

STALKER

WEB & CLOUD COMPUTING

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Introduction

This report accompanies the project for the course Web & Cloud Computing, that we have called STALKER. The main functionality our application STALKER is that it allows a user, the stalker, to request information on another person, the victim, on several social networks at once. Currently we support Facebook and LinkedIn, however due to the modularity of our application adding another social network should be easy. Unfortunately all social networks we tried require that a registered user log in before they allow you to search their user database.

The application also offers users the ability to view anonymous statistics on other users of the website, for example one can see from which countries the most searches originate.

In the next chapter we discuss the technology stack and control flow of the front end. Chapter 2 does the same for the back-end. The last chapter gives an evaluation of the project.

Chapter 1

Front End

This chapter discusses the front end. We start by presenting the technology stack in section 1. After that we describe the most important control flows in the front end in the section Design.

1 Technology Stack

This section devotes one section to each technology on the front ends stack. For each technology we will describe what it does and why we opted to use this technology in favour of other options.

1.1 AngularJS

AngularJS is a web application framework by Google for creating dynamic web applications.

AngularJS depends on JQuery, thus we had to include that too. We have also used JQuery in some places for the removing and adding of classes where that resulted in neater code than using Angular directives.

We chose to use AngularJS since one of us had some experience with it. We considered Backbone as an alternative but dropped it for its flexibility, which may be great if you are an experienced web developer and know exactly what you want, but would have been too much for us. Furthermore it is advised to add a framework on top of Backbone which would have added to the learning curve for Backbone [10].

Apart from the previous experience the fact that AngularJS was specifically developed for single page applications is what made us decide in favour of AngularJS.

One of the downsides of AngularJS is that its learning curve, after learning the basic features is quite steep. The documentation is rife with Angular-specific

terms which makes it hard to read.

Extensions

We have used some extensions to Angular. We list them and shortly describe their functionality.

ngRoute provides routing and deep-linking services and directives for angular applications [9]. We use it to make it possible to store a link to a specific part of our application.

ngFacebook provides an interface between AngularJS and the Facebook API. We have adapted the source of this service in some places to make it better suited to our purposes and to keep it consistent with **ngLinkedIn**.

ngLinkedIn is for LinkedIn what **ngFacebook** is for Facebook. We have also adapted its source code to extend its functionality and to keep it consistent with **ngFacebook**.

angular-md5 is a service that computes MD5 hashes. We use it to hash the Facebook and LinkedIn identifier of our users, so that we can find multiple searches of one user without storing the actual user.

1.2 Bootstrap

Bootstrap is a framework by Twitter which places emphasis on responsive design.

Although there are alternatives to Bootstrap, i.e. Zimit, InK or Pure, we did not really consider them since we were both familiar with Bootstrap and felt that we had enough new technologies to worry about. We did however use a different theme from <http://bootswatch.com> to avoid the distinctive Bootstrap look and feel. We add Font Awesome for the icons it provides.

1.3 UI Bootstrap

UI Bootstrap is an Angular version of the JavaScript part of Bootstrap. As far as we could find there are no alternatives other than building the directives yourself.

In the end we had to write the carousel at the login window, ourselves since the custom buttons we wanted were not supported by UI Bootstrap.

1.4 Dangle

“Dangle is a set of AngularJS directives that provide common visualizations based on D3.”[2]

We have used it to create the pie charts shown on the statistics page, after practically rewriting the directive. The directives provided by Dangle did not handle long labels, and pie charts with a lot of pieces very well. To solve this we

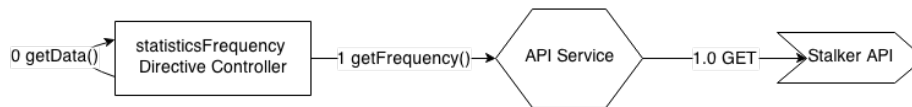


Figure 1.1: A schematic overview of the control flow of requesting the statistics and showing them to the user.

have removed all code from the pie chart directive that added labels and added a separate legend. The one upside of Dangle was that it expected its input in the same format our map-reduce-operations returned it.

