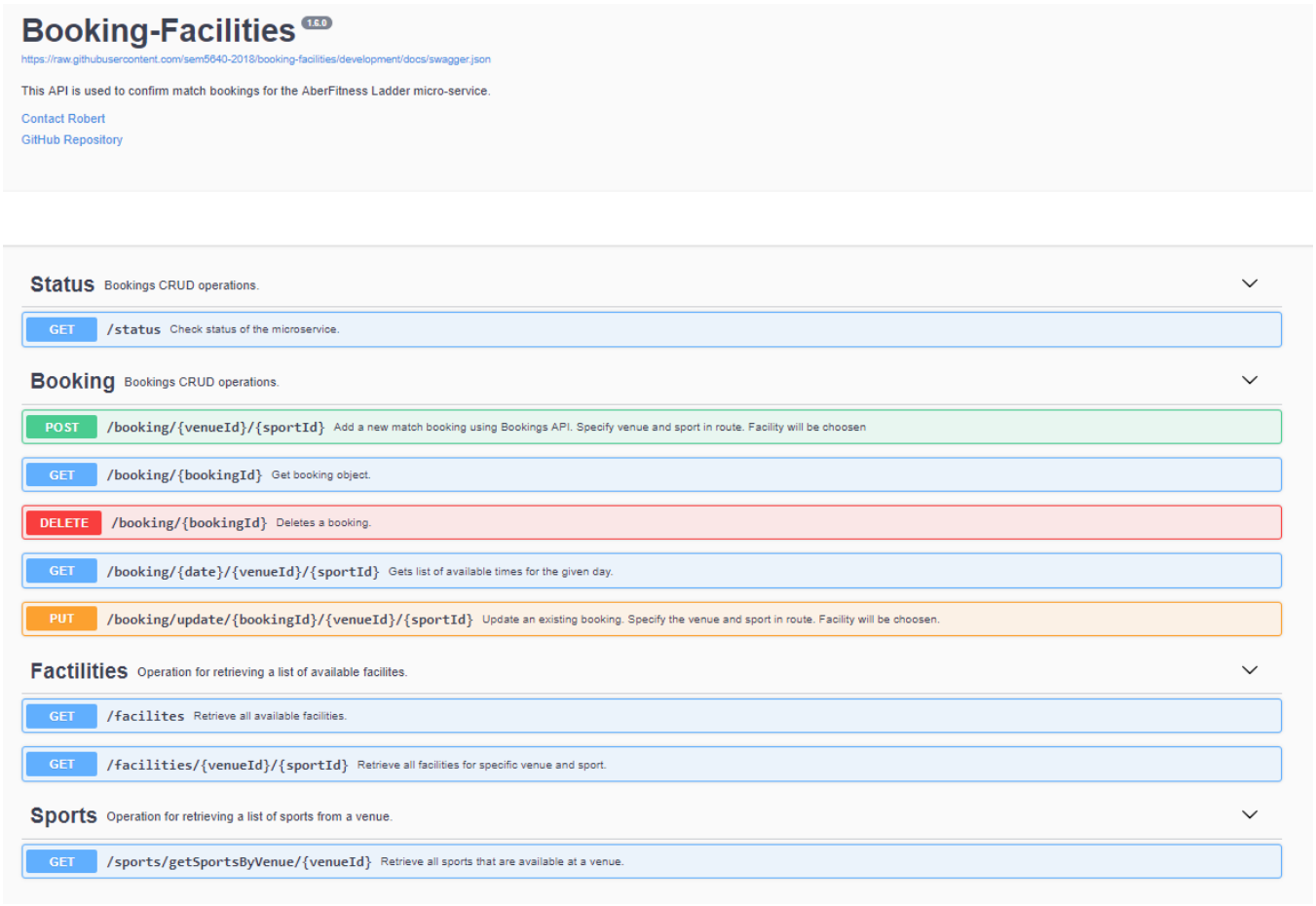

Figure 3.5: The Swagger interface for the *Booking Facilities* microservice

Swagger is a web based application for viewing API specifications. Each microservice within *Aber Fitness* has a file located at `docs/swagger.json` which defines its API endpoints and any associated data models. *Swagger* was a crucial part of the development process as it allowed us to draft up API specifications prior to development in order to get feedback from other members of the group, and allowed issues to be identified early on in the event that a draft API specification lacked endpoints which would be required by other microservices.

