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MILANO 1863

**SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE**

Students&Companies: Design Document (DD)

SOFTWARE ENGINEERING II

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1 | Introduction

1.1. Purpose

The primary purpose of this document is to provide a comprehensive blueprint that outlines how the software system will be developed. It acts as detailed road-map that guides the developers through the entire implementation process.

Also, the following text will ensure that everyone involved in the project has a shared understanding of the project's technical approach thus helping align expectations across the various teams and reducing misunderstandings.

The document captures and justifies key architectural decisions, explaining why certain technologies, patterns, or approaches were chosen. This helps maintain design consistency and provides rationale for future reference.

1.2. Scope

As described in the Requirements Analysis and Specification Document (RASD), S&C is a web application that aims to connect Students and Companies in order to facilitate the recruitment process. Students can find internships that match their skills and interests more easily, while Companies can find the best candidates for their positions.

The end goal is to allow students to gain practical experience in their field of study, thus reducing the skill mismatch between the academic and the professional world, while also providing companies with a pool of talented candidates to choose from when hiring.

1.3. Definitions, Acronyms, and Abbreviations

Acronym	Definition
Technical Concepts and Protocols	
HTTPS	Hypertext Transfer Protocol Secure.

TCP/IP	Transmission Control Protocol/Internet Protocol.
REST	Representational State Transfer.
DBMS	Database Management System.
SQL	Structured Query Language.
SMTP	Simple Mail Transfer Protocol.
JSON	JavaScript Object Notation.
API	Application Programming Interface.
Design, User, and Interfaces	
UI	User Interface.
UX	User Experience.
MVC	Model-View-Controller.
HTML	HyperText Markup Language.
CSS	Cascading Style Sheets.
Documents and Entities	
DD	Design Document.
RADS	Requirements Analysis and Specification Document.
CV	Curriculum Vitae.
S&C	Students&Companies.
ST	Student.
CO	Company.
UN	University.
Networks and Security	
SSO	Single Sign-On.
LAN	Local Area Network.
L3VPN	Layer 3 Virtual Private Network.
Operating Systems	
RHEL	Red Hat Enterprise Linux.

Table 1.1: Definitions, Acronyms, and Abbreviations Table

1.4. Revision History

- **Version 1.0** (2025-01-05): Initial release.

1.5. Reference Documents

- Assignment description.
- Provided course materials and notes.

1.6. Document Structure

1. **Introduction:** This section serves as the entry point to the document, providing a concise overview of the document's purpose, scope, key definitions, revision history, and reference materials. It provides a clear context for understanding the following technical details.
2. **Architectural Design:** This section presents the system's technical blueprint, detailing high-level components, their interactions, deployment strategies, and runtime behaviors. It explains the architectural choices and design intentions that shaped the system's structure.
3. **User Interface Design:** This section describes the system's user interface design, illustrating how users will interact with the system. It provides visual and functional insights into the interface's layout, navigation, and interaction models.
4. **Requirements Traceability:** This section maps requirements from the RASD to specific design elements, demonstrating how each system requirement is addressed and implemented through architectural and design choices.

5. **Implementation, Integration, and Test Plan:** This section outlines how system components will be validated. It details the planned sequence of implementation, integration, and testing to ensure the desired system qualities.
6. **Effort Spent:** This section documents the hours worked by each team member.
7. **References:** This section collects all sources cited within the document.

2 | Architectural Design

2.1. Overview

The following is an overview of the S&C architecture general components. A more detailed view will be provided in 2.3.

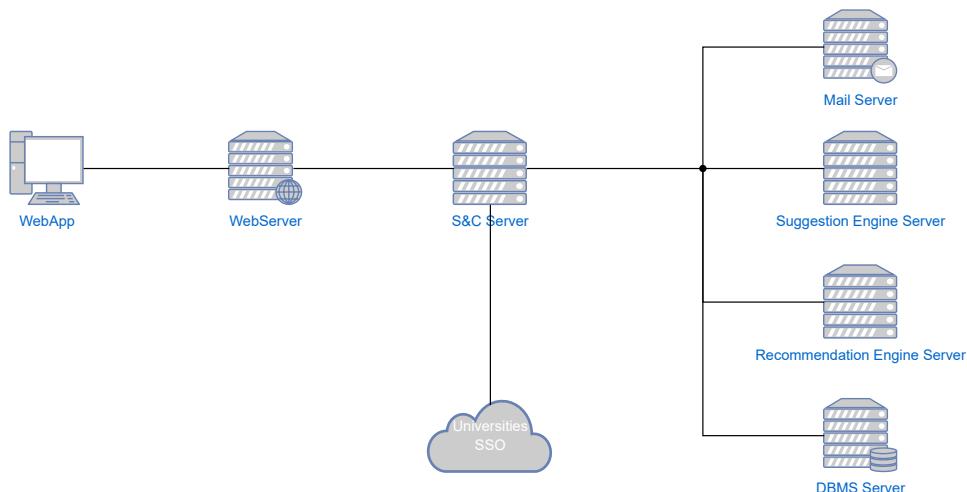


Figure 2.1: S&C Architecture Overview

On the client side can be seen:

- **WebApp:** The web application that the user interacts with, allowing users to connect to S&C. It displays the user interface and sends the user's requests to the core server.

On the server side, we can see:

- **Web Server:** It handles communication between users and the S&C system. It is responsible for serving the user interface and processing user requests by forwarding them to the S&C Server. Additionally, it manages user sessions and contains the necessary configuration for student authentication through university Single Sign-On (SSO) services.

- **S&C Server:** The main server of the S&C system. It is the core component and is responsible for communication between the Web Server and the databases and the APIs/Services.
- **DBMS Server:** This server archives all the essential information of the system. It stores data related to Users, CVs, Internship Advertisements, and Complaints.
- **Recommendation Engine Server:** This server is responsible for generating recommended Internship Advertisements for students and anonymous CVs for companies.
- **Suggestions Engine Server:** This server is responsible for generating suggestions for improving students' CVs and companies' internship advertisements.
- **Mail Server:** This server is responsible for sending emails to users. It is used for sending notifications and confirmations of actions performed by users.

2.2. Component View

2.2.1. High-Level Components

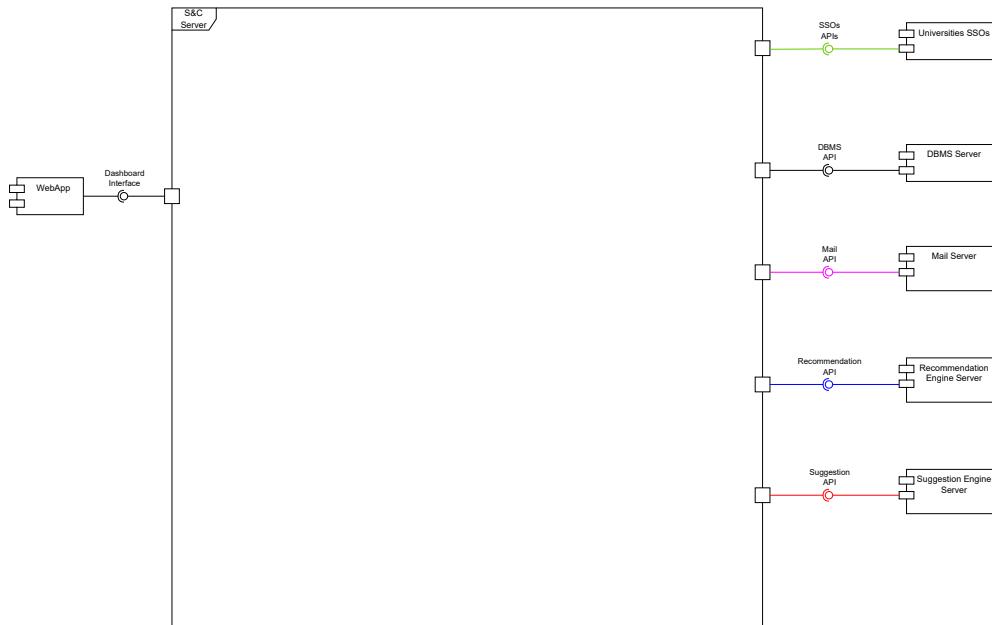


Figure 2.2: High-Level Components

Figure 2.2 shows the high-level components of the S&C system. The main external components are:

- **WebApp:** This is the web application that the user interacts with. It allows users to communicate with the S&C Server through the Dashboard Interface, which is the only means of interaction between the users and the system. The Dashboard Interface includes multiple functionalities, one of which allows the Dashboard to send notifications to users while they are using the system.
- **DBMS Server:** This server stores all the information of the Users, including their profile information, CVs, Internship Advertisements, Questionnaires, and Complaints. It is the main component of the system and is responsible for data management.
- **Mail Server:** This server is responsible for notifying users outside of the web application. It is used to send all types of notifications, including those confirming actions performed by a user, notifications of new recommendations for both students and companies, requests to fill out questionnaires, and notifications about the creation of new complaints, etc.
- **Recommendation Engine Server:** This server is responsible for generating recommended Internship Advertisements for students and anonymous CVs for companies. It periodically retrieves CV data and Internship Advertisement data to improve the program responsible for creating suggestions for each user.
- **Suggestions Engine Server:** This server is responsible for generating suggestions for improving students' CVs and companies' internship advertisements. It periodically retrieves CV data, Internship Advertisement data, and feedback answers at the end of internships to improve the program responsible for creating suggestions for each user.
- **Universities SSOs:** This external component allows students to log in to the system using their university credentials.

2.2.2. Low-Level Components

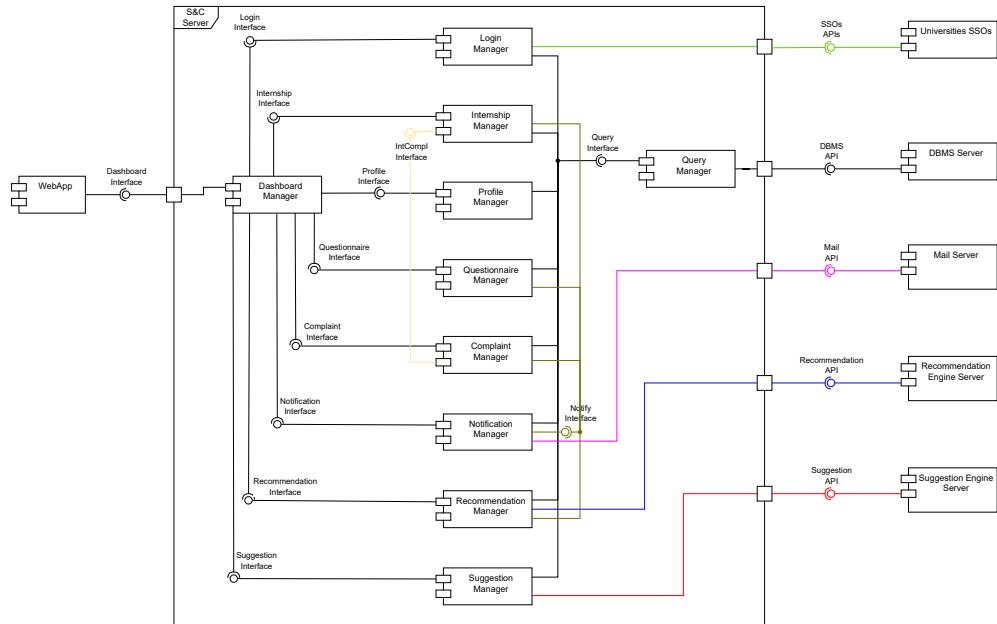


Figure 2.3: Low-Level Components

Figure 2.3 shows the complete architecture of the S&C system, detailing the components inside the S&C Server:

- **Dashboard Manager:** This component is responsible for interacting with users through the dashboard interface. The Dashboard Manager executes user requests and interacts with the appropriate components.
- **Login Manager:** This component is responsible for user login. For companies it checks credentials against those stored in the DBMS. For students and universities, it interacts with the Universities SSOs, for the students it also handle the first access to the platform.
- **Internship Manager:** This component manages all stages of the Internship selection and execution process. It handles the creation of Internship Advertisements, the list of student applications, and the status of internships. It also provides an interface for the Complaint Manager to modify the status of internships.
- **Profile Manager:** This component manages user profiles. It allows users to modify their profile information, students to upload their CVs, and companies to create their profile descriptions.

- **Questionnaire Manager:** This component manages Questionnaires, both those created by companies for selecting students for internships and those created by the system for feedback at the end of internships.
- **Complaints Manager:** This component manages complaints. It is used to create complaints, manage them, and if necessary, interact with the related internship to modify its status through the interface provided by the Internship Manager.
- **Notification Manager:** This component manages notifications. It generates notifications to send to the dashboard if the user is logged in, and interacts with the Mail Server to send notifications to users outside of the web application.
- **Recommendation Manager:** This component interacts with the Recommendation Engine Server. It retrieves the data required by the recommendation engine to improve its suggestions, and retrieves the results of the recommendation engine to display to users.
- **Suggestions Manager:** This component interacts with the Suggestions Engine Server. It retrieves the data required by the suggestion engine to improve its suggestions, and retrieves the results of the suggestion engine to display to users.
- **Query Manager:** This component executes queries and converts the data returned by the DBMS into the necessary objects for other components.

Login Manager

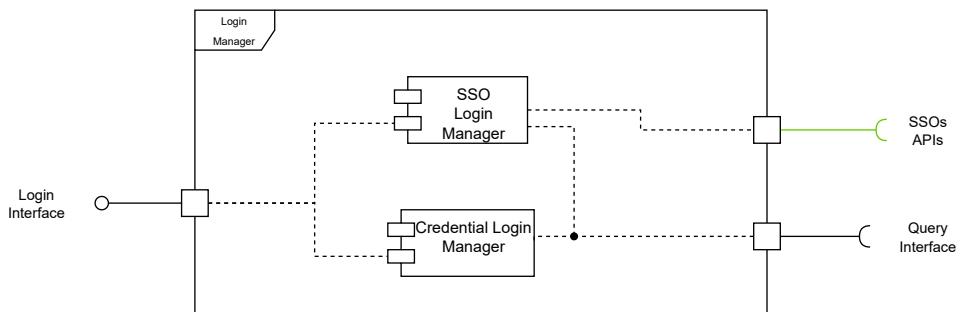


Figure 2.4: Login Manager

The Login Manager is composed of other two sub-components:

- **SSO Login Manager:** This component is responsible for interacting with the Universities SSOs to authenticate the students and the authorized staff with the

SSOs. It also manages the registration of new students. It creates a new student profile if the student is not already registered in the DBMS.

- **Credential Login Manager:** This component is responsible for authenticating the company with the credentials stored in the DBMS.

Internship Manager

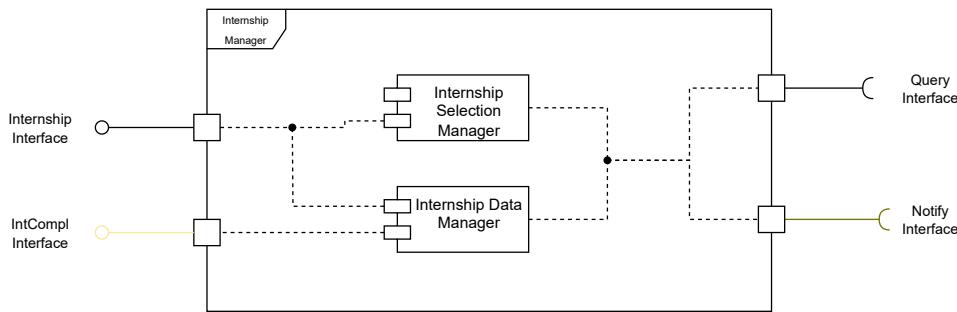


Figure 2.5: Internship Manager

The Internship Manager is composed of other two sub-components:

- **Internship Selection Manager:** This component is responsible all the stages of the internship selection process. It handles the creation of internship advertisements, the list of student applications.
- **Internship Data Manager:** This component is responsible for managing the status of internships, who's the responsible for the internship, the descriptions of it, the requirements and the duration. It also provides an interface for the Complaint Manager to modify the status of internships.

Profile Manager

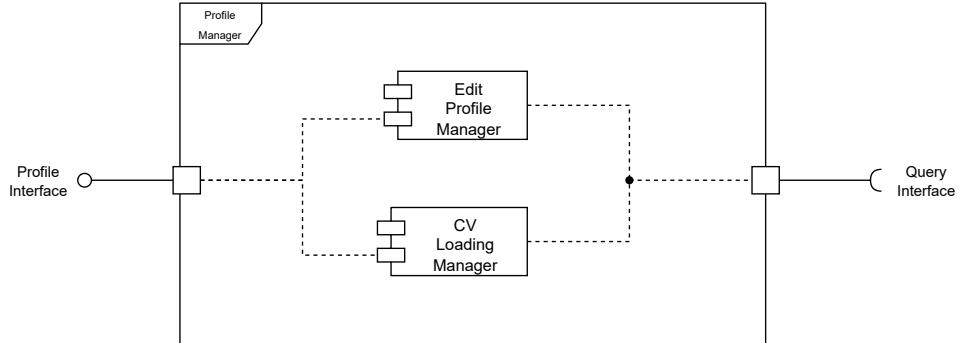


Figure 2.6: Profile Manager

The Profile Manager is composed of other two sub-components:

- **Profile Manager:** This component is responsible for the modification of the user's profile information. For the companies it allows to create their profile description that will be shown to students.
- **CV Manager:** This component is responsible for the management of the student's CVs and uploading them.

Questionnaire Manager

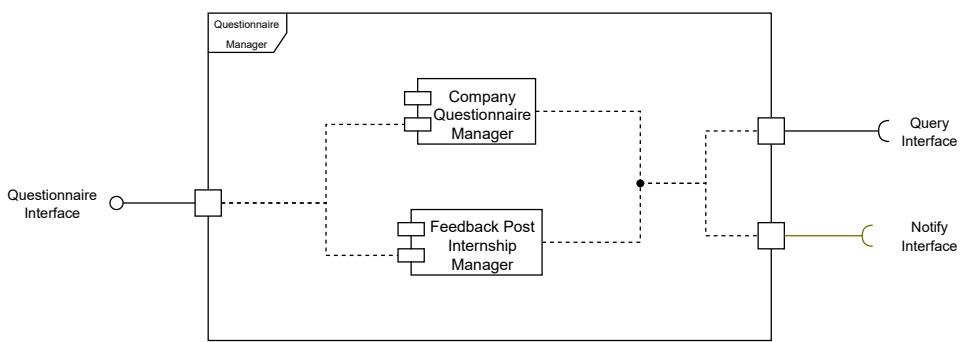


Figure 2.7: Questionnaire Manager

The Questionnaire Manager is composed of other two sub-components:

- **Company Questionnaire Manager:** This component is responsible for managing the questionnaires created by companies. It allows companies to create, modify and

delete questionnaires to select students for internships. It allows companies to see the answers to the questionnaires.

- **Feedback Questionnaire Manager:** This component is responsible for managing the feedback questionnaires created by the system. It allows the system to create questionnaires for feedback at the end of internships.