In hindsight we should have chosen something other than Dangle, however we did not look further since Dangle played nice with AngularJS.

1.5 RequireJS

RequireJS is a JavaScript file and module loader that is optimized for in-browser use. Neither one of us had any experience with anything like it and since RequireJS was mentioned during the lectures we chose to use it. We used the project structure suggested by Brad Green [1].

2 Design

In this section we discuss the control flow in the front end upon certain actions of the user. To avoid a lengthy report we will only discuss the flow of successful cases.

2.1 View Statistics

The control flow when a user views statistics is presented in Figure 1.1. We have defined a directive that displays a pie-chart for a statistic. When the element defined by this directive is loaded the method `getData()` is called without inference from the user.

2.2 Log In

As mentioned earlier users have to log in to a social network before being allowed to stalk somebody on that network. Since we store the ID of the user and we have not implemented an api call that adds for example the LinkedIn identification to a user that we have already stored with its Facebook identification.

Figure 1.2 presents the flow of control when a users logs in.

The `loggedIn`, and its not shown equivalent `loggedOut`, event ensure that the `searchController` knows that a user is logged in. The `Facebook Service`, `ngFacebook`, is discussed section 1.1 on page 2.

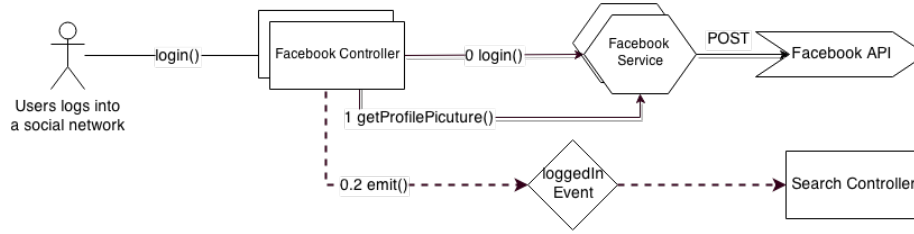


Figure 1.2: A schematic overview of the control flow when a user logs in.

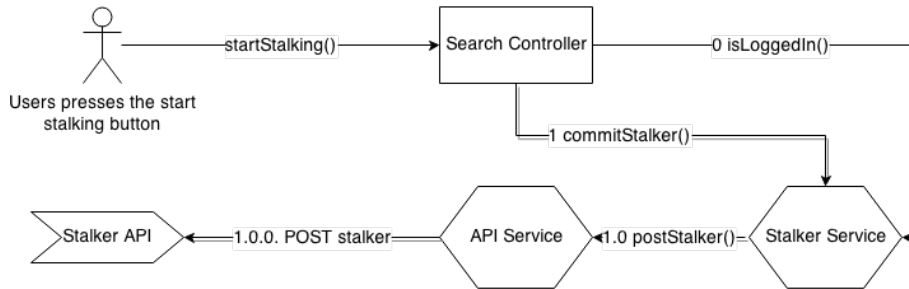


Figure 1.3: A schematic overview of the control flow when a user presses the 'start stalking' button.

Logging out of social network is comparable to logging into it. Figure 1.2 uses Facebook, the application works in exactly the same way for e.g. LinkedIn.

2.3 Start Stalking

Figure 1.3 shows what happens in the front end when the user indicates that he has logged in into all social networks he wishes to use.

If the POST to the **Stalker API** fails no error is reported to the user, since it does not matter to the user if his information is added to our database.

2.4 Stalk

Figure 1.4 presents the flow of control when a user searches for somebody on the social networks that he has logged in to.

The **Stalker Service** contains all information on the stalker. The **API Service** contains all calls to our own API, we have chosen for a separate service so that we only have to store the address of the API in one place. The **Search Service** broadcasts the search to the different social media controllers, in Figure 1.4 Facebook is shown as an example. Each social network controller does a search call by calling some function in the matching service that interacts with the actual API of that social network.

