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UNIVERSIDADE DE
COIMBRA

StackOverflow4UC

Architectural requirements

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Alexy de Almeida 2019192123

Rodrigo Ferreira 2019220060

Sofia Alves 2019227240

1. Project Context



Project Context

StackOverflow4UC is a platform aimed to create a network of shared knowledge that can be accessed by anyone in the UC environment when desired.

The problem to be solved comes from the University of Coimbra's community, namely students, professors and alumni, who need aiding in:

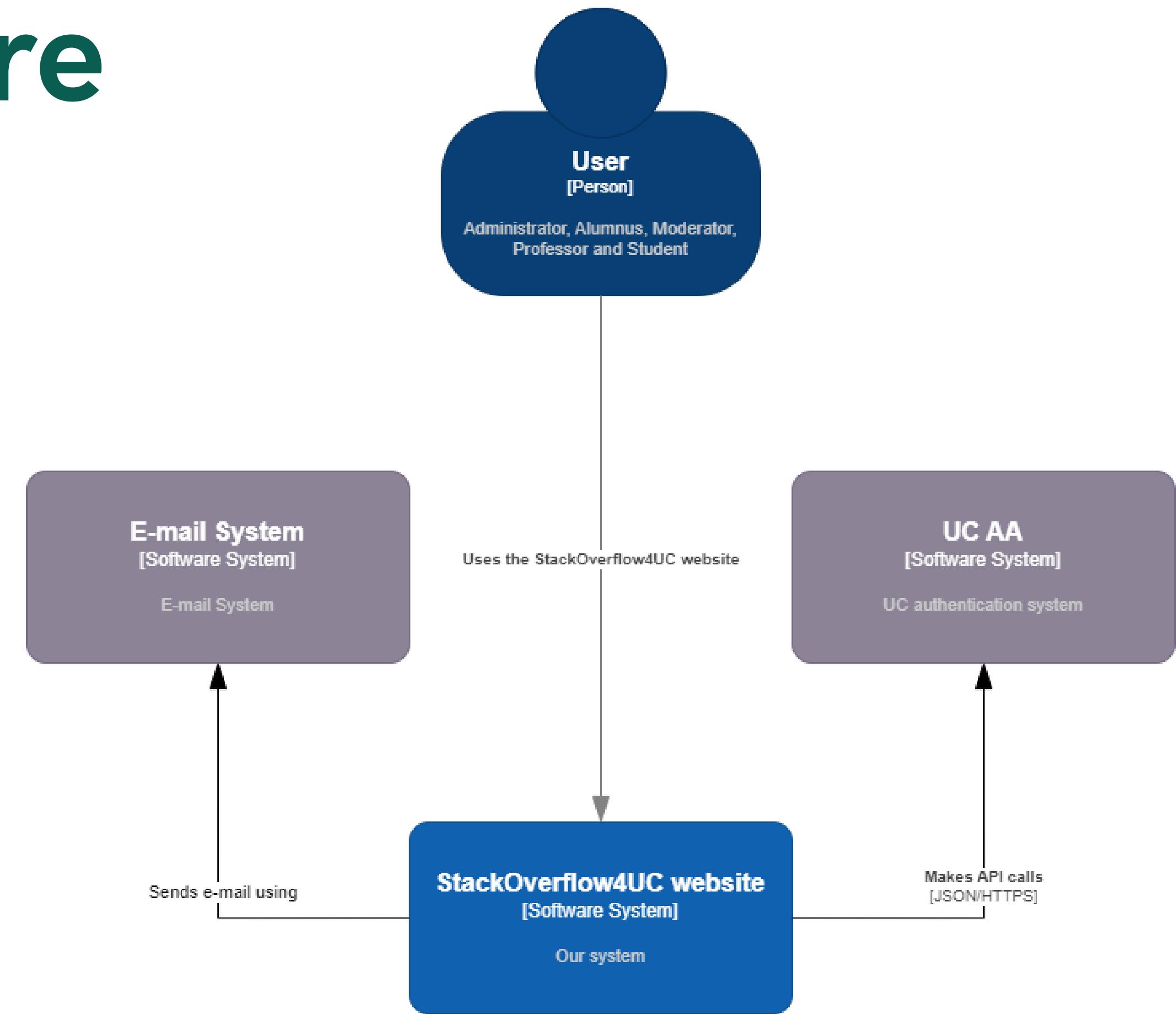
- having more information regarding university projects, assignments or any other important information;
- having a single source of truth;
- getting their specific questions answered, which are not found easily.