2.3. Deployment View

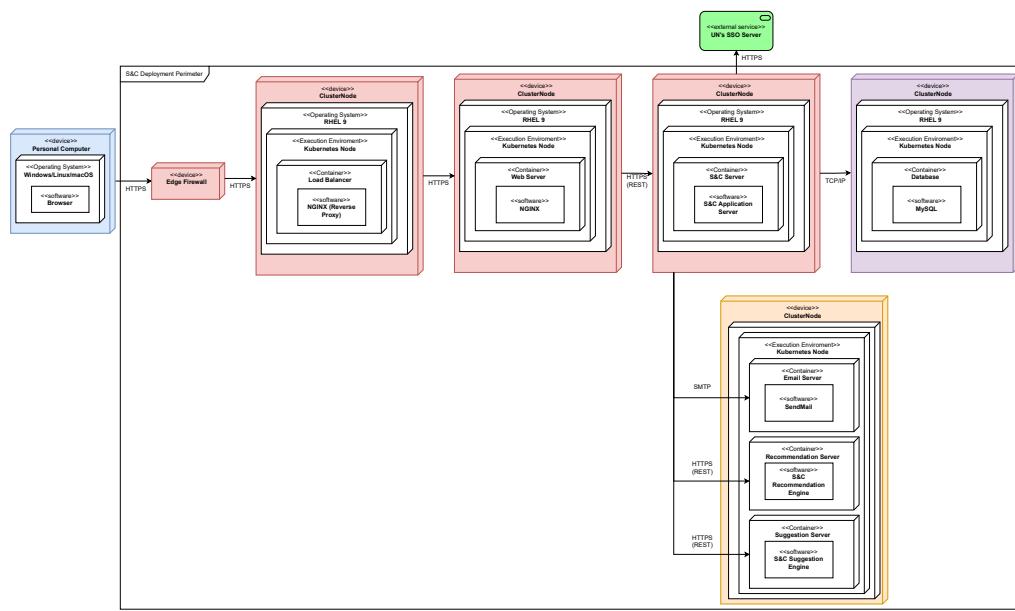


Figure 2.8: Deployment Diagram

The figure shows the deployment diagram of the S&C infrastructure. Running on the cluster are all the components previously described in 2.1 each one encapsulated in independent containers.

Notable additions are the Load Balancer and a Firewall. The Load Balancer is responsible for distributing the incoming traffic across the various Web Servers. The Firewall is responsible for filtering the incoming traffic and protecting the system from malicious attacks.

It must be noted that all the various services are running in containers on generic x86 hardware. The configuration shown is just an example and can be easily scaled: in a testing environment, all the services can run on the same machine, while in a production environment, the services can be distributed across n machines to improve performance

and reliability. In production, enough replicas of each service should be running to ensure high availability.

The system can be easily be implemented in bare-metal hardware or in a cloud environment of choice (e.g. AWS, Azure, Google Cloud, etc.). Multi-cloud deployment is also possible: no components are tied to a specific cloud provider or running specific hardware. Even the firewall(s) can be virtualized if needed.

The rationale behind the division of the system into the various components and the chosen communication protocols will be discussed in 2.6. Other minor design decisions will be explained in 2.7.

2.4. Runtime View

2.4.1. Student and Universities Staff Login

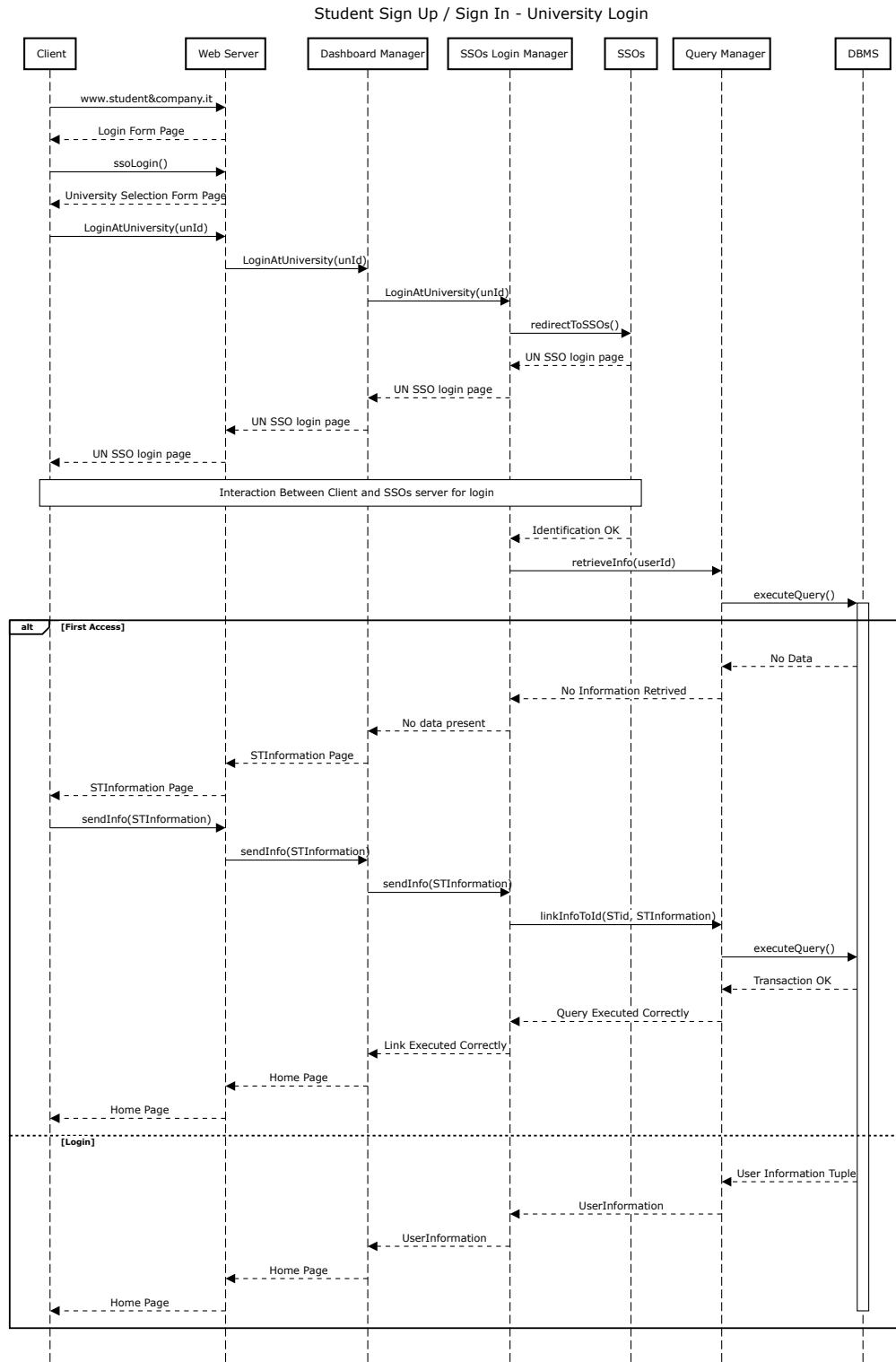


Figure 2.9: Runtime View - Student and Universities Staff Login

This sequence diagram represents the ST login and first access process. The ST searches into the browser for the S&C web application and gets the login page. After clicking on the "Login with SSO" button the ST is redirected to a page require the selection of the university of the ST between the available ones. After the selection, the ST is redirected to the university's SSO page where the ST inserts the credentials. The SSO validates the credentials and sends back a token to the S&C server. The S&C server validates the token and check if the ST is already registered in the system searching for it in the DBMS. If the ST is not registered, the S&C server creates a new ST profile and redirects the ST to the profile page to complete the registration. If the ST is already registered, the S&C server redirects the ST to the dashboard page. This process is the same for the UN staff but there is no registration process because the UN staff is registered by the S&C staff.

2.4.2. Company Login

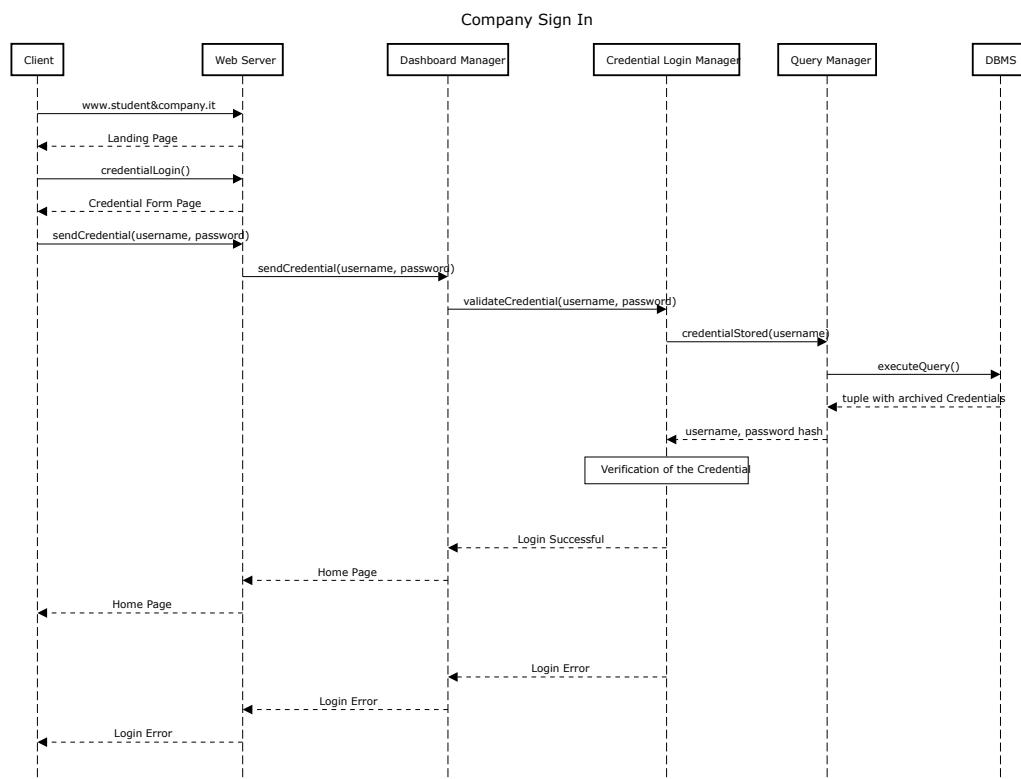


Figure 2.10: Runtime View - Company Login

This sequence diagram represents the CO login process. Here is not shown the registration process because it was done in a previous instance between the CO and the S&C staff by email. The CO searches into the browser for the S&C web application and gets the login page. After clicking on the "Login with Company credentials" button the CO inserts the

credentials and clicks on the "Login" button. The S&C server validates the credentials and if the credentials are correct the CO is redirected to the dashboard page otherwise an error message is shown.

2.4.3. Student Loads CV

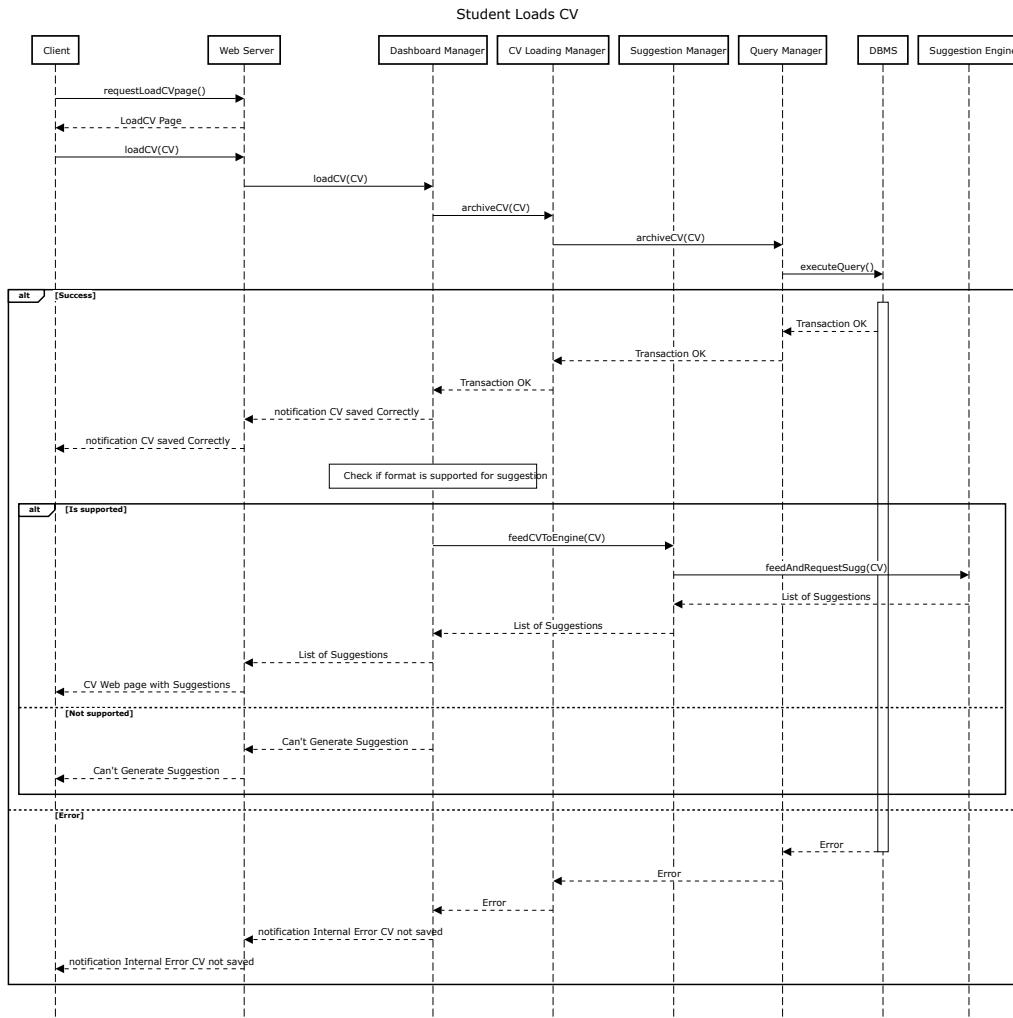


Figure 2.11: Runtime View - Student Loads CV

This sequence diagram represents the ST CV upload process. The ST clicks on the "Upload CV" button in his profile management page. The S&C server sends back the CV upload page. The ST selects the CV file and clicks on the "Upload" button. The S&C server validates the file and saves it in the DBMS and notifies the ST that the CV has been uploaded successfully otherwise an error message is shown. If the CV is uploaded successfully the S&C server checks if the CV is one of the standard formats supported by the Suggestion Engine, if it's not then a notification is sent that the CV is not supported

and so the ST can't receive suggestions, instead if the CV is supported it's sent to the Suggestion Engine to be analyzed and suggestions are sent back to the ST.

2.4.4. Student Browser and Search for Internships

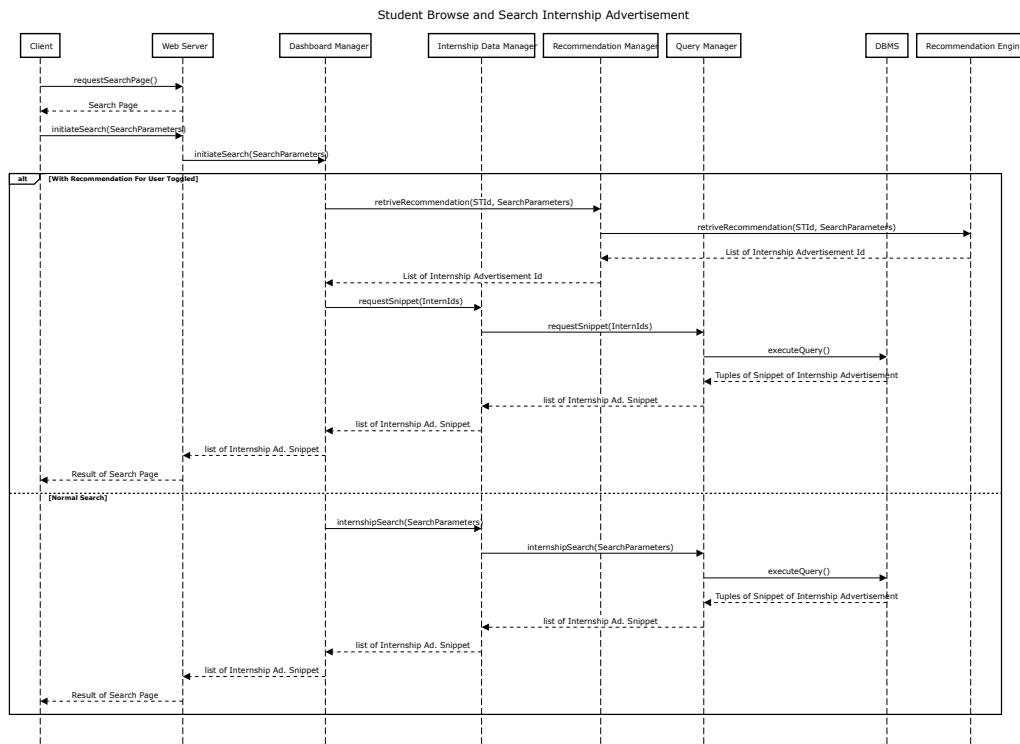


Figure 2.12: Runtime View - Student Browser and Search for Internships

This sequence diagram represents the ST search for internships process. ST clicks on the "Search" button in the dashboard page. The S&C server sends back the search page. The ST selects the filters and clicks on the "Search" button. The S&C server through the Internship Manager retrieves the internships that match the filters and sends them back to the ST. The ST can request the internship that the Recommendation Engine suggests to him by clicking on the "recommended for you" filter in the filter selection. The S&C server retrieve the recommended internships from the Recommendation Engine and sends them back to the ST.

2.4.5. Student Compiles Company Questionnaire

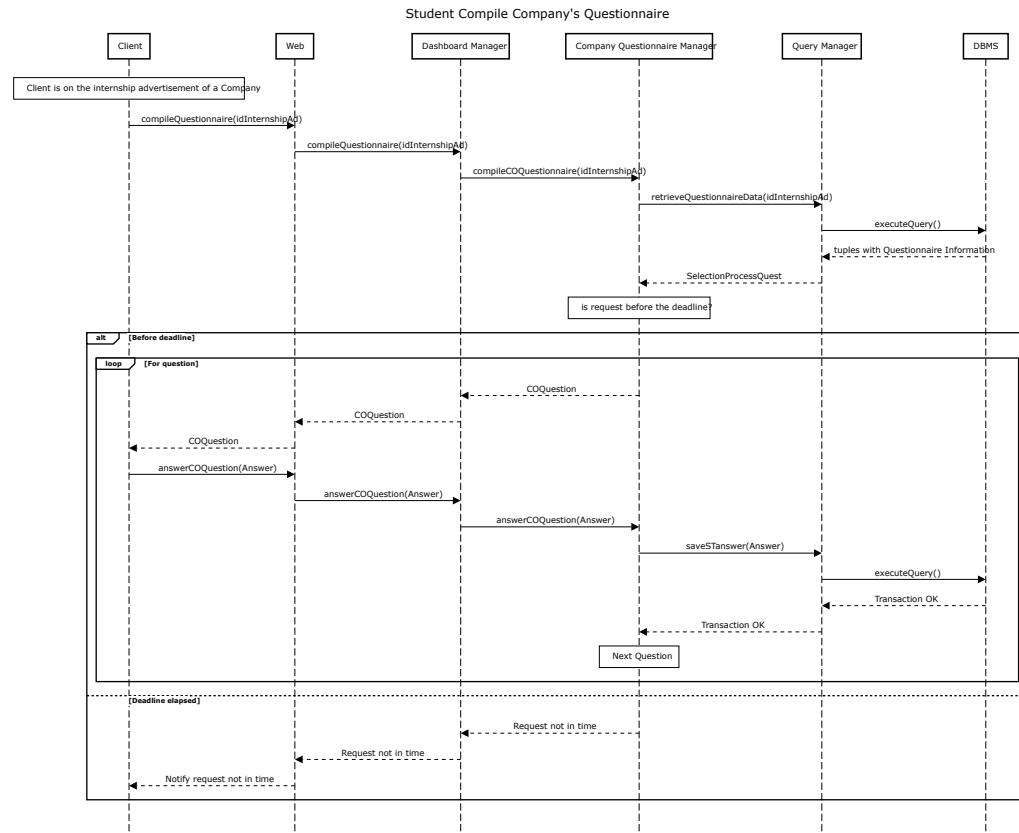


Figure 2.13: Runtime View - Student Compiles Company Questionnaire

This sequence diagram represents the ST compiles Company Questionnaire process. ST after receiving the email that a questionnaires for an internship he applied for is available. To compile the questionnaire ST access the specified internship advertisements and then clicks on the "Fill out Questionnaire" button or can directly access the questionnaire from the email. At first the S&C server checks if the ST is trying to answers the questionnaire after the deadline, if it's the case it notifies the ST that the questionnaire is no longer available. If the questionnaire is still available, the S&C server retrieves through the Company Questionnaire Manager the questions of the questionnaire and sends them one by one to the ST. The ST answers the questions and clicks on the "Next" button. The S&C server saves the answers and sends the next question until the last one.