We had to use a broadcast instead of an emit as in section 2.2 since we had

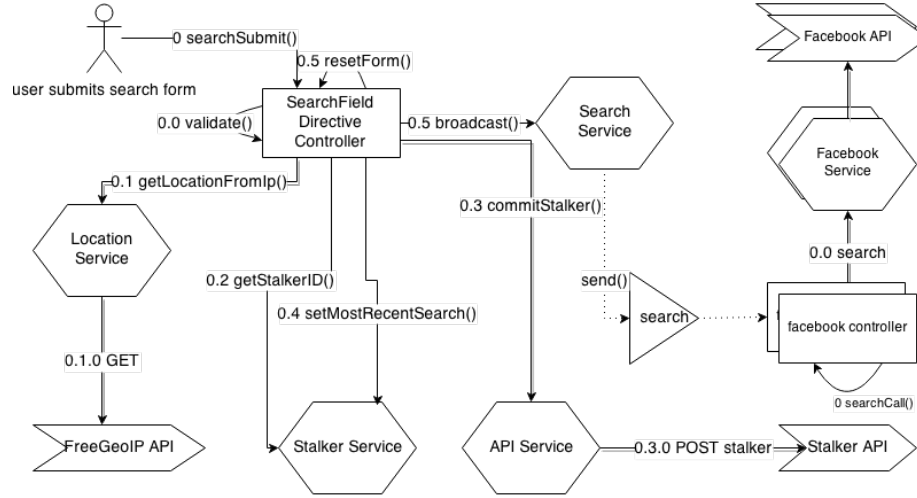


Figure 1.4: A schematic overview of the control flow when a user stalks somebody.

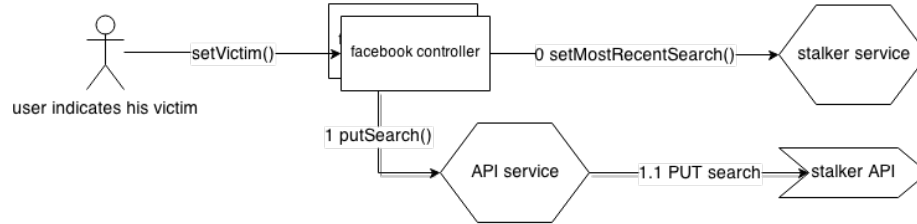


Figure 1.5: A schematic overview of the control flow when a user selects somebody as his victim.

to down in the scope hierarchy instead of up.

We added the start stalking button to force our users to first login to all social networks they wanted to use before actually stalking somebody. This was one of the concessions we had to make due to time constraints, since this button ensures that we can post complete stalkers, instead of having to update a stalker every time he adds a social network.

2.5 Select Victim

Figure 1.5 shows the control flow in the front end when a user indicates that one of the found results was his victim. Even though it does not matter to the user if the addition of his victim to our database has been reported we report success, and failure, since the user has no feedback on his actions otherwise. Once again we have chosen Facebook as an example, but the flow of control would be the same with a different social network.

Chapter 2

Back End

This chapter discusses the back-end. This includes the REST API plus the database storing all the statistics data. We will first discuss the technologies that were used to build these components then how together these technologies and components form the back-end.

1 Technology Stack

In this section we will describe as in section 1 what technologies were used and why we decided to use these above others.

1.1 Flask

Flask [3] is a python micro framework for the web. Flask is based on Werkzeug [12] and Jinja2 [7]. We have used the Flask framework as a base, but mostly used its extensions described below. We choose Flask for our back-end because one of us already had some experience with Flask and both of us had worked (a little bit) with python before.

Extensions

To make our development easier we decided to use already existing solutions for building a REST API using Flask and MongoDB (subsection 1.2). In this section we will describe the used extensions.