3.2.3 Portainer

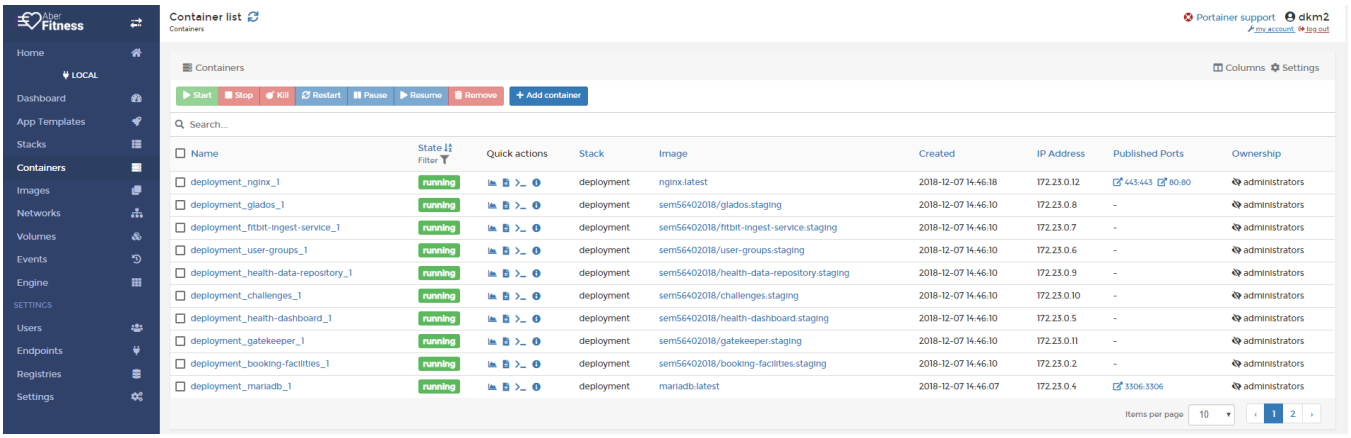

Figure 3.6: The Portainer interface for our staging / development Docker host, `docker2-m56.dcs.aber.ac.uk`

Portainer provides a dashboard for managing volumes, networks, images and containers on *Docker* hosts. Throughout the initial configuration of the *Docker* images, *Portainer* proved invaluable as it provided the ability to quickly and easily understand what the host was running. **TODO: More here probably.**

3.2.4 Docker Hub

Docker Hub is a platform provided by *Docker* which allows *Docker* container images to be uploaded and hosted, and easily pulled down by the `docker-compose` script. As part of our build process (**TODO: reference build pipline diagram here**), images are built by *TravisCI* and then pushed to *Docker Hub* before being pulled down onto the *Docker* hosts.

3.2.5 Slack & Deployment

Slack is an online text based chat service designed for offices and teams, and paticuarly suits itself to the development of software. The group used *Slack* extensively throughout the development of *Aber Fitness* not only to communicate and discuss progress, ideas and troubleshoot problems, but also made extensive use of *Slack*'s integrations with services such as *TravisCI* and *GitHub*.