2.4.6. Student Compiles Feedback Questionnaire

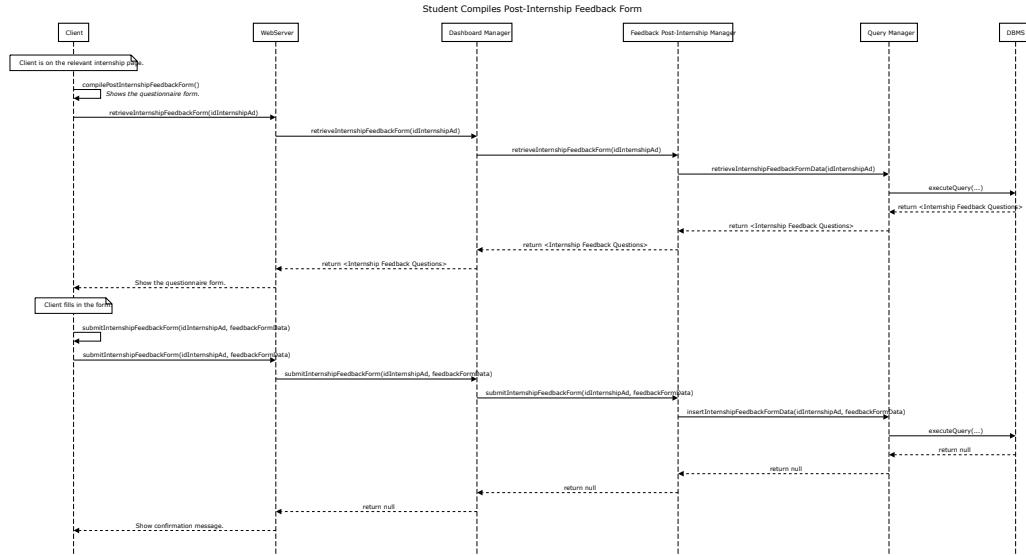


Figure 2.14: Runtime View - Student Compiles Feedback Questionnaire

This sequence diagram represents the ST compiles Feedback Questionnaire process. ST after receiving the email that a feedback questionnaire for an internship he completed is available, To compile the questionnaire ST access the specified internship advertisements and then clicks on the "Post-Internship Feedback" button or can directly access the questionnaire from the email. In this case there is no deadline check because the questionnaire is for statistic and feedback purposes. The S&C server retrieves the feedback form and sends it to the client. The ST then fills in the form with the necessary information and clicks on the "Submit" button. The S&C server saves the feedback and sends a confirmation message to the CO.

2.4.7. Student Creates a Complaint

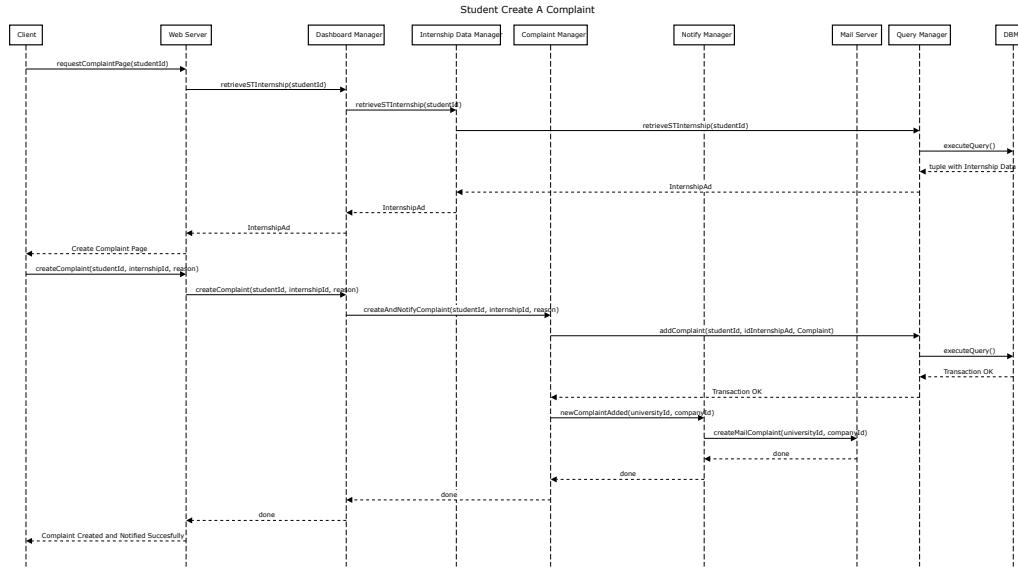


Figure 2.15: Runtime View - Student Creates a Complaint

This sequence diagram represents the ST creates a complaint process. ST clicks on the "Create Complaint" button in the dashboard page. The S&C server sends back the complaint creation page after retrieving the internships that the ST is involved in, if the ST is not involved in any internship the page will show that a complaint can't be created. The ST selects the internship and the reason for the complaint and writes the complaint in the text area. The ST clicks on the "Submit" button. The S&C server saves the complaint and sends a notification to the CO and UN staff involved in the internship.

2.4.8. Company Creates an Internship Advertisement

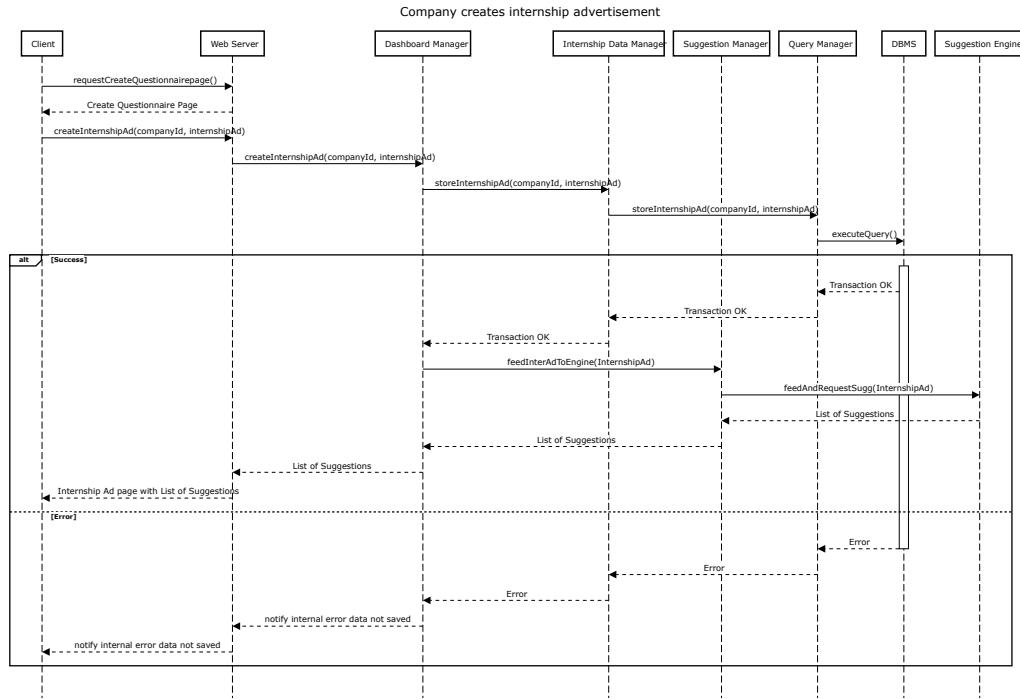


Figure 2.16: Runtime View - Company Creates an Internship Advertisement

This sequence diagram represents the CO creates an internship advertisement process. CO clicks on the "Create Internship Advertisement" button in the dashboard page. The S&C server sends back the internship advertisement creation page. The CO fills the form with the details of the internship advertisement and clicks on the "Submit" button. If the internship advertisement is saved correctly then the S&C server feeds the data to the Suggestion Engine to be analyzed and suggestions are sent back to the CO.

2.4.9. Company Creates a Questionnaire

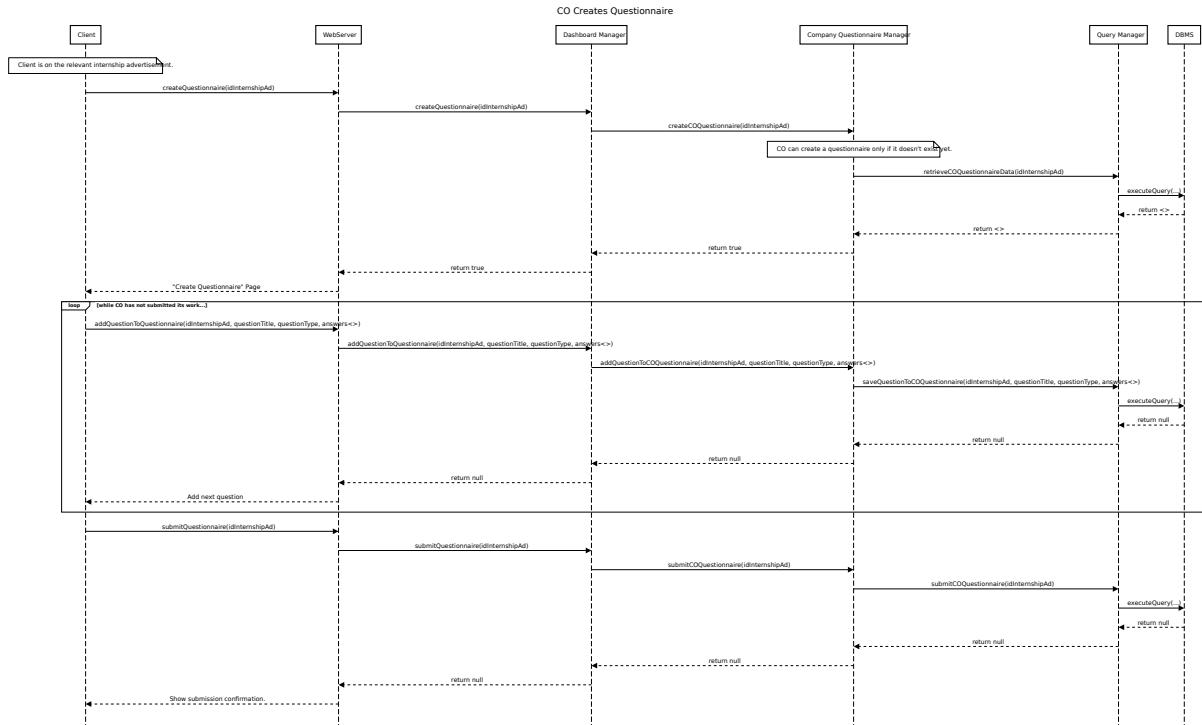


Figure 2.17: Runtime View - Company Creates a Questionnaire for Selecting Students

This sequence diagram illustrates the general process involved by a CO in creating a questionnaire for selecting and evaluating candidates for the relevant internship. The CO is viewing the internship advertisement and clicks on the "Create Questionnaire" button. The S&C server checks if a form has already been created for the that internship, and if not, allows the client to open the questionnaire creation page. The CO then fills in the form with the questions that they wish to ask the candidates and the points that each question is worth. Since the form that CO is creating maybe long and complex, the client sends each question to the server as it is created. Once the form is completed, the CO clicks on the "Submit" button. The S&C server saves the form and sends a confirmation message to the CO.

2.4.10. Company Selects Applicants to Send Questionnaire to

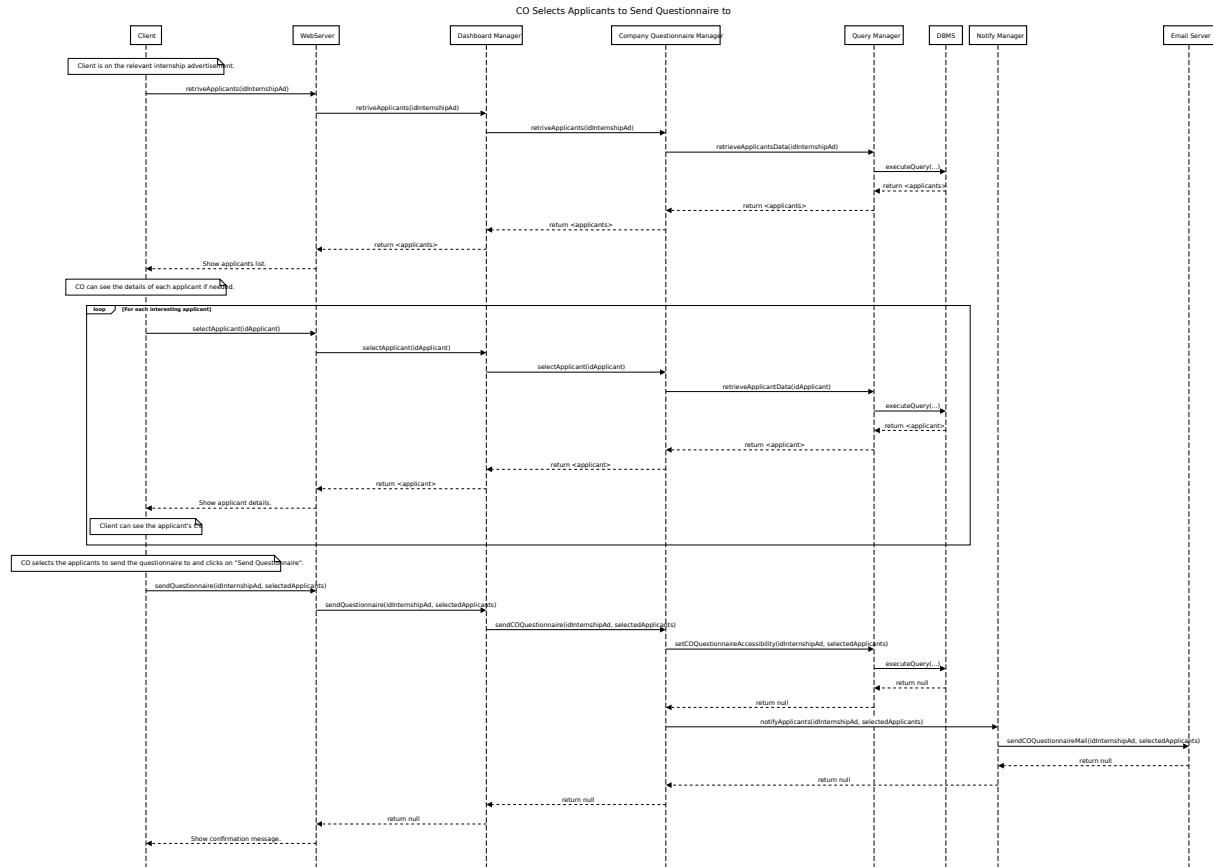


Figure 2.18: Runtime View - Company Selects Applicants to Send Questionnaire to

This sequence diagram illustrates the process involved by a CO in selecting applicants to send a questionnaire to for the relevant internship. The CO is viewing the internship advertisement and clicks on the "Send Questionnaire" button. The S&C server retrieves the list of applicants for the internship and sends it to the client that will display it. If the CO wishes so they can see the profile of each applicant individually in order to make a more informed decision. The CO then selects all the applicants that they wish to send the questionnaire to and clicks on the "Send" button. The candidates pool is identified and sent to the S&C server. S&C Core will then notify all selected students via email - using the Email Server - that they have a questionnaire to fill out.

2.4.11. Company Edits Its Own Profile

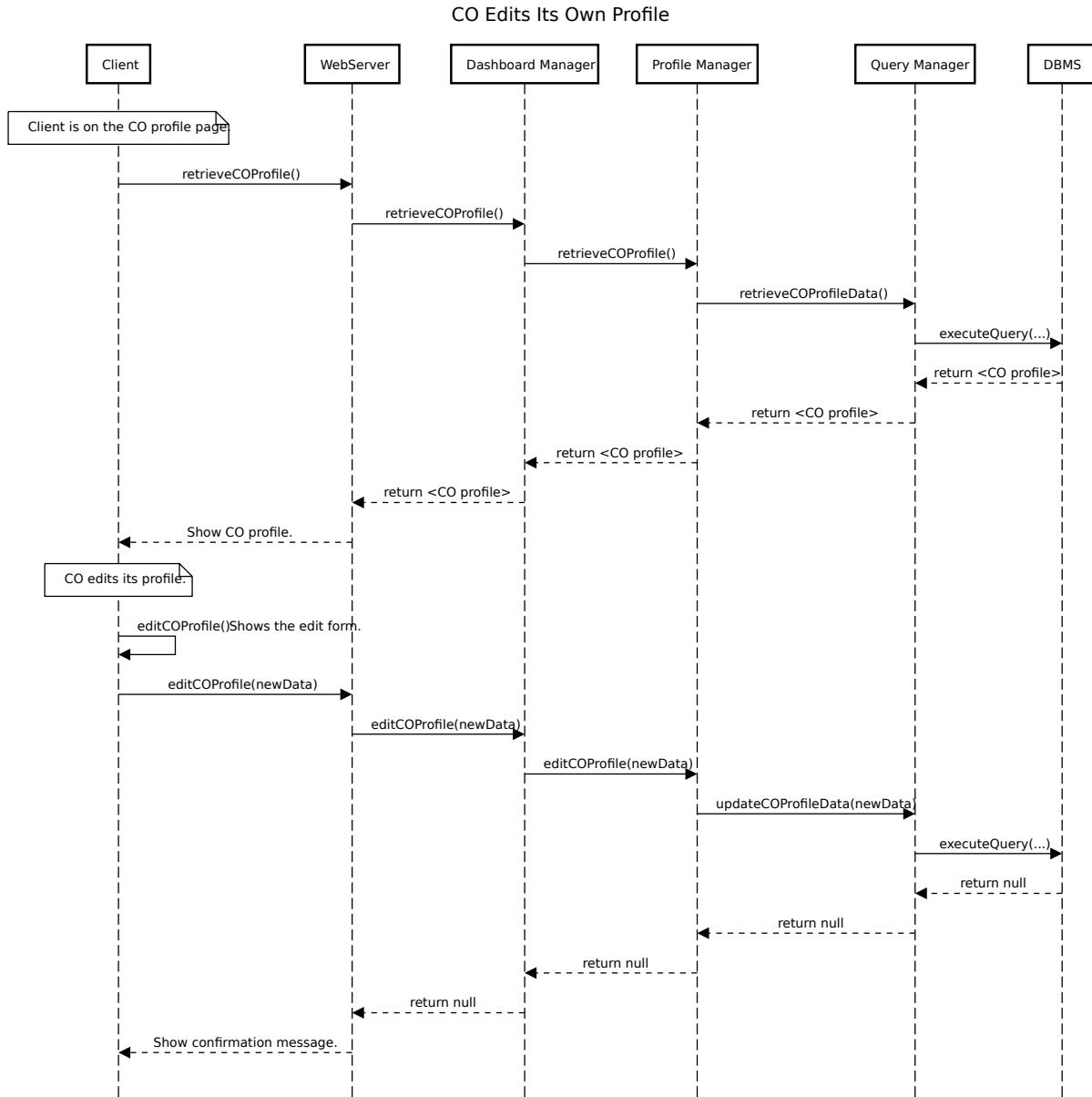


Figure 2.19: Runtime View - Company Edits its Own Profile

This sequence diagram states how a CO can edit its own profile page. The CO clicks on the "Edit Profile" button in its own profile page. The client will then show the editing form. After the CO has made the necessary changes, they click on the "Submit" button. The S&C server will then save the changes and shows a confirmation message to the CO.