Flask-RESTful is an extension for Flask that adds support for quickly building REST APIs. It is a lightweight abstraction that can work together with existing ORM/libraries. Because Flask-RESTful [5] encourages best practices with minimal setup we were able to build a qualitatively good REST with reasonable ease.

Flask-MongoKit is an extension that builds on the Python Pymongo extension [11] and Flask. MongoKit adds an easy way to define MongoDB database models/documents [4].

1.2 MongoDB

MongoDB (from “humongous”) is an open-source, document based, NoSQL database with a lot of cool features, we list a few of these that were important for the choice for MongoDB over other NoSQL database solutions [8].

Replication & High Availability A replica set in MongoDB is a group of mongod processes that maintain the same data set. Replica sets provide redundancy and high availability, and are the basis for all production deployments. Because of this feature and the requirement for the project to be fault tolerant we found this to be a positive point for choosing MongoDB. The actual implementation of this feature in our project will be discussed in section 2.1.

Map/Reduce MongoDB provides an easy way to use map/reduce functionality. The map and reduce function can be written in JavaScript. In the Flask back-end it is very easy to apply these function to the database. This functionality was a requirement for the project and will be discussed in section 2.1.

1.3 HAProxy

From the website of HAProxy [6]. HAProxy is a free, very fast and reliable solution offering high availability, load balancing, and proxying for TCP and HTTP-based applications. It is particularly suited for very high traffic web sites and powers quite a number of the world’s most visited ones. Over the years it has become the de-facto standard opensource load balancer, is now shipped with most mainstream Linux distributions, and is often deployed by default in cloud platforms.

HAProxy is a load balancing solution pointed out by one of the student assistants and we chose to use this because it is according to their website the default solution for any professional cloud platform and beside fairly easy to set up. We will discuss HAProxy further in section 2.2.

2 Design

This section describes the design of the back-end of the STALKER project.

2.1 Database

Because API calls to the social media API’s are done in the frontend (see section 2) the back-end only has to worry about the statistics. We will first describe

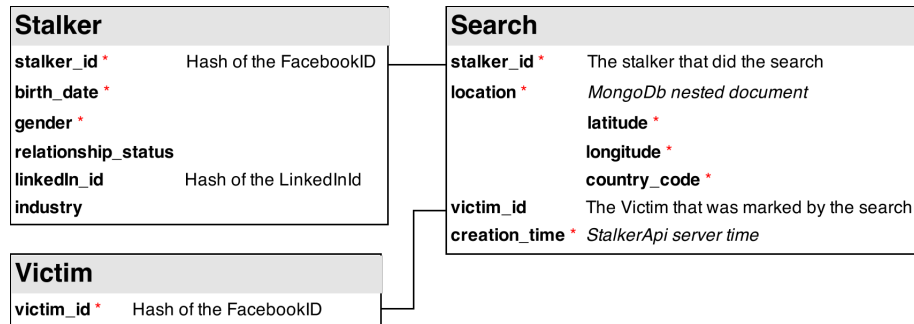


Figure 2.1: A overview of the database models. The attributes that are required and should be always available are marked with the red *. Not all information is available from the social media API's.

the database models. Below a list of descriptions of the used terminology is provided. In Figure 2.1 we give a more detailed overview of the data models.

Stalker A person who uses the STALKER application to search other people.

Victim A person who is being searches and is marked by the Stalker as the person he/she wanted to find.

Search This stores the link between a stalker, search and a victim.

The statistics are generated with the map reduce methods described in section 2.1.

Map Reduce

Map-reduce is a paradigm invented by google and is inspired by the functional programming functions map and reduce. The map-reduce method thus consists of a map function which performs filtering and sorting of the data. The reduce method then performs a summary operations and in our case reduces the data to some nice statistic.

Example of map-reduce in our project. When the front end requests a statistic e.g. the number of searches done per location. The map function will filter the data stored in the collection that stores the searches and will emit per search every location with a count of one. The reduce function will then reduce this list of locations into a list of unique locations. The reduce function does this by merging (taking the sum of) the counts when encountering double locations, this has as result a list of unique location and the number of searches done from those locations. This statistic is then shown in the front end see ??.