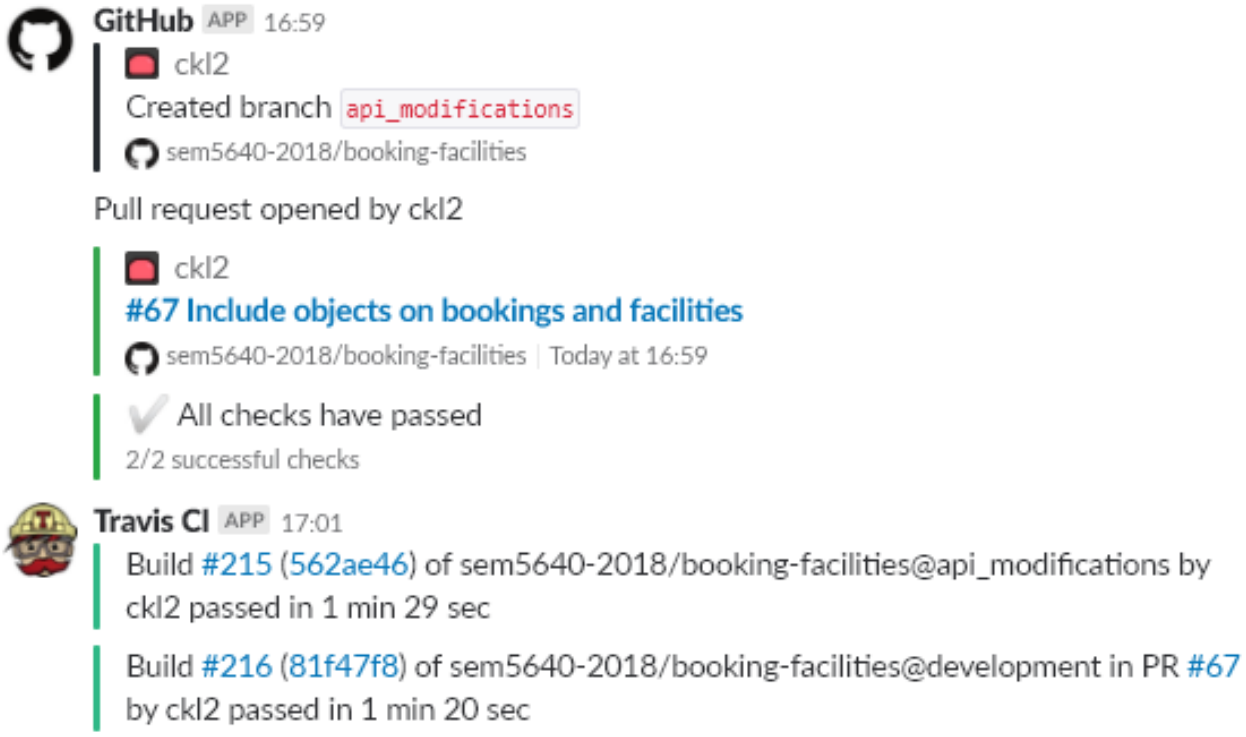

Figure 3.7: A screenshot of the *Slack* channel `#dev-booking-facilities` demonstrating the integrations between *Slack*, *GitHub* and *TravisCI*

Slack also played a major role in our deployment strategy when rolling out updated *Docker* images to our staging host. Due to the nature of the configuration of the two *Docker* hosts we had been provided by the Computer Science department we ran into many issues with our deployment process, primarily to do with permissions on the host. Each member of the team had their own individual log in to the hosts, however we would frequently run into permissions errors when performing commands like `git pull`. Other issues we had involved team members forgetting the specific set of commands which needed to be executed, wasting valuable development time. **TODO: figure no.**

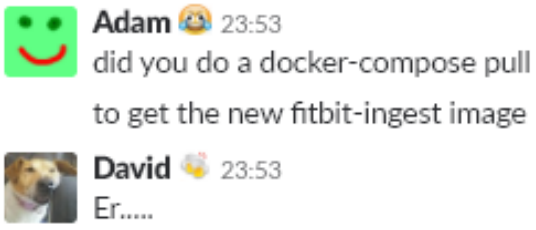

Figure 3.8: An example situation where the execution of `docker-compose pull` caused a large amount of confusion amongst *Aber Fitness* developers

Slack ended up providing us with an elegant solution to this through its ability to easily call a webhook when a user typed a specific message in a chat channel. A quick *Slack* application was put together to automatically pull the latest `docker-compose.yml` file from GitHub, as well as updating all the *Docker Hub* images, then re-deploying the stack. This could all be done from within *Slack* itself through the `/deploy` command. **TODO: Figure no.**