2.4.12. Company Compiles the Post-Internship Feedback Form

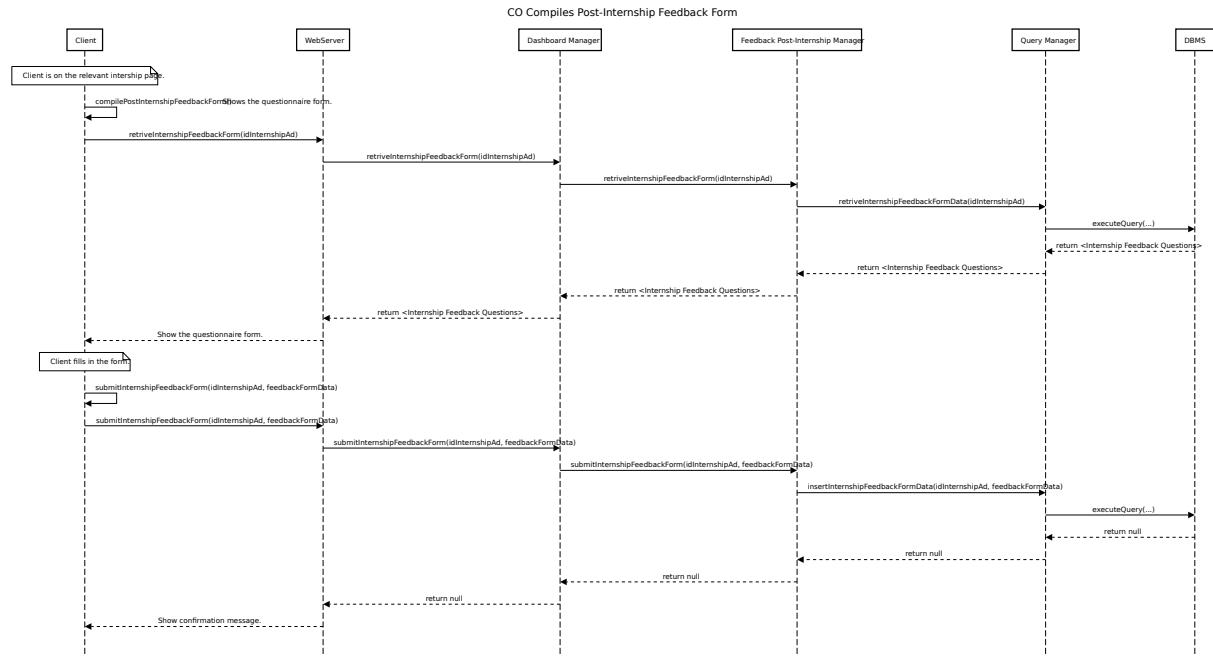


Figure 2.20: Runtime View - Company Compiles the Post-internship Feedback Form

This sequence diagram illustrates how the CO can compile the post-internship feedback form. The client is on the now ended internship page and clicks on the "Post-Internship Feedback" button. The S&C server retrieves the feedback form and sends it to the client. The CO then fills in the form with the necessary information and clicks on the "Submit" button. The S&C server saves the feedback and sends a confirmation message to the CO.

Since this questionnaire are usually very short and simple, the client sends the entire form to the server at once without saving the answers one by one.

2.4.13. Company Creates a Complaint

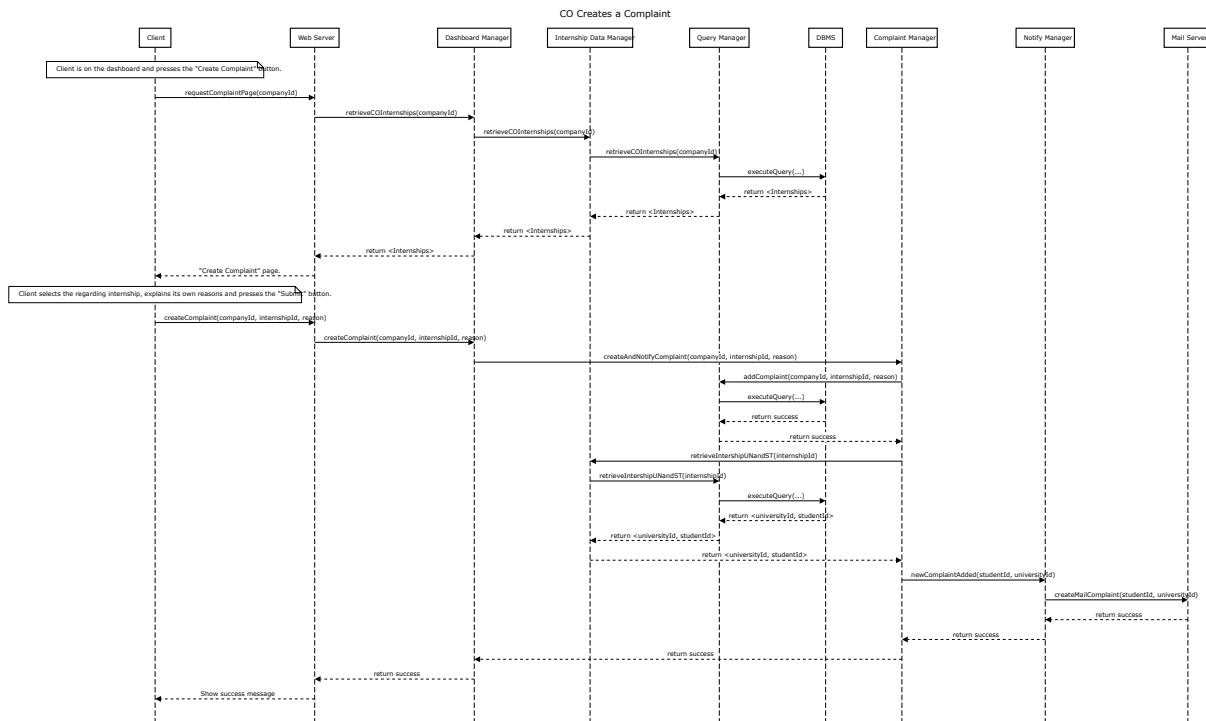


Figure 2.21: Runtime View - Company Creates a Complaint

This sequence diagram illustrates how a CO can create a complaint. The client is on the dashboard and clicks on the "Create Complaint" button. The S&C server provides the client with the list of internships that the CO is involved in to allow the CO to select the internship that the complaint is related to. The CO then writes the in the form its reasons and clicks on the "Submit" button. The S&C server saves the complaint and sends a notification to the UN staff and the ST involved in the work experience.

Again, since the complaint form is short storing the intermediate answers is not necessary.

2.4.14. University Monitors the Status of the Internships

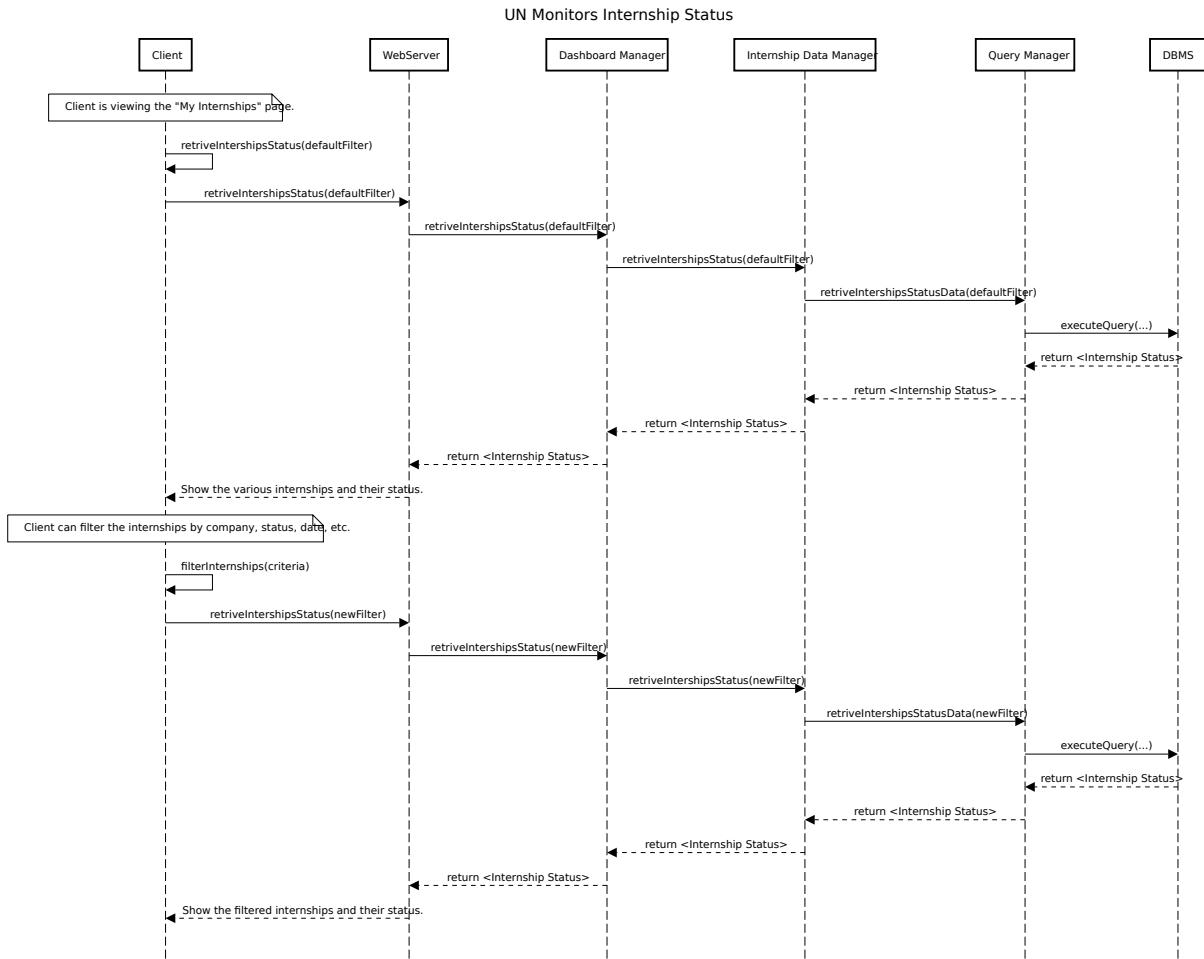


Figure 2.22: Runtime View - University Monitors the Status of the Internships

This sequence diagram illustrates how a UN can monitor the status of the internships. The clients load the "My Internships" page. The S&C server retrieves the list of internships that the UN is involved in and sends it to the client. The UN can then see the status of each internship and if any complaints that have been made. If needed the UN can filter the list by status, company, or other criteria to find the desired information.

2.4.15. University Handles a Complaint

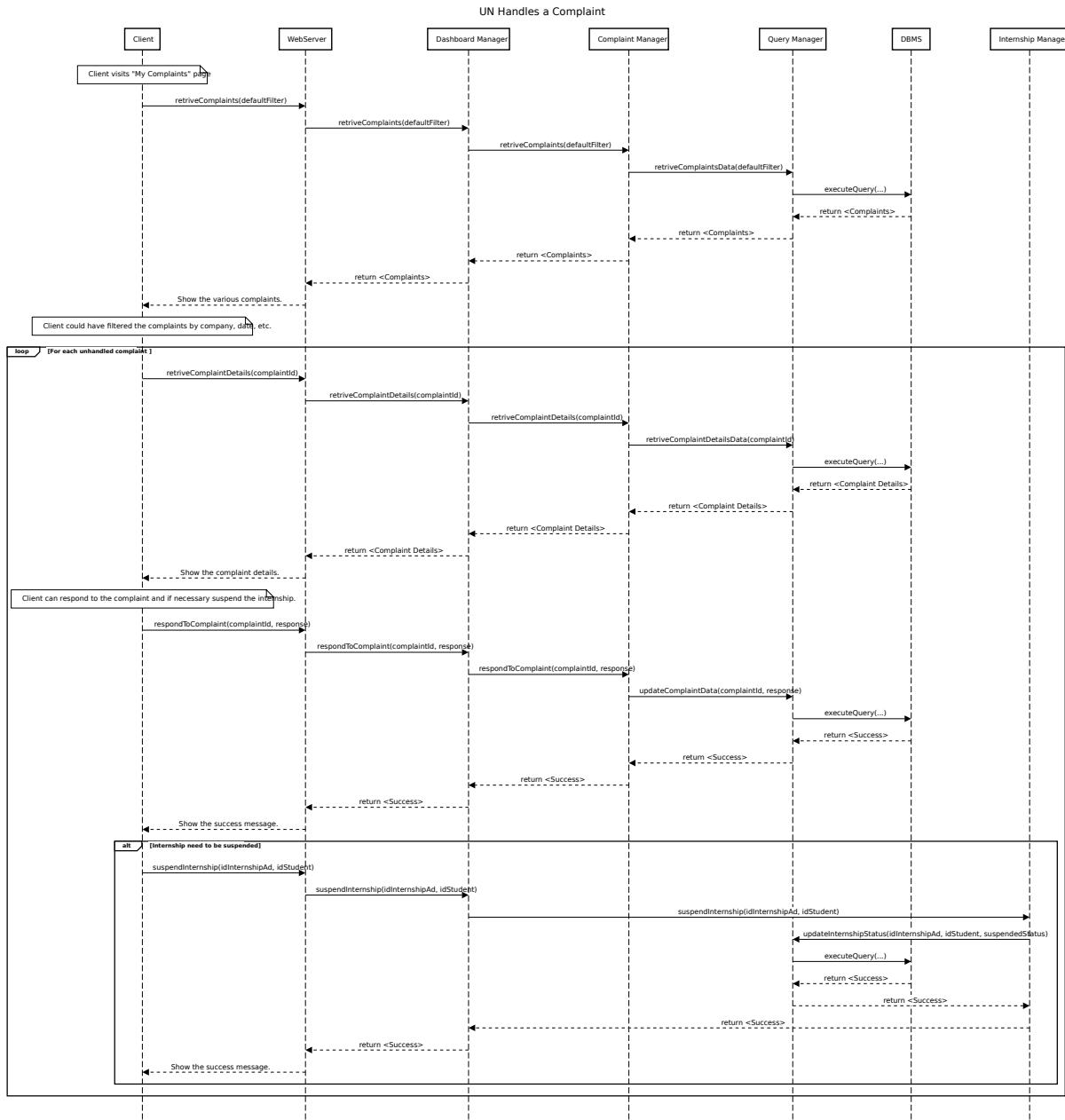


Figure 2.23: Runtime View - University Handles a Complaint

This sequence diagram illustrates how a UN can handle a complaint. The client is on the "My Complaints" page. The S&C server retrieves the list of "active" complaints that the UN is involved in and sends it to the client. The UN can then see the status of each complaint and - if needed - can filter the list by company, or other criteria.

The UN can then click on a complaint to see the details. The S&C server retrieves the

complaint details and sends it back to the client. The UN can then see the complaint and the related internship. UN can respond to the complaint and also suspend the internship if necessary. The S&C server saves the changes made and sends a confirmation message to the UN after each action.

2.4.16. University Blocks a Malicious Company

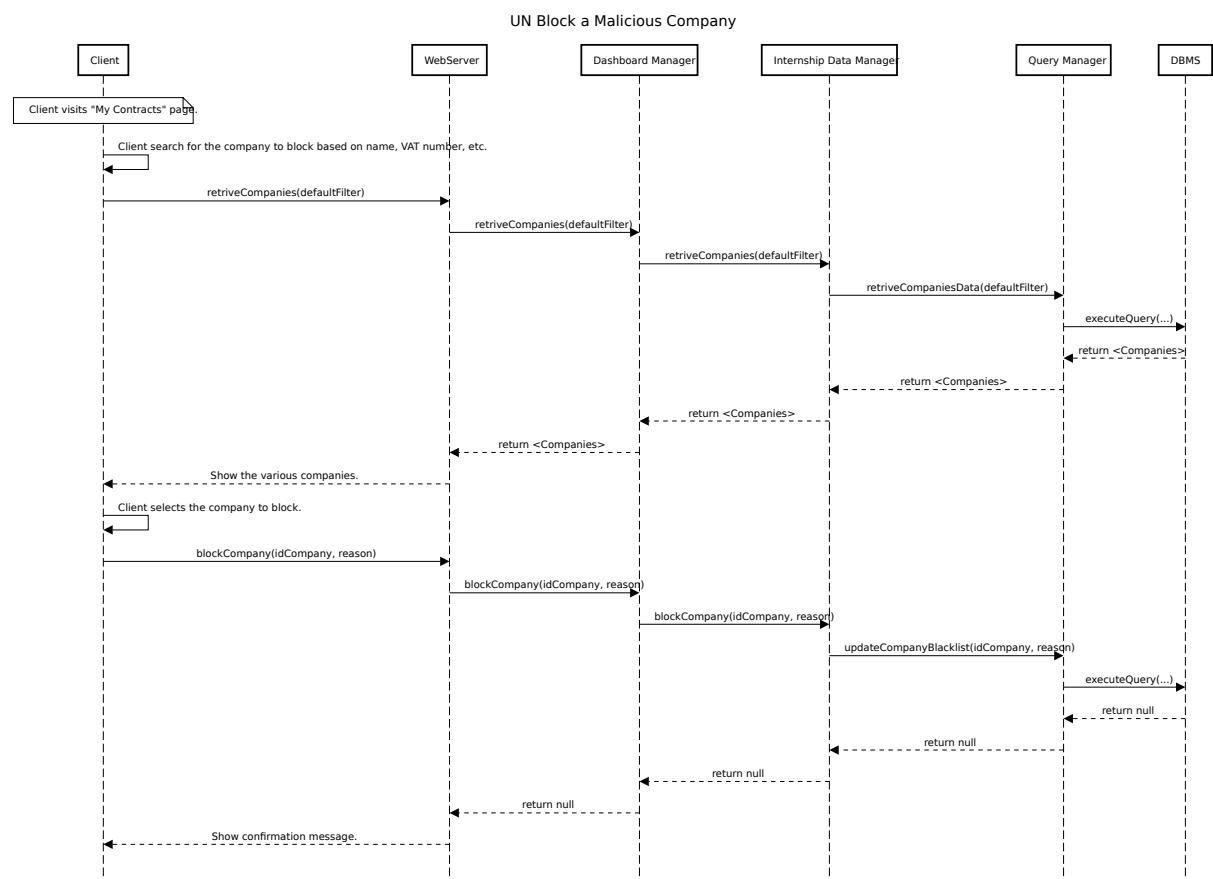


Figure 2.24: Runtime View - University Blocks a Malicious Company

This sequence diagram illustrates how a UN can block a malicious company. The client is on the "My Contracts" page and clicks on the "Block Company" button. The client shows a search bar where the UN can search for the company to block using the company's name, VAT number, or other criteria. The S&C server retrieves the list of companies that match the search criteria and sends it to the client. The UN can then select the company to block and clicks on the "Block" button. The S&C server adds the company to the blacklist and sends a confirmation message to the UN.

2.5. Component Interfaces

- **Login Manager:**
 - loginAtUniversity(String unId)
 - sendInfo(STInfo stInfo)
 - validateCredential(String username, String password)
- **Internship Manager**
 - requestSnipped(List<String> internIds)
 - internshipSearch(SearchParameters searchParams)
 - retrieveSTInternship(String stId)
 - storeInternshipAd(String companyId, InternshipAd internshipAd)
- **Profile Manager**
 - archiveCV(File CV)
- **Questionnaire Manager**
 - compileCQQuestionnaire(String idInternshipAd)
 - answerCQQuestionnaire(Answer answer)
 - retrieveInternshipFeedbackForm(String idInternshipAd)
 - submitInternshipFeedbackForm(String idInternshipAd, FeedbackData feedbackFormData)
- **Complaint Manager**
 - createAndNotifyComplaint(String stId, String internshipId, Complaint reason)
- **Notification Manager**
 - newComplaintAdded(String universityId, String companyId)
- **Recommendation Manager**
 - retrieveRecommendation(String stId, SearchParameters searchParams)
- **Suggestion Manager**

- feedCVToEngine(File CV)
- feedInternAdToEngine(InternshipAd internshipAd)

- Query Manager

- retrieveInfo(String userId)
- linkInfoToId(String userId, STInfo stInfo)
- credentialStored(String username)
- archiveCV(File CV)
- requestSnipped(List<String> internIds)
- internshipSearch(SearchParameters searchParams)
- retrieveQuestionnaireData(String idInternshipAd)
- saveSTAnswer(Answer answer)
- retrieveInternshipFeedbackForm(String idInternshipAd)
- insertInternshipFeedbackFormData(String idInternshipAd, FeedbackData feedbackFormData)
- retrieveSTInternship(String stId)
- addComplaint(String stId, String idInternshipAd, Complaint reason)
- storeInternshipAd(String companyId, InternshipAd internshipAd)

- Dashboard Manager

- loginAtUniversity(String unId)
- sendInfo(STInfo stInfo)
- sendCredential(String username, String password)
- loadCV(File CV)
- initiateSearch(SearchParameters searchParams)
- compileQuestionnaire(String idInternshipAd)
- answerCQQuestionnaire(Answer answer)
- retrieveInternshipFeedbackForm(String idInternshipAd)

- submitInternshipFeedbackForm(String idInternshipAd,
FeedbackData feedbackFormData)
- retrieveSTInternship(String stId)
- createComplaint(String stId, String internshipId,
Complaint reason)
- createInternshipAd(String companyId, InternshipAd internshipAd)

2.6. Selected Architectural Styles and Patterns

Architectural Design: The architectural design of S&C is based on the industry-standard 3-Tier-Architecture pattern:

1. **Presentation Tier:** This is the upper layer that directly interacts with users. The presentation tier focuses on displaying information to the user and capturing user inputs. It's designed to handle all client-side interactions and renders the application's visual components.
2. **Application Tier:** This layer contains the core business logic and processing rules of the application. It receives requests from the presentation tier, applies business rules, validates data, and coordinates the flow of information. This tier acts as an intermediary, ensuring that data is processed according to the application's specific requirements before being passed to or retrieved from the data tier.
3. **Data Tier:** The bottom layer of the architecture, responsible for storing, retrieving, and managing data. The data tier ensures data integrity, provides database connection management, and implements data access methods that the application tier can use to interact with the stored information.