Replication

This section describes a way MongoDB handles replication, see the image shown in Figure 2.2. All write calls from the REST API (see subsection 2.2) to the

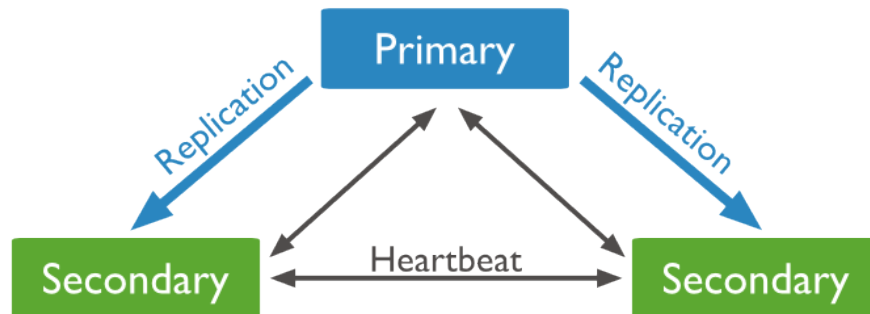


Figure 2.2: Replication implementation MongoDB

database are done to the primary MongoDB instance. This data is then replicated to the secondary instances (That run on different machines). Read operation can be load balanced to any of the instances.

All instances know of the other instances and send heartbeat message to each other to ensure this. Whenever the other detect the primary stopped running they decide which one of them becomes the new primary (the first secondary that receives a majority votes becomes the new primary). When you have three database instances you can handle one faulty instance, so if another one stops the communication between the database and REST Api is gone.

We chose for three databases because this number was according to the MongoDB website more than enough replication for most problems. Plus this number of processes was still manageable on our development environments.

2.2 REST API

This section describes the part of the back-end that implements all the server calls and is the part that does the communication with the database(s). A RESTful api is a

Possible api calls table?

Motivation why we used a REST API

Load balancing

3 Scalability

REST API Mongo replicaset enzo...

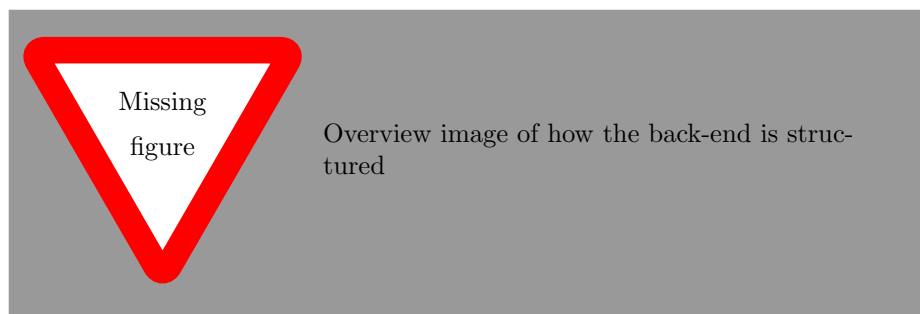


Figure 2.3: A schematic overview of the control flow when a user logs in.

Chapter 3

Evaluation

1 Front End

When we first started building the application we were not very experienced with Angular, this is clearly visible from the oldest code. Due to time constraints we could not refactor that code.

As mentioned earlier had we had more time we would have removed the ‘start stalking’ button and used multiple PUTs to update the **Stalker**. Some other, enhancements that we would have build, had we had more time are working AJAX spinners and better legends for the pie charts. Most importantly we would have improved the quality of the front end code.

Concerning Angular, we are not sure if it was the right choice. If we had to start over we would choose once again for choose for Angular, because of the experience argument. However we would like to chance to experience some of the competing frameworks before stating that Angular definitely was the right tool for this project.

2 Back End

- Security
- Check on data → idempotent post actions

Bibliography

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