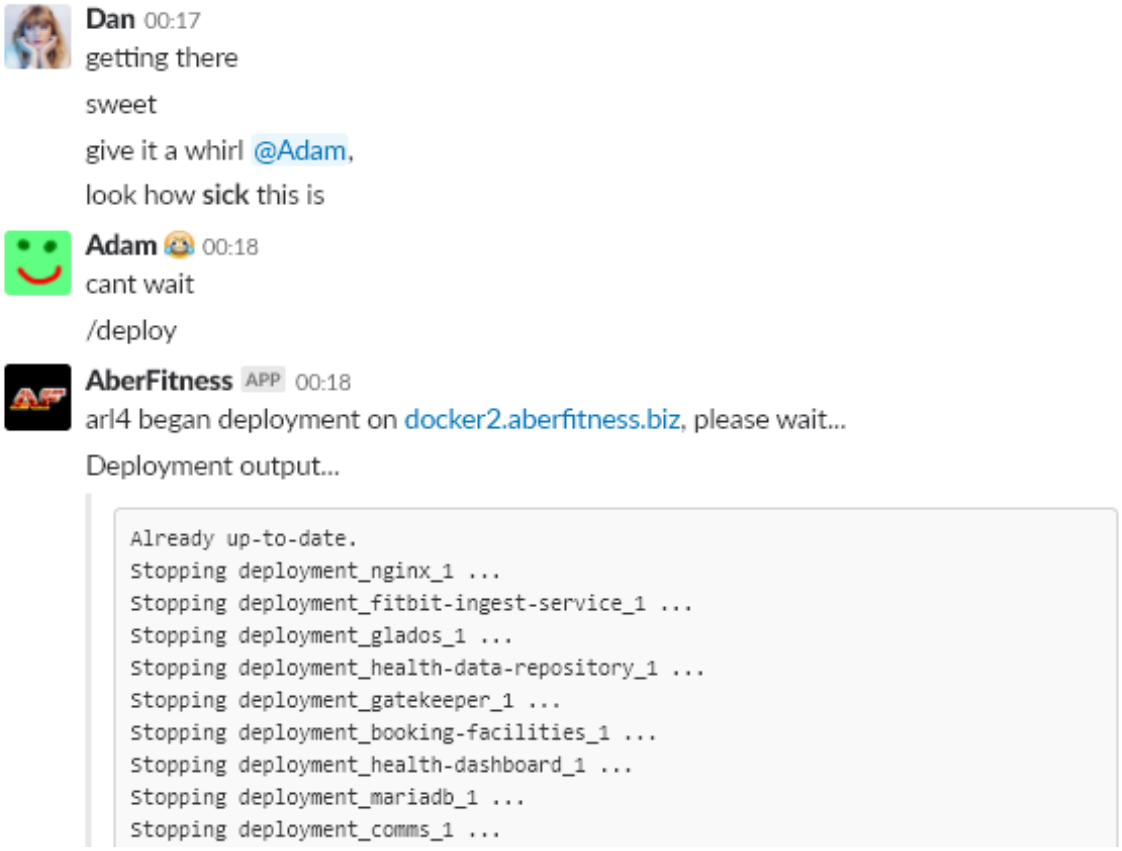

Figure 3.9: A demonstration of the `/deploy` command being used to re-deploy *Aber Fitness* onto `docker2-m56.dcs.aber.ac.uk`

Chapter 4

Design

4.1 System Overview

The *Aber Fitness* system is broken down into a number of microservices in order to aid portability, scalability and promotes a more maintainable codebase. After reviewing the initial project specification, the following microservices were created:

- **Booking & Facilities** - The *Aber Fitness* offers functionality for users to be able to schedule bookings at sports venues, such as swimming pools and squash courts. This microservice is called used by the *Ladders* service to create bookings for competitions.
- **Challenges** - The system offers the ability to give users activity challenges, for example completing a number of steps in a specific timeframe. These challenges can also be 'group' challenges, where a number of users can compete against each another to achieve goals such as furthest distance walked in a week, etc.
- **Communications** - This microservice provides an API for other services to send email notifications to users. It does not present any form of web UI, and users do not directly interact with it. This system could also be easily expanded to send out text messages, push alerts, etc. depending on future requirements.
- **Fitbit Ingest Service** - At launch, the *Aber Fitness* platform allows a user to link their *Fitbit* accounts to the system in order to import their activity data. The service periodically polls the Fitbit API for new data on the users' behalf, then stores this into the *Health Data Repository*.

  With the possibility of adding future platform support the "ingest service" concept was created. This would allow us to support services such as Apple's *HealthKit* and other fitness tech providers. This architectural design means that activity data can be normalised by a number of "ingest services" before being passed through to the *Health Data Repository* service for storage.
- **Gatekeeper** - *Gatekeeper* is *Aber Fitness*'s OpenID Provider, and handles all authentication within the system. User credentials and account metadata is stored within *GatekeeperGatekeeper* uses the OAuth 2.0 flow and is responsible for providing a single sign-on service for all of the various microservices. Microservices also contact *Gatekeeper* to obtain and verify tokens when calling internal APIs.
- **GLaDOS** - *GLaDOS* is the centralised auditing mechanism for *Aber Fitness*. It presents a REST API which is used to store audit data; such as when a user's data was accessed, modified, or deleted. *GLaDOS* is provides a Status page which displays the availability of all the other microservices.

- **Health Dashboard** - *Health Dashboard* is the first interface users will encounter after logging in, or navigating to *Aber Fitness*. It provides the user with an overview of their recent activity as well as providing updates on any challenges or ladder competitions the user may be involved in.
- **Health Data Repository** - The *Health Data Repository* service is responsible for providing an API for accessing and storing activity data. It receives normalised activity data from the Ingest Services, and provides multiple API endpoints for other microservices to access user activity data.
- **Ladders** - *Ladders* is responsible for organising and managing ladder style competitions among users of the system. Users can compete in sporting championships for a variety of competitive sports such as tennis, running or cycling etc. The *Ladders* also automatically books venues for upcoming competitive events, which is managed by the *Booking Facilities* microservice.
- **User Groups** - *Challenges* can also be turned into a competition amongst users of a group. For example, a group may consist of a few friends or an entire office department. Users within a group compete to complete goals, such as who can achieve the most steps in a single day. The *User Groups* service is responsible for managing users into groups, and allowing users to leave and join other groups.

Chapter 5

Implementation

Chapter 6

Testing

Chapter 7

Status

Chapter 8

Evaluation

Appendices

Bibliography

[1] "What is Scrumban?" Available at: https://leankit.com/learn/agile/what-is-scrumban/. [Accessed: 08- Dec- 2018]