The division of the system into these three layers allows a reduction in complexity, improves maintainability, and facilitates scalability: each layer can be developed, tested, deployed and maintained independently, enabling a more modular and flexible system architecture while also paralleling development efforts.

The choice of a 3-Tier-Architecture is also motivated by the fact that it can be easily mapped to the MVC (Model-View-Controller) pattern - a widely-used design pattern that separates the application into three interconnected components: the Model (data), the View (interface), and the Controller (business logic). This pattern is particularly useful since it allows for a clear separation of concerns and a more modular and maintainable codebase.

With this knowledge in mind, the services division shown in the Deployment Diagram (2.8) can be easily understood: the Web Server is the presentation tier, the S&C Server is the application tier, and the DBMS Server is the data tier. The other services are additional components that provide extra functionalities to the system.

Client-Server Communication: S&C - like almost all modern web applications - is based on a Client-Server architecture. The client (the user's browser) sends requests to the server, which processes them and returns the appropriate responses. All the static content (HTML, CSS, JavaScript) is served directly using HTTPS, while the dynamic content is generated by the server and sent back to the client as JSON data (REST over HTTPS) to be rendered by the client-side JavaScript code.

Server-Server Communication: The communication between the presentation tier and the application tier will be based on REST API. The communication between the application tier and the data tier will be based on SQL Queries over TCP/IP (as implemented by the database driver).

2.7. Other Design Decisions

Auxiliary Components: In 2.6 we said that the application tier of S&C is composed of the S&C Server but, in reality, the core application depends on other auxiliary services that provide additional functionalities. These services are:

- **Email Service:** Communicates with the core using SMTP over TCP/IP. Core prepares the email and "tasks" the service to deliver it to the recipient.
- **Recommendation Engine:** A service that provides internships recommendations to STs and anonymized CVs to COs. Communicates with the core using REST API. Core asks the Recommendation Engine for recommendations and service provides them.
- **Suggestion Engine:** A service that provides suggestions to improve CVs and Internship Advertisements. Communicates with the core using REST API. Core asks the Suggestion Engine for suggestions and service provides them.

It must also be noted that the core application communicates with the various UNs' SSOs using REST API. These portals are not under S&C control and are considered external services.

The choice of not having a fully-integrated monolithic application is motivated by these reasons:

- **Scalability:** The Suggestion and Recommendation Engines can be scaled independently from the core application. This is useful since the load on these services is expected to be higher than on the core application due to the complexity of the algorithms they run.
- **Make-vs-Buy:** The Email Service is a commodity service and open source solutions are available. It's more cost-effective to use an existing solution than to develop a custom one.

Orchestration: The various services will be orchestrated using Kubernetes. This choice is motivated by the fact that Kubernetes is the industry standard for container orchestration and provides a robust and scalable solution for managing containerized applications.

The presence of orchestrators node is implicit and as such is not shown in the Deployment Diagram (2.8). An orchestrator can also be bought as a service from cloud providers thus making it outside the scope of the S&C system. Also, an orchestrator can be superfluous in a small-scale deployment such as the one used in the testing environment.

Networking: In the Deployment Diagram (2.8) the cluster LAN is separated from the outside world by a firewall acting as a gateway. This is a common practice to protect the internal network from malicious attacks by filtering incoming traffic. The firewall can be a physical device or a virtual one, depending on the deployment environment. In a cloud environment, the firewall can be a virtualized service provided by the cloud provider.

In case of a multi-tenant deployment, the firewall should be replicated and will act as a router between the various clusters connected to each other in a fully-meshed topology using L3VPN and dynamic routing protocols. However, this is outside the scope of the S&C system.

3 | User Interface Design

This section aims to provide a overview of the UI/UX of S&C. The main focus will be on describing the rationale that led to the design choices of the UI and the UX instead of providing a detailed description of all the UI components: the interface should be intuitive and easy to use and, as such, the design should be self-explanatory.

The interface will be presented in a series of mockups that will follow the user flow of the application. Each user type will have its own flow and, as such, its own section. For the sake of clarity, some trivial mockups - especially if already presented in one of the previous sections - will be omitted in favor of more complex ones; a short description of the omitted mockups will be provided for consistency.

Even if the interface is fully responsive, the mockups will be presented in a desktop format for better readability. The mobile version will have the same structure and the same components, but will be optimized for smaller screens.

3.1. User Flow: ST

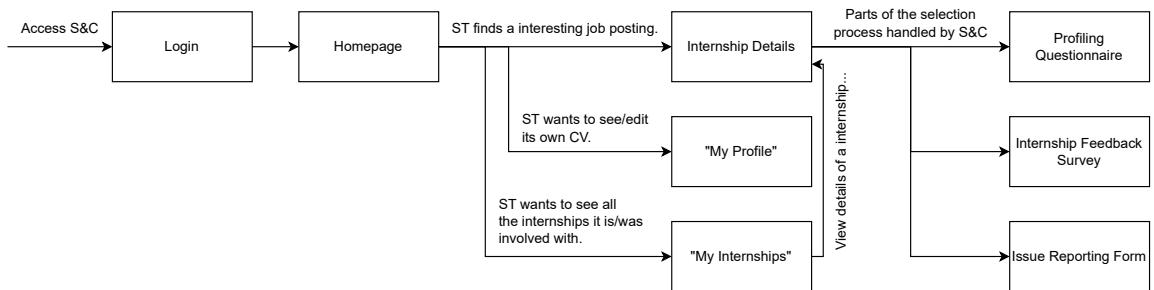


Figure 3.1: ST User Flow Diagram

Here is presented the user flow diagram for the ST. The ST uses the Login page to authenticate and access S&C and then is redirected to the Homepage. Here the user can discover new internships and view their details (Internship Details). The Internship Details page will allow the user to apply for the internship, access the Profiling Questionnaire, reports

violations using the Issue Reporting Form and, once the internship is over, access the Internship Feedback Survey. By using the functions in the header the user can access their own profile ("My Profile"), view all the internships they have interacted with ("My Internships") and log out of the system.

3.1.1. Login - ST

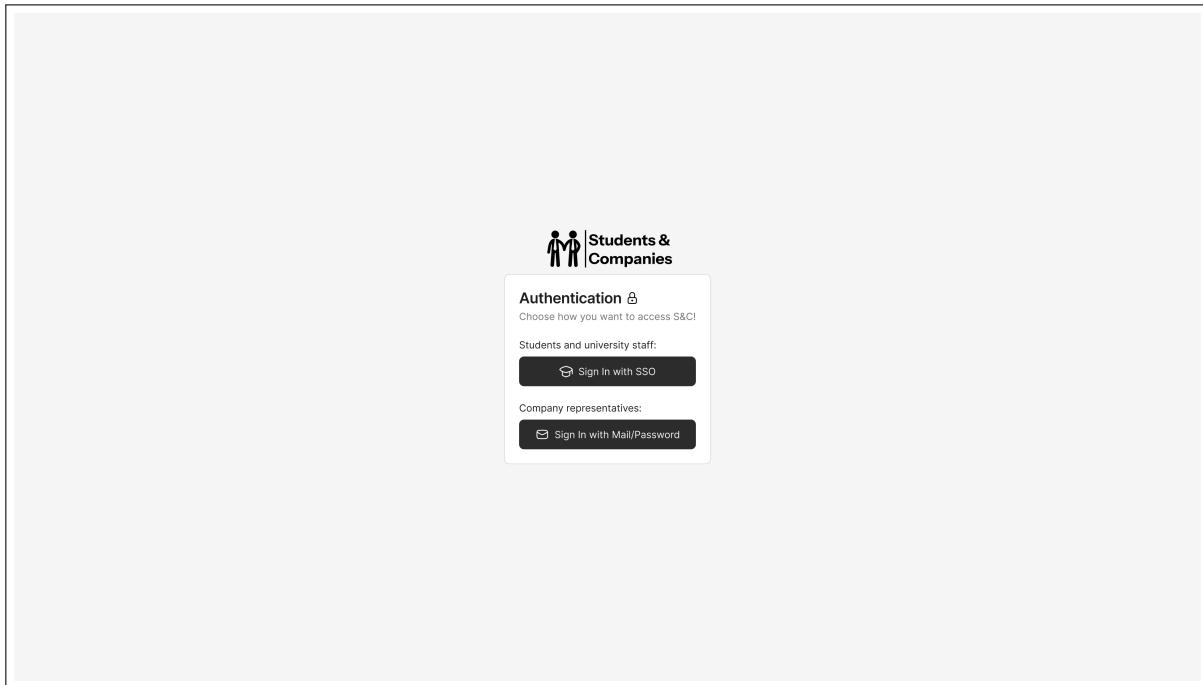


Figure 3.2: Login Page - ST

The login page is the first page the ST will see when accessing the S&C platform. While ST and UN will use their university authentication service to log in, a button to use standard credentials is also provided for CO users.

3.1.2. Homepage - ST

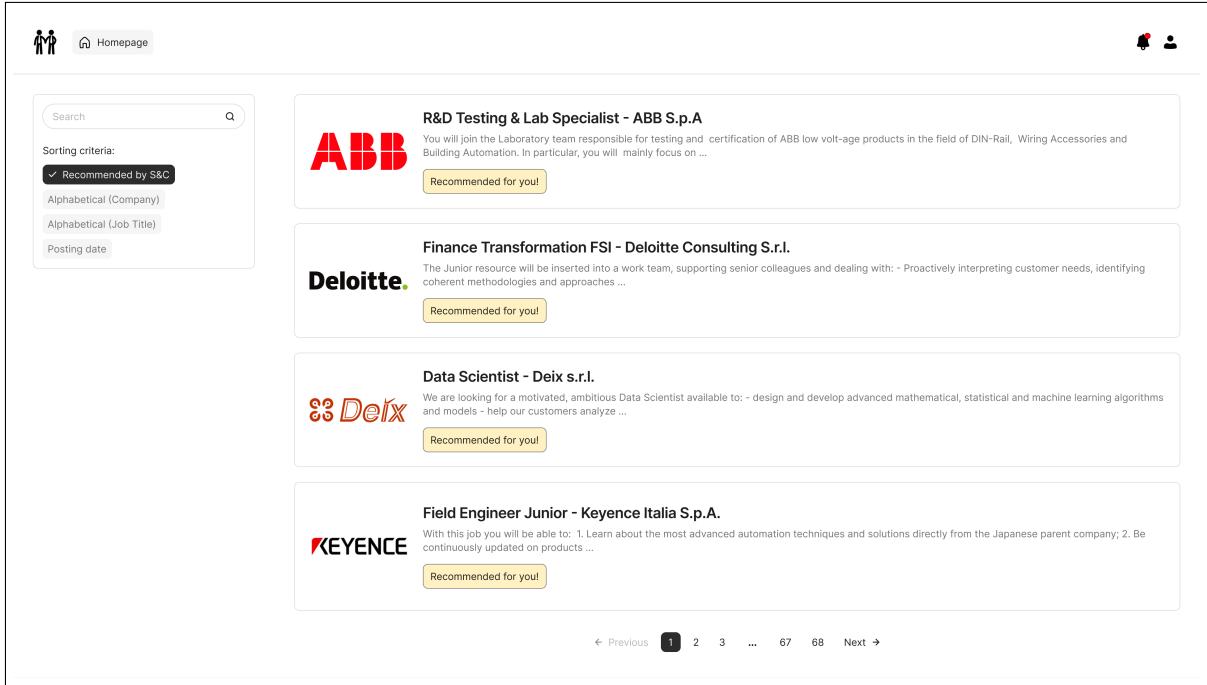


Figure 3.3: Homepage - ST

The homepage is the main page for the ST. Here the user can discover new internships and view their details. As all the other pages, the header is present and allows the user to access their profile, view their internships and log out. Also, a notification submenu is present to show the user any new notifications in case they missed the email.

Appropriate filters are provided to allow the user to search for internships based on their preferences.

3| User Interface Design

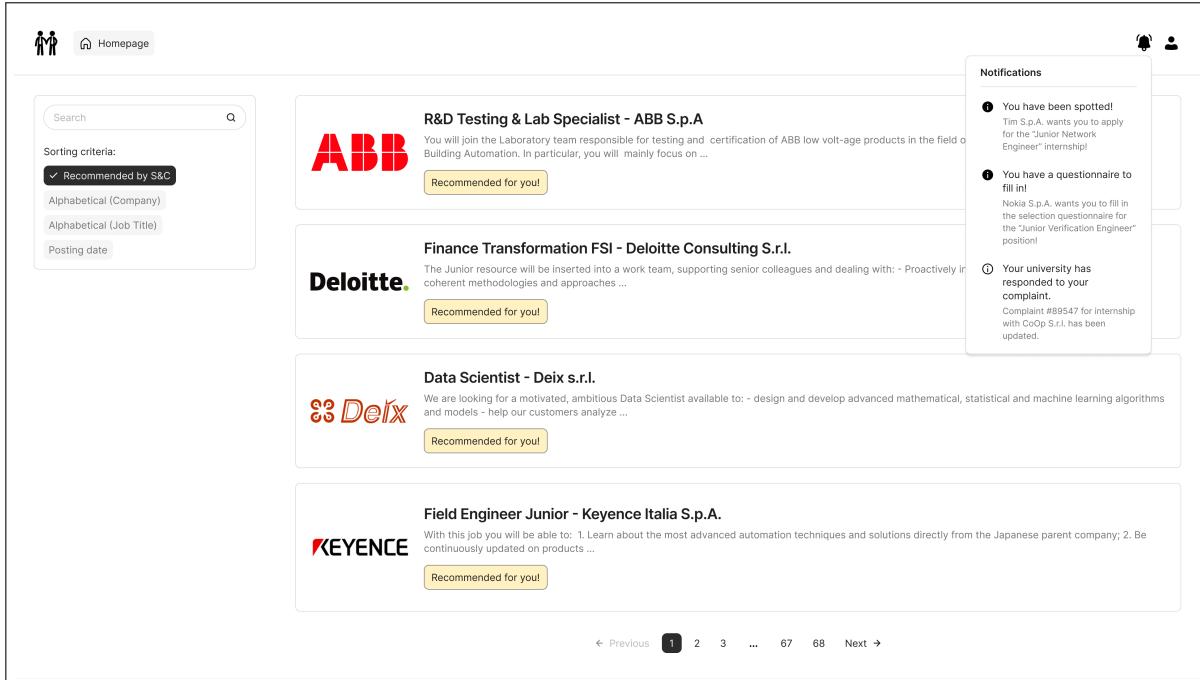


Figure 3.4: Homepage - ST - Notification

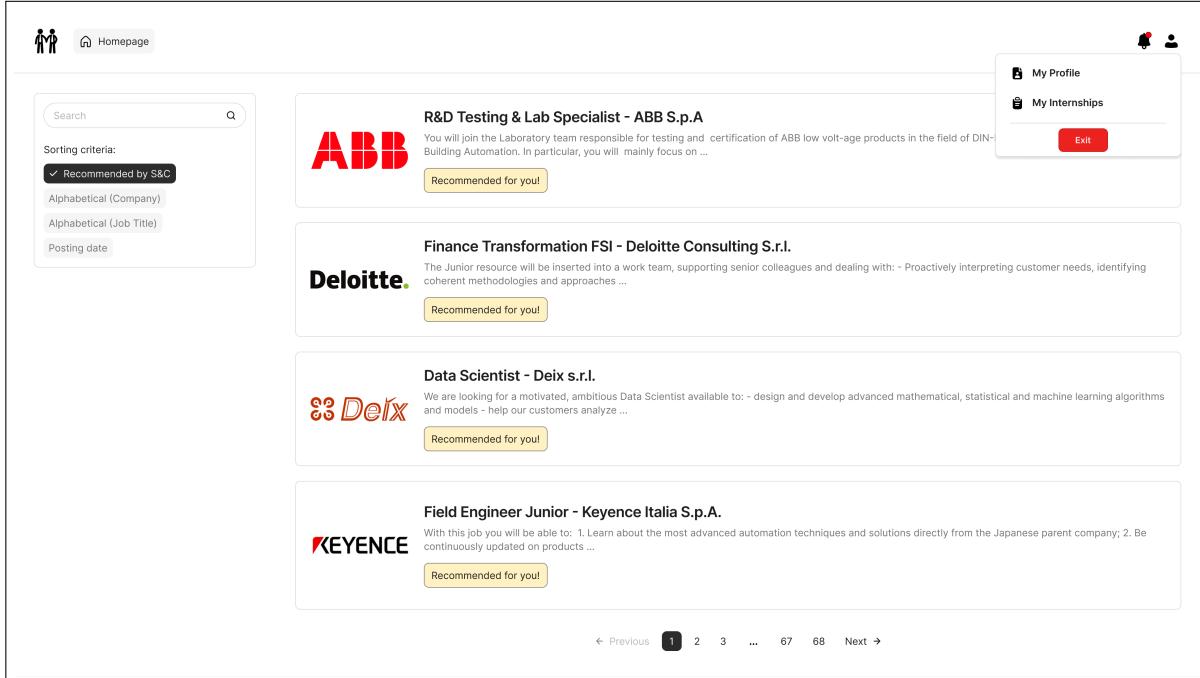


Figure 3.5: Homepage - ST - Profile

3.1.3. "My Internships" - ST

The screenshot shows the 'My Internships' page with the following interface elements:

- Header:** Includes a user icon, a 'Homepage' link, and a search bar.
- Left sidebar:** Contains 'Sorting criteria:' with 'Recent updates' checked, and 'Alphabetical (Job Title)' and 'Alphabetical (Company)' options. It also has 'Filter by status:' with 'Applied', 'Ongoing', 'Completed', 'Suspended', and 'Terminated' buttons.
- Job Listings:**
 - R&D Testing & Lab Specialist - ABB S.p.A.** (Applied)
ABB logo. Description: You will join the Laboratory team responsible for testing and certification of ABB low voltage products in the field of DIN-Rail, Wiring Accessories and Building Automation. In particular, you will mainly focus on ...
Status: Applied
 - Stage Digital & Technical Support Specialist - Ikea Italia S.p.A.** (Ongoing)
IKEA logo. Description: You will be responsible for: - Assisting the international team in resolving daily IT issues (hardware, software, infrastructure, etc.); - Supporting the team in digitalizing processes (sales, logistics, point-of-sale systems, electronic payments, evaluation of new workflows, etc.) ...
Status: Ongoing
 - Junior Data & Reporting Analyst - Aldi S.r.l.** (Completed)
ALDI logo. Description: We are looking for a motivated, ambitious Data Scientist available to: - design and develop advanced mathematical, statistical and machine learning algorithms and models - help our customers analyze ...
Status: Completed
- Pagination:** Shows page 1 of 1.

Figure 3.6: "My Internships" - ST

The "My Internships" page allows the ST to view all the internships they have interacted with. It is similar to the homepage and as such filters are provided.

3.1.4. "My Profile" - ST

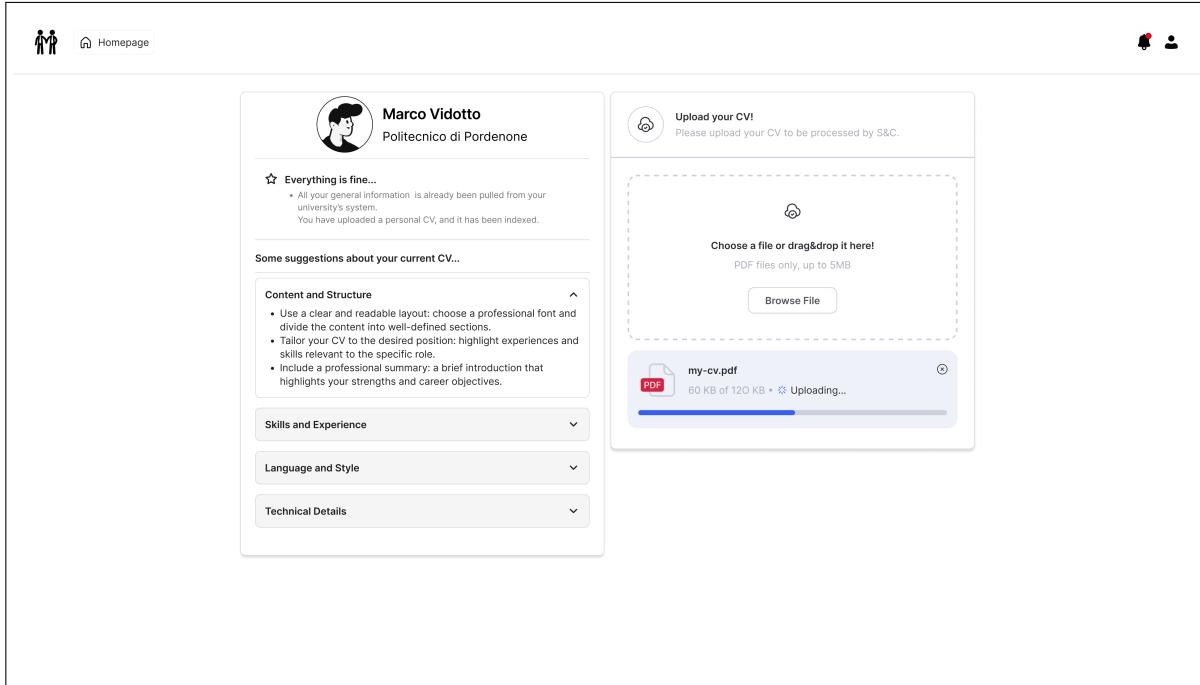


Figure 3.7: "My Profile" - ST

The "My Profile" page allows the ST to update their personal information by uploading a new CV (PDF only!). Suggestions on how to improve the CV are also provided and will be updated based on the processed CV's data.

3.1.5. Internship Details - ST

The screenshot displays the IKEA Internship Details - ST page. At the top, there's a navigation bar with icons for user profile, search, and homepage. The main content area features the IKEA logo and a sidebar titled "About the company" which contains text about IKEA's mission and culture. The central part of the page is titled "Stage Digital & Technical Support Specialist" and "IKEA Italia S.p.A.". Below this, there are several sections: "Who are you?", "What are you gonna do?", and "What is offered?", each containing a bulleted list of requirements or details. To the right, a large sidebar titled "Actions" lists four steps: "1. Apply to the internship" (with a "Apply for this job!" button), "2. Fill in the questionnaire" (with a "Compile the survey!" button), "3. You have been hired!" (with a "Open a complaint" button), and "4. You have completed the internship" (with a "Judge your experience!" button). A progress bar at the bottom of the sidebar indicates the status of the hiring process.

Figure 3.8: Internship Details - ST

The Internship Details page allows the ST to view all the details of an internship and the company that is offering it. The ST can apply for the internship, access the Profiling Questionnaire, report violations using the Issue Reporting Form and, once the internship is over, access the Internship Feedback Survey.

The various functions are enabled or disabled based on the status of the internship. A progress bar is also present to show the progression of the hiring process.

For simplicity, here is presented the page for a completed internship; from this example will it be easy to infer how the page will look like for all the various stages of the hiring process.

3.1.6. Profiling Questionnaire - ST

Profiling questionnaire

- How do you prefer to approach problem-solving?
 - A) Analyzing the situation thoroughly before deciding.
 - B) Collaborating with others to brainstorm solutions.
 - C) Taking quick action based on past experiences.
 - D) Delegating tasks to others while overseeing the process.
- What do you think is the most important quality in a leader, and why?

The most important quality in a leader is effective communication because it fosters transparency, builds trust, and ensures that everyone understands their roles and responsibilities. A leader who communicates well can articulate a clear vision, provide constructive feedback, and inspire their team to work toward shared goals. This creates a collaborative and motivated environment where challenges can be addressed efficiently.
- What do you consider the most important skill in a team environment?
 - A) Clear communication.
 - B) Time management.
 - C) Conflict resolution.
 - D) Adaptability.
- If you encounter a challenge in your work, what is your first reaction?
 - A) Research solutions independently.
 - B) Ask a colleague or mentor for advice.
 - C) Try different approaches until something works.
 - D) Escalate the issue to a supervisor.
- If you had to explain your work style to a potential colleague, what would you say?

My work style is organized, collaborative, and adaptable. I like to plan my tasks in advance, setting clear priorities to stay on track and meet deadlines. I value teamwork and open communication, as I believe that sharing ideas and feedback leads to better results. At the same time, I am flexible and can adjust quickly to changing circumstances or unexpected challenges while maintaining a focus on quality and efficiency.

Figure 3.9: Profiling Questionnaire - ST

The Profiling Questionnaire page allows the ST to fill in a questionnaire to provide the company with more information about themselves. The various questions will be automatically graded by the system to provide the company with a synthetic evaluation of the ST. The questions will be provided manually by the CO.

A ST can only fill in the questionnaire only if they have been selected by the CO. This is de-facto the first filtering step of the hiring process.

3.1.7. Issue Reporting Form - ST

Issue Reporting Form

1. How urgent is your concern?

A) Critical – Requires immediate attention
 B) High – Needs to be addressed soon
 C) Moderate – Important but not time-sensitive
 D) Low – Can be resolved at a later time

2. Please describe your concern or issue.

I was promised a reimbursement for travel expenses during my internship, but I have not received any payment as agreed. Despite submitting all the required documentation on time, the reimbursement has not been processed or communicated to me. This has caused some financial inconvenience, as I relied on this reimbursement for covering travel costs incurred during the internship.

Submit!

Figure 3.10: Issue Reporting Form - ST

The Issue Reporting Form page allows the ST to report any violations they have encountered during the internship. The form is simple and allows the user to provide a description of the violation and any evidence they have. The form is then sent to the company and the UN to evaluate the situation.

The user himself can choose the urgency of their issue.

3.1.8. Internship Feedback Survey - ST

Internship Feedback Survey

1. How satisfied were you with the overall internship experience?
 A) Very satisfied
 B) Satisfied
 C) Neutral
 D) Dissatisfied
2. How would you rate the support provided by your mentor or supervisor?
 A) Excellent
 B) Good
 C) Average
 D) Poor
3. How relevant were the tasks assigned to your professional growth and learning goals?
 A) Highly relevant
 B) Relevant
 C) Somewhat relevant
 D) Not very relevant
4. Would you recommend this internship program to other students or professionals?
 A) Definitely yes
 B) Probably yes
 C) Not sure
 D) Probably no

Submit!

Figure 3.11: Internship Feedback Survey - ST

The Internship Feedback Survey page allows the ST to provide a final evaluation on the internship. S&C and UN will use this information to improve the quality of the internships and the platform.

3.2. User Flow: CO

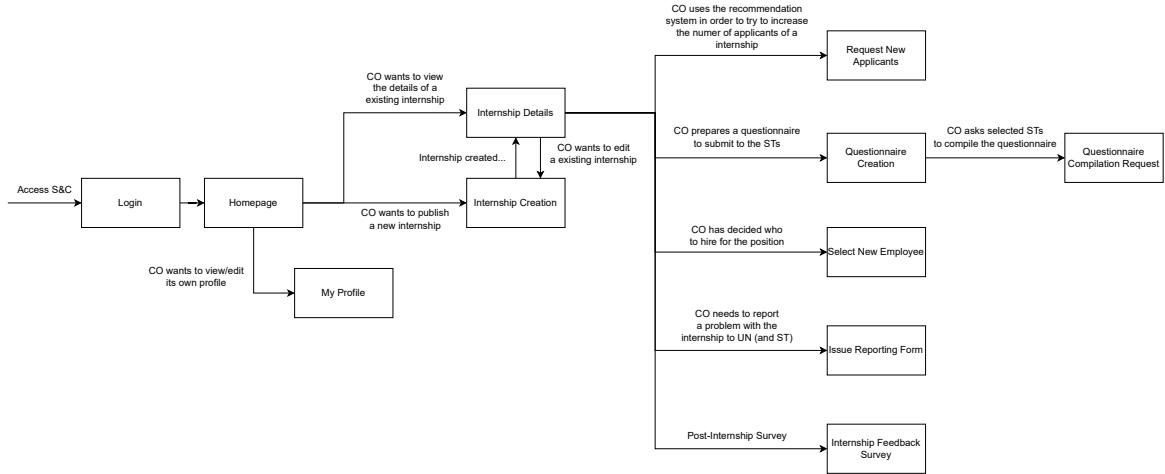


Figure 3.12: CO User Flow Diagram

Now is presented the user flow diagram for the CO. The CO uses the Login page to authenticate and access S&C using plain credentials provided by S&C's administrators. Once logged in, the CO is redirected to the Homepage, here the user can view all the internships they have posted (past and present) and view their details (Internship Details). The Login page is the same for all the users and as such will not be presented again.

On the Internship Details page, the CO can view all the details of the internship, edit them - up until the application deadline - and send notifications to the STs that the system has deemed as a good match for the internship (more details will be provided later). After the application deadline, the CO can create the questionnaire (Questionnaire Creation) to submit to the STs that the CO has selected - thus creating a first filter - using the Questionnaire Compilation Request. Using the Select New Employee page the CO can view the results of said questionnaire and select the ST that will be hired. Once the internship is over, the CO can access the Internship Feedback Survey page to evaluate the internship. In case of issues, the CO can access the Issue Reporting Form page to report them.

The creation of a new internship is done using the Internship Creation page also accessible from the Homepage: the CO will be presented with a two-step form to fill in all the required information. Finally, the CO can access and update their profile using the Profile page accessible from a button in the header.

3.2.1. Homepage - CO

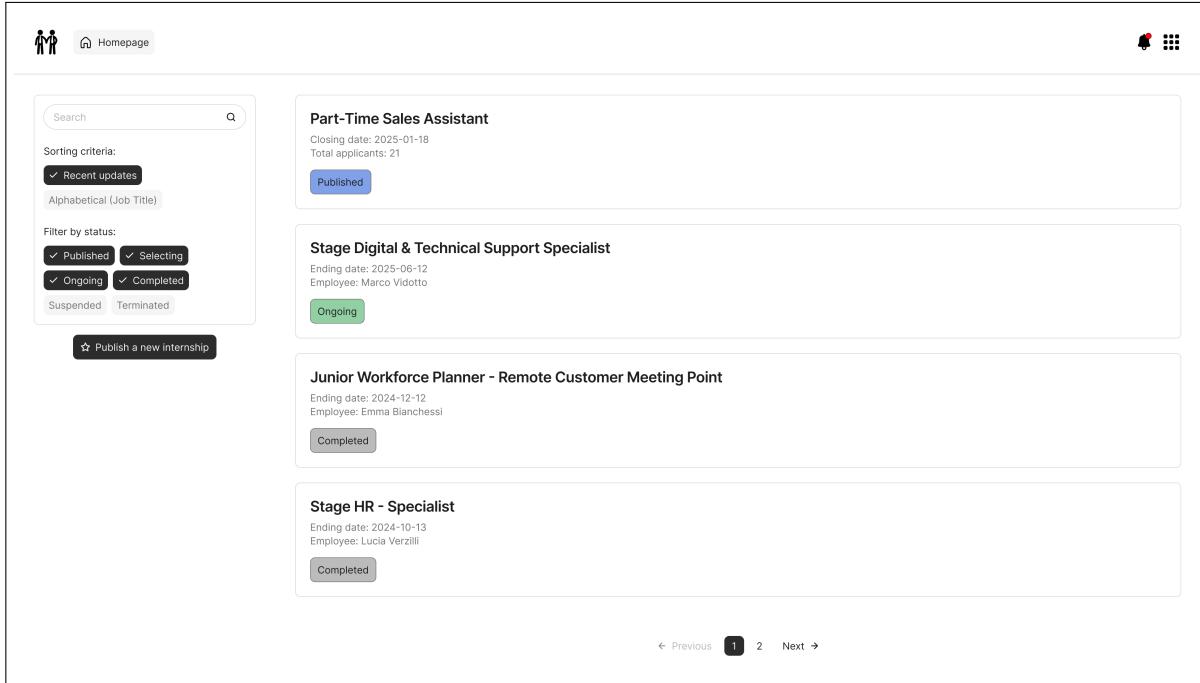


Figure 3.13: Homepage - CO

The Homepage is the main page for the CO. Here the user can view all the internships they have posted (past and present) and view their details. Proper filters are provided to allow the user to search for internships based on their preferences and needs. Also, in this page is present a button that allows the CO to create a new internship.

As all the other pages, the header is present and allows the user to: access their profile, log out from the platform and view any new notifications from the related submenu.

CO's homepage already shows the internships that involve the enterprise: can be considered as a "My Internships" page but for the company. This choice was made to simplify the user flow and to provide a more intuitive experience.

The screenshot shows the homepage of a platform for managing internships. On the left, there's a sidebar with a search bar, sorting criteria (Recent updates, Alphabetical), and filtering by status (Published, Selecting, Ongoing, Completed, Suspended, Terminated). A button to 'Publish a new internship' is also present. The main content area displays four job listings:

- Part-Time Sales Assistant**: Closing date: 2025-01-18, Total applicants: 21, Status: Published.
- Stage Digital & Technical Support Specialist**: Ending date: 2025-06-12, Employee: Marco Vidotto, Status: Ongoing.
- Junior Workforce Planner - Remote Customer Meeting Point**: Ending date: 2024-12-12, Employee: Emma Bianchessi, Status: Completed.
- Stage HR - Specialist**: Ending date: 2024-10-13, Employee: Lucia Verzilli, Status: Completed.

At the bottom right, there's a 'Notifications' box containing two items:

- 1 New recommendations available for internship #98547. The system has identified ideal candidates who have not applied for your internship. Would you like to express your interest to them?
- 1 A student has opened a new complaint on internship #87536. A student has opened a new complaint on internship #87536.

Pagination at the bottom indicates there are two pages, with page 1 currently selected.

Figure 3.14: Homepage - CO - Notification

This screenshot is similar to Figure 3.14, showing the homepage with job listings. However, a 'Company's profile' overlay is visible on the right side of the screen. The overlay includes a 'Company's profile' header, a red 'Exit' button, and a small icon of a person with a red dot above it. The main content area (jobs) and navigation (search, filters, notifications) remain the same as in Figure 3.14.

Figure 3.15: Homepage - CO - Profile

3.2.2. Internship Creation - CO

The screenshot shows a web-based application for creating a new internship. At the top left is a user icon and a 'Homepage' link. At the top right are a search icon and a grid icon. Below the header is a large 'X' button. The main content area is titled 'Publish a new internship' with a subtitle: 'Describe the job like as you are talking directly to a new employee.' It contains several input fields and a list of requirements.

Title: Stage Digital & Technical Support Specialist

Application deadline: 2024-12-18

Internship ending date: 2025-06-01

Who is the ideal employee?

- You hold a degree (high school diploma, university degree, or ITS certification) in computer science, business information systems, or a related field.
- You have a strong passion for technology.
- You are highly interested in process digitalization, including applications in the retail sector.
- You are eager to join a program focused on training, development, and professional growth.

Next

Figure 3.16: Internship Creation - 1 - CO

This screenshot shows the continuation of the internship creation form. It includes sections for 'What are they gonna do?' and 'What are you offering?'. Both sections contain bulleted lists of details.

What are they gonna do?

- Working closely with IT and digital area leaders and/or managers, you will be responsible for:
- Assisting the international team in resolving daily IT issues (hardware, software, infrastructure, etc.);
- Supporting the team in digitizing processes (sales, logistics, point-of-sale systems, electronic payments, evaluation of new workflows, etc.);
- Implementing new digital tools (mobile planning, IKEA app, etc.);
- Aiding the team in the daily management of new digital projects.

What are you offering?

- The position offers an initial full-time internship (40 hours per week) with a duration of 6 months. Upon successful completion of the program and a positive evaluation, a long-term position within the company may be considered.
- Compensation includes a monthly allowance of €850 and free access to the company cafeteria during working hours.
- Work location: Carugate (MI).

Publish

Figure 3.17: Internship Creation - 2 - CO

The Internship Creation page allows the CO to create a new internship. The CO is tasked to fill in all the required information in order to post the internship on the platform.

3.2.3. Internship Details - CO

Stage Digital & Technical Support Specialist
This is how your adv. is looking like on the student's side.

Who are you?

- You hold a degree (high school diploma, university degree, or ITS certification) in computer science, business information systems, or a related field.
- You have a strong passion for technology.
- You are highly interested in process digitalization, including applications in the retail sector.
- You are eager to join a program focused on training, development, and professional growth.

What are you gonna do?

- Working closely with IT and digital area leaders and/or managers, you will be responsible for:
 - Assisting the international team in resolving daily IT issues (hardware, software, infrastructure, etc.);
 - Supporting the team in digitizing processes (sales, logistics, point-of-sale systems, electronic payments, evaluation of new workflows, etc.);
 - Implementing new digital tools (mobile planning, IKEA app, etc.);
 - Aiding the team in the daily management of new digital projects.

What is offered?

- The position offers an initial full-time internship (40 hours per week) with a duration of 6 months. Upon successful completion of the program and a positive evaluation, a long-term position within the company may be considered.
- Compensation includes a monthly allowance of €850 and free access to the company cafeteria during working hours.
- Work location: Carugate (MI).

Edit Informations

Some suggestions about your current advertisement...

Logistics

- Specify the application process, including required documents and deadlines, to make it easier for candidates to apply.
- Mention remote or hybrid work possibilities, if applicable, to appeal to a broader pool of applicants.
- Include information about potential growth opportunities post-internship to make the listing more appealing.

Clarity and Formatting

Engagement and Tone

Clarity and Formatting

Actions

1. Internship published.

Currently, 23 candidates have applied.

Expand applicant pool.

Figure 3.18: Internship Details - 1 - CO

The Internship Details page will be presented in two critical stages divided by the application deadline. Before the deadline the CO can not only edit the internship but also actively receive suggestions on how improve the advertisement itself. After the deadline, the CO cannot edit the internship anymore in order to prevent abuse and prevent confusion among the STs.

Also in this phase the CO can send notifications to the STs that the system has deemed as a good match for the internship but have not applied yet. The CO can only view an anonymized version of the STs' profiles to prevent information leakage. The interface used to select the STs will be shown later in the description of the "Request New Applicants" page.

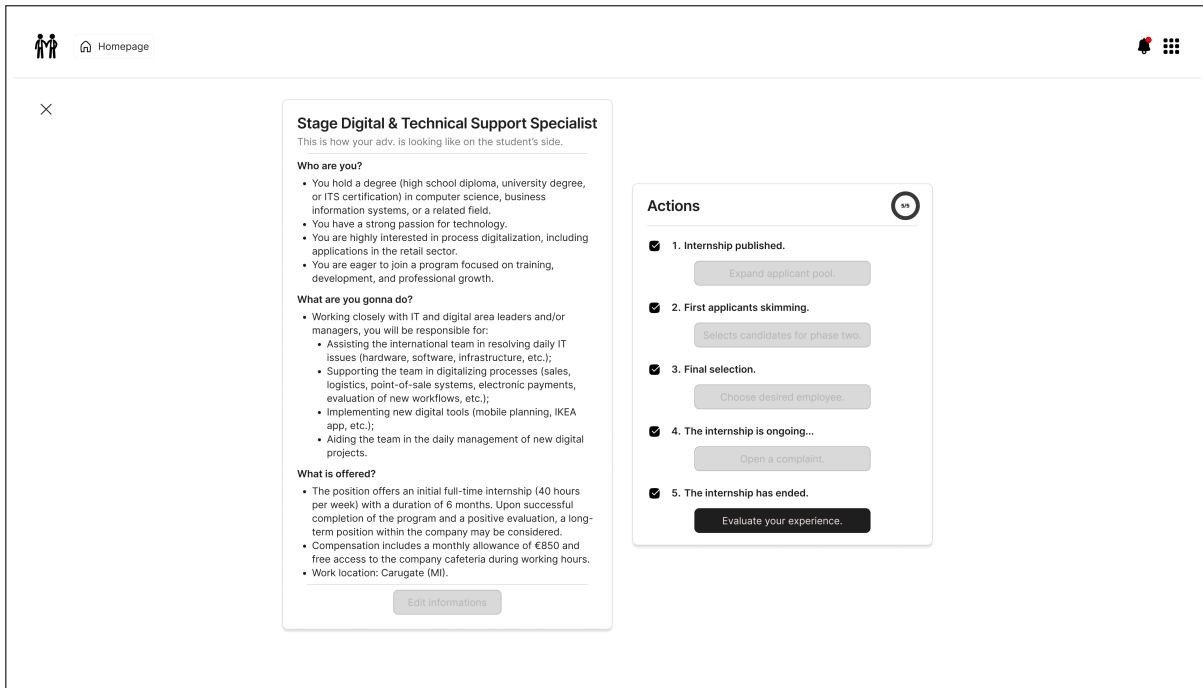


Figure 3.19: Internship Details - 1 - CO

As before, here is presented the page for a completed internship; the whole page evolution can easily be inferred from this example.

Other than what has been already described, the CO can use this page - when appropriate - to request selected STs to fill in the profiling questionnaire (Request Questionnaire), view the results of the questionnaire and select the ST that will be hired (Select Employee), open a complaint if needed (Issue Reporting Form) and evaluate the internship once it is over (Internship Feedback Survey).

The Internship Feedback Survey page and the Issue Reporting Form page are the same as the ones presented for the ST and varies slightly only for the questions asked. For this reason, they will not be presented again.

3.2.4. Request New Applicants - CO

The screenshot shows a user interface for a 'CO' (Coordinator) to request new applicants. At the top left is a user icon and a 'Homepage' link. At the top right are a search bar, a notification icon, and a grid icon. Below the header is a back arrow. The main content area is titled 'Recommended Applicants' with a subtitle: 'Here are listed all the students S&C thinks will be a good fit. Want to send them a notification?'. It features a table with columns: Name (sorted by name), Surname (sorted by surname), University (sorted by university), and Anonymized CV (sorted by anonymized CV). Each row contains a checkbox, the student's name, surname, university, and a download link for the anonymized CV. The table includes rows for Alessio Rossi (Università di Milano-Bicocca), Giulia Bianchi (Politecnico di Milano), Andrea Fontana (Università Cattolica del Sacro Cuore), Sara Fabbri (Università degli Studi di Milano-Bicocca), Federico Barone (Università Vita-Salute San Raffaele), Alice Marchi (Università IULM di Milano), Stefano Caruso (Università degli Studi di Milano), and Beatrice Parisi (Università Vita-Salute San Raffaele).

	Name	Surname	University	Anonymized CV
<input checked="" type="checkbox"/>	Alessio	Rossi	Università di Milano-Bicocca	Download here!
<input checked="" type="checkbox"/>	Giulia	Bianchi	Politechnico di Milano	Download here!
<input checked="" type="checkbox"/>	Andrea	Fontana	Università Cattolica del Sacro Cuore	Download here!
<input checked="" type="checkbox"/>	Sara	Fabbri	Università degli Studi di Milano-Bicocca	Download here!
<input checked="" type="checkbox"/>	Federico	Barone	Università Vita-Salute San Raffaele	Download here!
<input checked="" type="checkbox"/>	Alice	Marchi	Università IULM di Milano	Download here!
<input type="checkbox"/>	Stefano	Caruso	Università degli Studi di Milano	Download here!
<input type="checkbox"/>	Beatrice	Parisi	Università Vita-Salute San Raffaele	Download here!

Figure 3.20: Request New Applicants - CO

The Request New Applicants page allows the CO to send notifications to the STs that the system has deemed as a good match for the internship but have not applied yet. These STs will maybe already have seen the internship thanks to the system's suggestions but now we are showing them an active interest from the CO thus hoping to increase the chances of them applying. The CO can only view an anonymized version of the STs' profiles to prevent information leakage and abuse of the system: if the CO were able to see the full profiles of the STs, they could contact them directly and bypass S&C's system entirely.

3.2.5. Request Questionnaire - CO

The screenshot shows a web interface for managing applicants. At the top left is a user icon and a 'Homepage' link. At the top right are navigation icons. Below the header is a back arrow. The main content area is titled 'All the Applicants' and includes a subtitle: 'Select all the applicants you want to submit the questionnaire to.' To the right are 'Filters' and a 'Send Questionnaire' button. A table lists nine applicants with checkboxes next to their names. Each row also includes a 'CV' download link.

<input checked="" type="checkbox"/>	Name ↓	Surname ↓	University ↓	CV ↓
<input checked="" type="checkbox"/>	Giovanni	Marchetti	Università degli Studi di Milano	Download here!
<input checked="" type="checkbox"/>	Laura	Leone	Politecnico di Milano	Download here!
<input checked="" type="checkbox"/>	Paolo	De Luca	Università Cattolica del Sacro Cuore	Download here!
<input checked="" type="checkbox"/>	Francesca	Ricci	Università degli Studi di Milano-Bicocca	Download here!
<input checked="" type="checkbox"/>	Michele	Gatti	Università Vita-Salute San Raffaele	Download here!
<input checked="" type="checkbox"/>	Martina	Pugliese	Università IULM di Milano	Download here!
<input checked="" type="checkbox"/>	Giorgio	Lombardi	Università degli Studi di Milano	Download here!
<input checked="" type="checkbox"/>	Silvia	Morelli	Università Vita-Salute San Raffaele	Download here!

Figure 3.21: Request Questionnaire - CO

The Request Questionnaire page allows the CO to request the selected STs to fill in the profiling questionnaire. Since the application deadline has passed - and the ST had already expressed their "consent" to be involved in this internship - the CO can now see the full profiles of the STs.

3.2.6. Select Employee - CO

The screenshot shows a web-based application interface for selecting an employee. At the top left is a user icon with two people and a 'Homepage' link. At the top right are three icons: a person, a gear, and a grid. Below the header is a back arrow. The main content area has a title 'All the Respondent to the Questionnaire' and a subtitle 'Select who you have decided to hire.' It includes a 'Filters' button and a 'Hire Candidate' button. A table lists eight respondents:

	Questionnaire Score (Click to view)	Name	Surname	University	CV
<input type="checkbox"/>	20/100	Giovanni	Marchetti	Università degli Studi di Milano	Download here!
<input type="checkbox"/>	80/100	Laura	Leone	Politecnico di Milano	Download here!
<input type="checkbox"/>	96/100	Paolo	De Luca	Università Cattolica del Sacro Cuore	Download here!
<input checked="" type="checkbox"/>	98/100	Francesca	Ricci	Università degli Studi di Milano-Bicocca	Download here!
<input type="checkbox"/>	30/100	Michele	Gatti	Università Vita-Salute San Raffaele	Download here!
<input type="checkbox"/>	85/100	Martina	Pugliese	Università IULM di Milano	Download here!
<input type="checkbox"/>	90/100	Giorgio	Lombardi	Università degli Studi di Milano	Download here!
<input type="checkbox"/>	30/100	Silvia	Morelli	Università Vita-Salute San Raffaele	Download here!

Figure 3.22: Select Employee - CO

The Select Employee page allows the CO to view the results of the questionnaire filled in by the STs and select the ST that will be hired. This page is very similar to the Request Questionnaire page but with the addition of the results of the questionnaire.

3.2.7. "My Profile" - CO

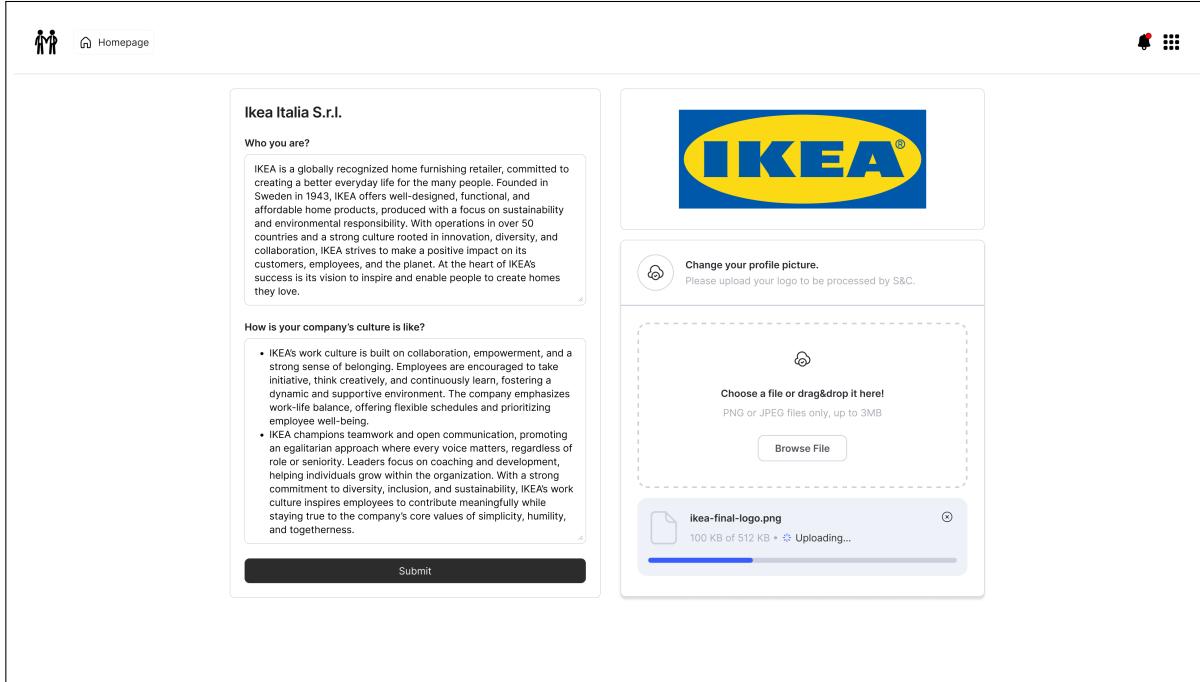


Figure 3.23: "My Profile" - CO

The "My Profile" page allows the CO to update their personal information. Along with the standard information, this page offers the possibility to upload a the company's logo.

3.3. User Flow: UN

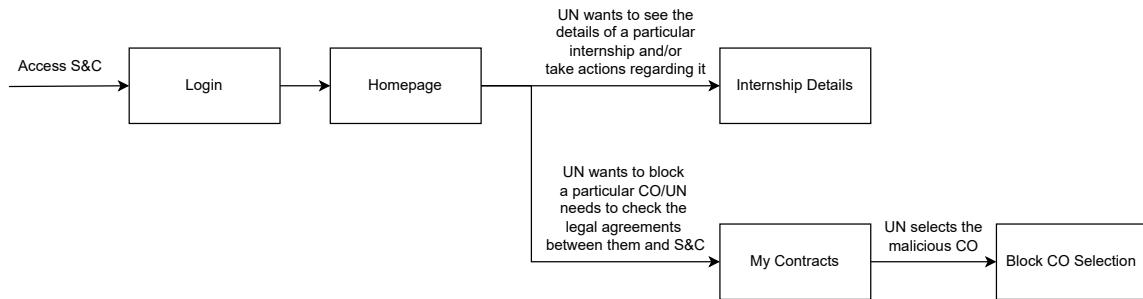


Figure 3.24: UN User Flow Diagram

Here is presented the user flow diagram for the UN. The UN uses the Login page to authenticate and access S&C and then is redirected to the Homepage. On the Homepage, the UN can view all the internships that their students have interacted with and the

relative details (Internship Details). The Internship Details page will allow the UN: to view all the details of an internship, view and answer to eventual complaints, and if needed, suspend the internship.

From the header, the UN can access the "My Contracts" page and log out of the system. In the "My Contracts" page, the UN can view all the contracts that exist between the university and S&C as well as block a malicious company.

3.3.1. Homepage - UN

The screenshot shows the UN homepage with a sidebar on the left containing search and filter options. The main area displays four internship entries, each with a company logo, title, student involved, and status information. At the bottom, there is a pagination bar.

Internship Details	Student Involved	Internship Status	Complaint Status
Safety&Engineering Data Analyst - Virgin Active Italia S.p.A	Claudia Santoro	Ongoing	Unanswered
Software Developer - Cami S.r.l	Roberto Costa	Terminated	Answered
Data Scientist - Elfi Systems S.r.l	Silvia Morelli	Ongoing	Answered
SQL Developer - Sopran Ciode S.p.A	Paolo De Luca	Suspended	Answered

Figure 3.25: Homepage - UN

The Homepage is the main page for the UN. Here the user can view all the internships that their students have interacted with and the relative details. Proper filters are provided to allow the user to search for internships based on their preferences and needs.

As all the other pages, the header is present and allows the user to: access the "My Contracts" page, log out from the platform and view any new notifications from the related submenu.

The UN's homepage shows the internships that involve UN's students: can be considered as a "My Internships" page but for the university. Also, thanks to appropriate filters, internships with complaints are immediately visible thus making a section "My Com-

plaints" unnecessary without losing any functionality or details. This choice streamlines the user flow and provides a simpler and more intuitive experience.

The screenshot shows the UN homepage with a sidebar on the left containing search and filter options. The main content area displays four internship opportunities with their respective company logos, job titles, student involved, and status. A 'Notifications' sidebar on the right lists three recent events: a new complaint on an internship, a new complaint from a student, and a new complaint from a company. At the bottom, there is a navigation bar with page numbers and arrows.

Job Title	Company	Student Involved	Internship Status	Complaint Status
Safety&Engineering Data Analyst	Virgin Active Italia S.p.A	Claudia Santoro	Ongoing	Unanswered
Software Developer	Cami S.r.l	Roberto Costa	Terminated	Answered
Data Scientist	Elfi Systems S.r.l	Silvia Morelli	Ongoing	Answered
SQL Developer	Sopran Ciodue S.p.A	Paolo De Luca	Suspended	Answered

Figure 3.26: Homepage - UN - Notification

This screenshot is identical to Figure 3.26, showing the UN homepage layout. The main difference is the presence of a 'My Contracts' button in the top right corner of the notifications sidebar, which was not present in the previous version.

Job Title	Company	Student Involved	Internship Status	Complaint Status
Safety&Engineering Data Analyst	Virgin Active Italia S.p.A	Claudia Santoro	Ongoing	Unanswered
Software Developer	Cami S.r.l	Roberto Costa	Terminated	Answered
Data Scientist	Elfi Systems S.r.l	Silvia Morelli	Ongoing	Answered
SQL Developer	Sopran Ciodue S.p.A	Paolo De Luca	Suspended	Answered

Figure 3.27: Homepage - UN - Contract

3.3.2. "My Contracts" - UN

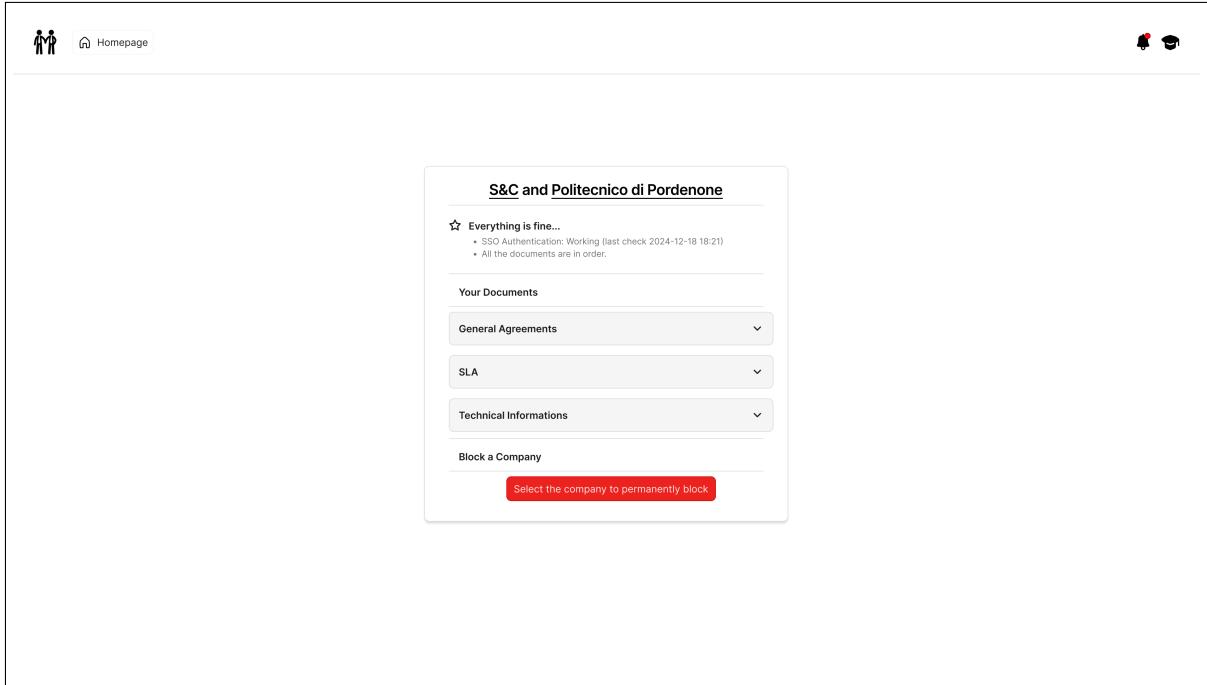


Figure 3.28: "My Contracts" - UN

The "My Contracts" page allows the UN to view all the contracts that exist between the university and S&C as well as block a malicious company. The page also provides a status check for the connection between the university's SSO service and S&C.

The screenshot shows a user interface for selecting companies to block. At the top, there are navigation icons for a user profile, a back arrow, and a search bar labeled "Homepage". Below the search bar is a "Filters" button and a "Block Company" button. The main content area is titled "All the Companies" and contains a sub-instruction: "Select the company you want to block.". A table lists eight companies with columns for Name, Email HR, and VAT Number. The "DigitalTech Group" row has a checked checkbox next to it, indicating it is selected for blocking.

	Name ↓	Email HR ↓	VAT Number ↓
<input type="checkbox"/>	TecnoItalia S.p.A.	hr@tecnitalia.it	01234567890
<input type="checkbox"/>	GreenFuture S.r.l.	risorseumane@greenfuture.it	09876543210
<input type="checkbox"/>	Innovab Solutions	hr@innovalabsolutions.com	12345678901
<input checked="" type="checkbox"/>	DigitalTech Group	hr@digitaltechgroup.it	10987654321
<input type="checkbox"/>	EcoBuild Systems	risorseumane@ecobuildsystems.it	23456789012
<input type="checkbox"/>	SmartVision Consulting	hr@smartvisionconsulting.it	21098765432
<input type="checkbox"/>	BlueCode Software	hr@bluecodesoftware.it	34567890123
<input type="checkbox"/>	SolarGrid S.r.l.	risorseumane@solargrid.it	32109876543

Figure 3.29: Block CO Selection - UN

The "Block CO Selection" page allows the UN to block a malicious company. The UN can search for the company using the filters provided and then block it.

3.3.3. Internship Details - UN

The screenshot shows the 'Internship Details - UN' page. At the top left is a user icon and a 'Homepage' link. At the top right are navigation icons. The main content area has a header 'Stage Digital & Technical Support Specialist' and a sub-header 'Internship advertisement posting.' Below this are sections for 'Who are you?' (with a list of requirements), 'What are you gonna do?' (with a list of responsibilities), and 'What is offered?' (with a list of benefits). To the right is a sidebar titled 'Other Details & Actions' containing 'Application deadline' (2024-12-18) and 'Internship ending date' (2025-06-01), with a red 'Suspend Internship' button. Another sidebar titled 'Student Complaint' (Priority: Critical) contains a message about travel reimbursement issues. A third sidebar titled 'Company Complaint' (Priority: Critical) contains a message about intern punctuality. At the bottom right is a large text input field for 'Answer:' with a 'Send' button.

Figure 3.30: Internship Details - UN

The Internship Details page allows the UN to view all the details of an internship. The UN can view and answer to eventual complaints and, if needed, suspend the internship.

4 | Requirements Traceability

In this section, we aim to establish a clear mapping between the components previously described and the requirements they fulfill. Keeping track of which requirements a component should satisfy is crucial to ensure that the final product meets the initial specifications. The considered requirements can be found in the associated RASD document.

- **Login Manager:**

- R01
- R04
- R05
- R06
- R07

- **Internship Manager:**

- R11
- R14
- R15
- R16
- R22
- R23
- R25
- R27
- R28
- R29
- R33

- R36
- R37
- R39
- R43

- **Profile Manager:**

- R08
- R15
- R25
- R39
- R40

- **Questionnaire Manager:**

- R18
- R21
- R26
- R32

- **Complaint Manager:**

- R19
- R30
- R34
- R37

- **Notification Manager:**

- R13
- R17
- R20
- R31
- R35

– R38

– R42

– R43

- **Recommendation Manager:**

– R11

– R12

– R41

– R42

- **Suggestion Manager:**

– R09

– R24

- **Dashboard Manager:**

– R10

– R11

– R14

– R36

– R13

– R17

– R20

– R31

– R35

– R38

– R42

- **Query Manager:**

– R02

– R03

- R06
- R08
- R26
- R40

5 | Implementation, Integration and Testing

5.1. Overview and Implementation Plan

In this chapter, we will discuss the implementation of the S&C Web Application, the integration and the test strategy that will be used to ensure the quality of the software. In general, the methodology used to implement the S&C Web Application is the Bottom-Up approach, which is a software development approach that starts by implementing the lower-level modules first, and then integrating them to create higher-level modules.

By using this approach, we can ensure that the lower-level modules are working correctly before integrating them into higher-level modules. Each module will require a Driver to test the module. The Driver will simulate the behavior of the higher-level module and will call the lower-level module to test its functionality by making calls of the interfaces given by the lower-level module. The Bottom-Up strategy grants a step by step integration of the modules and ensures that the software is working correctly thanks to the testing of each module, that will make easier to identify and fix the bugs of the different modules before integrating them into more complex ones. This strategy also allows the development team to work on different modules simultaneously, which can speed up the development process.

5.2. Features Identifications

The S&C Web Application is a complex software that has different features that are going to be used by the different users. The features are divided into three main categories: the CO Features, the ST Features, and the UN Features. Each category has different features that are going to be used by the different users. The features are identified as follows:

CO Features: This set of features is used by the COs to manage their profile, the internships advertisement that they will create, their editing, the creation of the questionnaires,

the management of the applicants lists and the management of the internships.

- **[CO.1] Profile Management:** This feature allows the COs to manage their profile, by changing their CO's information, such as the description provided and the CO's logo.
- **[CO.2] COs' Questionnaires Management:** This feature allows the COs to create, edit and delete the questionnaires that they will send to the applicants that have applied to their internships.
- **[CO.3] Internship Advertisement Management:** This feature allows the COs to create, edit and delete the internships advertisements.
- **[CO.4] Internship Progress Management:** This feature allows the COs to see the applicants that have applied to their internships, to visualize the applicants' information, to select the applicants that they want to send the interview questionnaires and to set the deadlines for the applicants to answer the questionnaires.
- **[CO.5] System's Questionnaires Answering:** This feature allows the COs to answer the feedback questionnaires that the system will send to them after the internships have ended.

ST Features: This set of features is used by the STs to manage their profile, to apply to the internships and to answer the questionnaires sent by the COs.

- **[ST.1] Profile Management:** This feature allows the STs to manage their profile, by changing their ST's information, and to load their CV.
- **[ST.2] Internship Advertisement Application:** This feature allows the STs to apply to the internships advertisements that they are interested in.
- **[ST.3] COs' Questionnaires Answering:** This feature allows the STs to answer the questionnaires sent by the COs and to see the deadlines for the questionnaires.
- **[ST.4] Internship Progression:** This feature allows the STs to see the status of the internships advertisement that they have applied to.
- **[ST.5] System's Questionnaires Answering:** This feature allows the STs to answer the feedback questionnaires that the system will send to them after the internships have ended.

UN Features: This set of features is used by the UN's staff to visualize the information of the internships to which it's students are involved, the contracts that the UN has with S&C, and the ability to block the COs that are not following the terms of the application.

- **[UN.1] Internships Information Visualization:** This feature allows the UN's staff to see the information and the status of the internships to which it's students are involved.
- **[UN.2] Contracts Visualization:** This feature allows the UN's staff to see the contracts that the UN has with S&C.
- **[UN.3] COs' Blocking:** This feature allows the UN's staff to block the COs.

This feature identification is useful to identify what the different users can do in the Web Application. Now it's going to be discussed how the different features are going to be implemented based on the architecture given in chapter 2:

[F1] Login Features:

- **[F1.1] Login by SSOs:** This feature allows the STs and the UN's staff to login into the Web Application using their SSOs.
- **[F1.2] Login by Email and Password:** This feature allows the COs to login into the Web Application using the username and password provided by S&C staff

[F2] Internship Management Features:

- **[CO.3] Internship Advertisement Management:** This feature allows the COs to create, edit and delete the internships advertisements.
- **[CO.4] Internship Progress Management:** This feature allows the COs to see the applicants that have applied to their internships, to visualize the applicants' information, to select the applicants that they want to send the interview questionnaires and to set the deadlines for the applicants to answer the questionnaires.
- **[ST.2] Internship Advertisement Application:** This feature allows the STs to apply to the internships advertisements that they are interested in.
- **[ST.4] Internship Progression:** This feature allows the STs to see the status of the internships advertisement that they have applied to.
- **[UN.1] Internships Information Visualization:** This feature allows the UN's staff to see the information and the status of the internships to which it's students are involved.

[F3] Profile Management Features:

- **[CO.1] Profile Management:** This feature allows the COs to manage their profile, by changing their CO's information, such as the description provided and the CO's

logo.

- **[ST.1] Profile Management:** This feature allows the STs to manage their profile, by changing their ST's information, and to load their CV.

[F4] Questionnaires Management Features:

- **[CO.2] COs' Questionnaires Management:** This feature allows the COs to create, edit and delete the questionnaires that they will send to the applicants that have applied to their internships.
- **[CO.5] System's Questionnaires Answering:** This feature allows the COs to answer the feedback questionnaires that the system will send to them after the internships have ended.
- **[ST.3] COs' Questionnaires Answering:** This feature allows the STs to answer the questionnaires sent by the COs and to see the deadlines for the questionnaires.
- **[ST.5] System's Questionnaires Answering:** This feature allows the STs to answer the feedback questionnaires that the system will send to them after the internships have ended.

[F5] Complaint Features: This set of features is used by the COs and the STs to make complaints about the internships, and allow the UN's staff to see the complaints and to take action about it.

- **[F5.1] Complaint Creation:** This feature allows the COs and the STs to create complaints about the internships.
- **[F5.2] Complaint Visualization:** This feature allows all the users involved to see the complaint created.
- **[F5.3] Complaint Resolution:** This feature allows the UN's staff to take action about the complaints and eventually to suspend the internship.

[F6] Notification Features: This set of features is to send notifications to the user, like that they received a questionnaires to which they need to answer, or that a new complaint has been created about an internship that they are involved in.

[F7] Recommendation Features: This set of features is to recommend internships to the STs based on their CVs and to the COs to recommend STs based on the internships that they have created.

[F8] Suggestions Features: This set of features is to suggest to the COs how to improve their internships applications to make them more attractive to the STs, to the STs how

to make their CVs more attractive to the COs

[F9] Visualization Features: This set of features is to visualize all the information that a user needs, the notifications that they have received, the search engine with its filter.

5.3. Integration Strategy

The integration strategy and the testing will start as soon as the DBMS and the host server are built and ready to be used. The integration will be done by using the Bottom-Up approach and so the first module that will be implemented and tested will be the Query Manager module, that is the module that will return the fundamental classes that are going to be used by the other modules. So the Query Manager module is containing and will generate objects of the classes that are part of the Model in the MVC architecture. The Query Manager module will be tested by using a proper Driver that will simulate the behavior of the other modules that will use the Query Manager module.

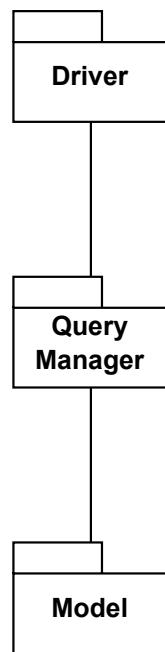


Figure 5.1: Integration Strategy - Step 0

The next module that will be implemented and tested will be the Login Manager module, that is the module that will allow the users to login into the Web Application.

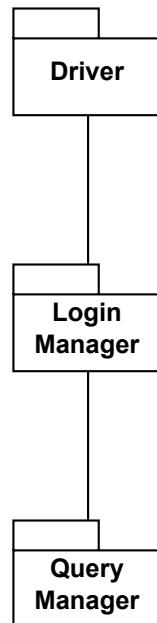


Figure 5.2: Integration Strategy - Step 1

the next modules that can be implemented and tested are the Profile Manager module and the Notification Manager. Both of these modules are independent of each other and can be implemented and tested simultaneously. The Notification Manager module is crucial, because a lot of other modules will use it to generate notifications that will be sent to the users.

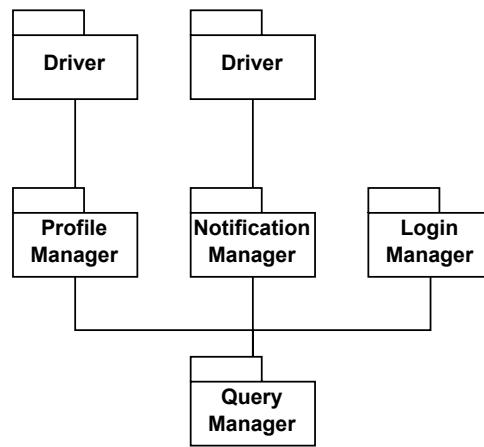


Figure 5.3: Integration Strategy - Step 2

The next module that will be implemented and tested will be the Questionnaires Manager module. For the tidiness of the schemes, from here onward all the modules that will be added will not have the connection to the Query Manager module in the schema, but only have the connections of the dependencies between the modules.

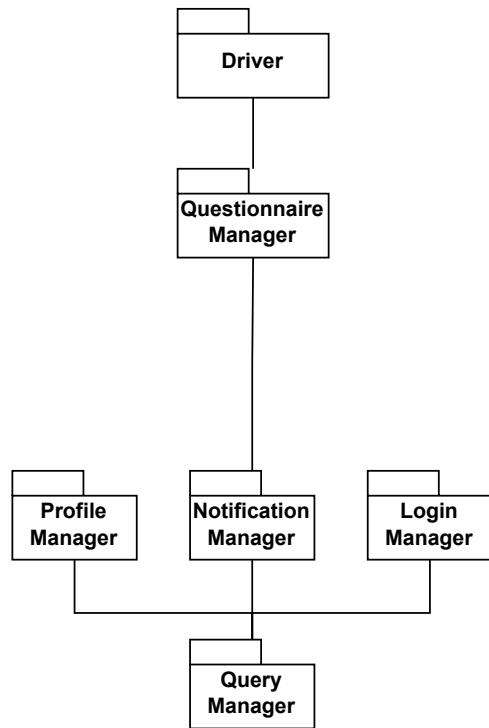


Figure 5.4: Integration Strategy - Step 3

The next module that will be implemented and tested will be the Internship Manager module. This module and the previous one need to be implemented sequentially because the process of creating an internship advertisement will require the COs to create a questionnaire that will be sent to the applicants that have applied to the internship.

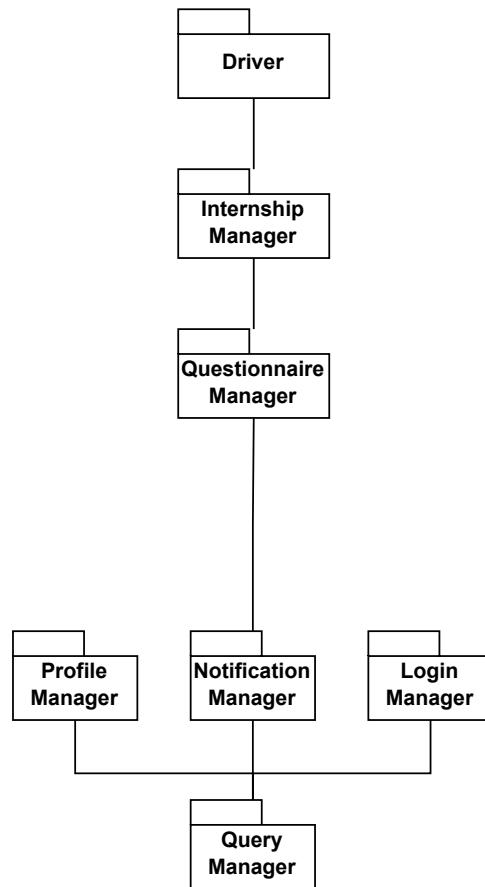


Figure 5.5: Integration Strategy - Step 4

The next step of integration will be the implementation and testing of the Complaint Manager module, the Recommendation Manager module, and the Suggestion Manager module. These modules are independent of each other and can be implemented and tested simultaneously.

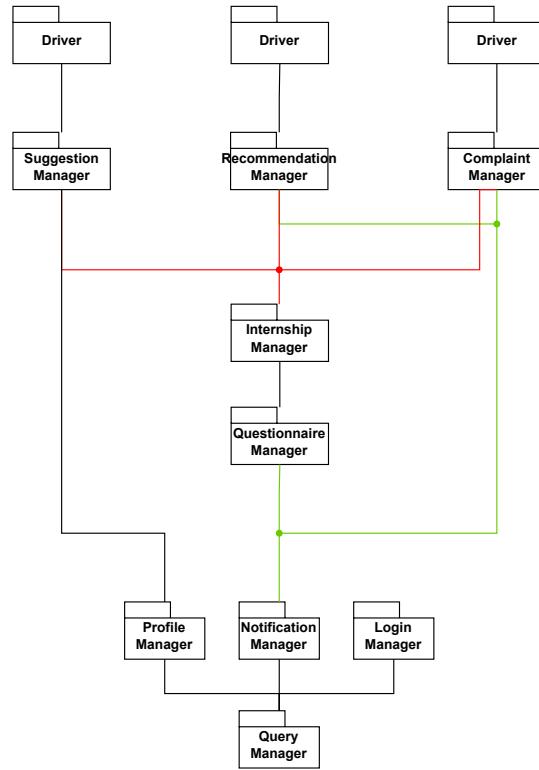


Figure 5.6: Integration Strategy - Step 5

The last step of integration will be the implementation and testing of the Dashboard Manager module that requires all the interfaces of all the other modules except the Query Manager module, to which it doesn't have a direct connection.

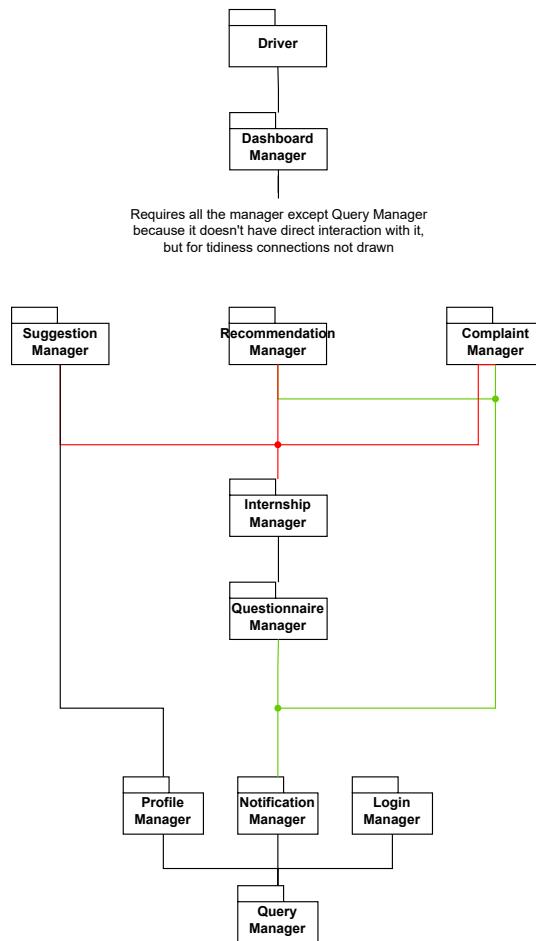


Figure 5.7: Integration Strategy - Step 6

The last driver that will be used to test the Dashboard Manager module will simulate the behavior of the Web server that will simulate the behavior of the Web Application that requires the data that the user needs to see.

5.4. System Testing Strategy

After each module is implemented and tested, its time to test the system as a whole. The system testing will be done using a Black-Box testing strategy: the system will be tested and evaluated from the user's perspective, without any knowledge of the internal architecture.

Among all the different types of test that could be conducted, the following are the one

that will be detailed and conducted:

1. **Functional Testing:** The system will be tested to ensure that all workflows operate as intended and meet the specified functional requirements, satisfying user needs.
2. **Performance Testing:** The application will undergo tests to confirm it can handle expected user loads, sustain peak conditions, and maintain response times within acceptable latency.
3. **Security Testing:** The system will be tested to verify that sensitive data is protected, and the application is resilient against unauthorized access and common security threats.
4. **Failure Testing:** Tests will simulate unexpected scenarios, such as hardware or network failures, to confirm that the system can recover gracefully and maintain reliability with minimal disruption.
5. **Endurance Testing:** The system will be tested under prolonged usage conditions to ensure stability, consistent performance, and the absence of issues like resource exhaustion.
6. **User Acceptance Testing:** End-users will validate the application by executing real-world tasks to ensure it meets their requirements and is ready for deployment in production environments.

6 | Effort Spent

Group Member	Effort Spent	
Apollonio Marco	Introduction	1 h
	Architectural Design	15 h
	User Interface Design	3 h
	Requirements Traceability	2 h
	Implementation, Integration and Testing	3.5 h
Bossi Giacomo	Reasoning	3.5 h
	Introduction	2 h
	Architectural Design	14 h
	User Interface Design	4 h
	Requirements Traceability	0.5 h
Lorenzo Chirolì	Implementation, Integration and Testing	2 h
	Reasoning	3.5 h
	Introduction	1 h
	Architectural Design	6 h
	User Interface Design	16 h
	Requirements Traceability	0.5 h
	Implementation, Integration and Testing	1 h
	Reasoning	3.5 h

Table 6.1: Effort Spent by Each Member of the Group Table

7 | References

7.1. References

- ISO/IEC/IEEE 29148:2018 - Systems and software engineering - Life cycle processes - Requirements engineering.
- The Requirement Engineering and Design Project specification document A.Y. 2024-2025.

7.2. Used Tools

- **GitHub** - Used for project versioning and sharing.
- **LATEX** and **Visual Studio Code** - Used as editor for writing the document.
- **draw.io** - Used for diagrams' design.
- **sequencediagram.org** - Used for sequence diagrams' design.
- **Figma** - Used for the mockups' design.