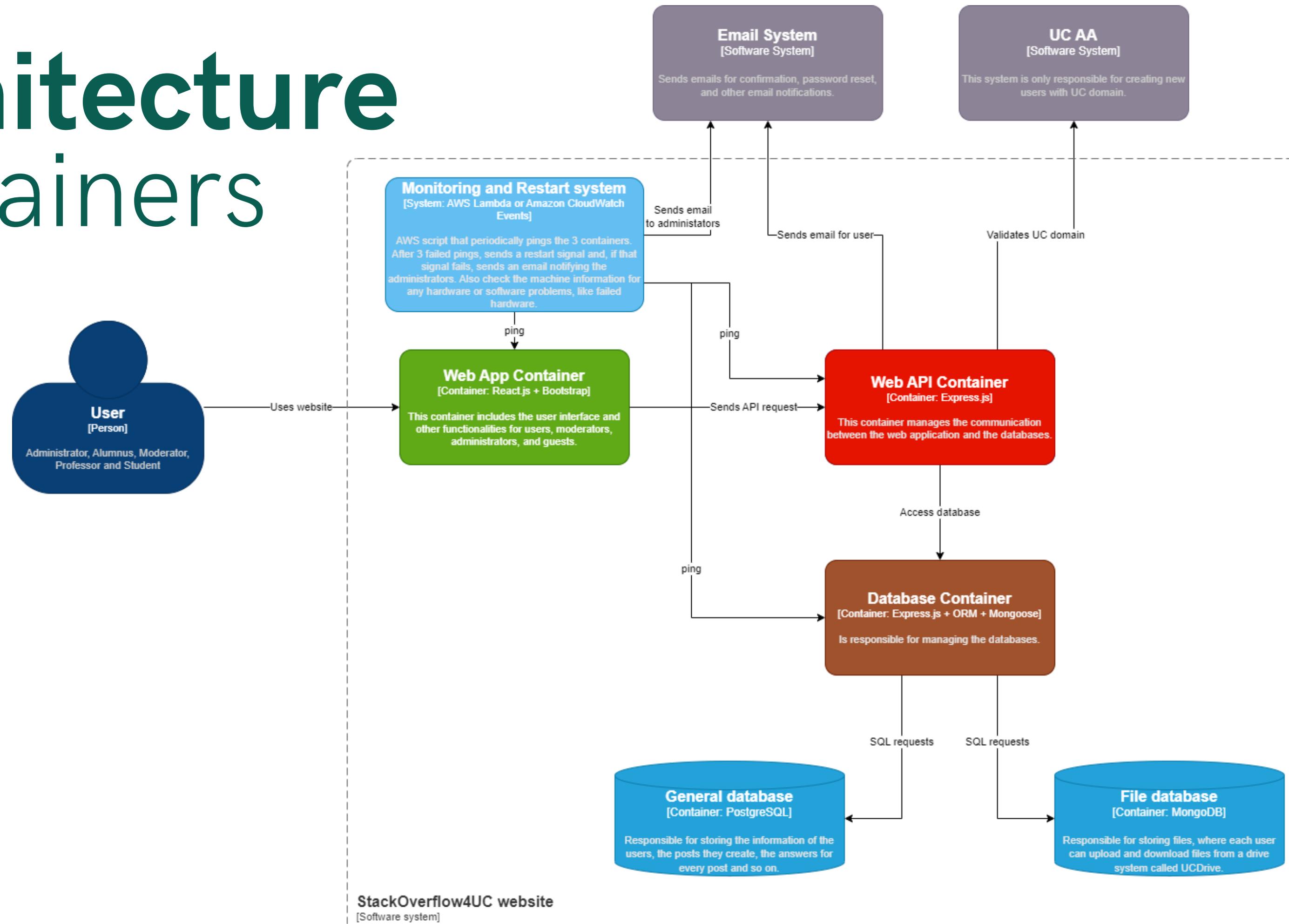
2. Architecture Environment



Architecture Context



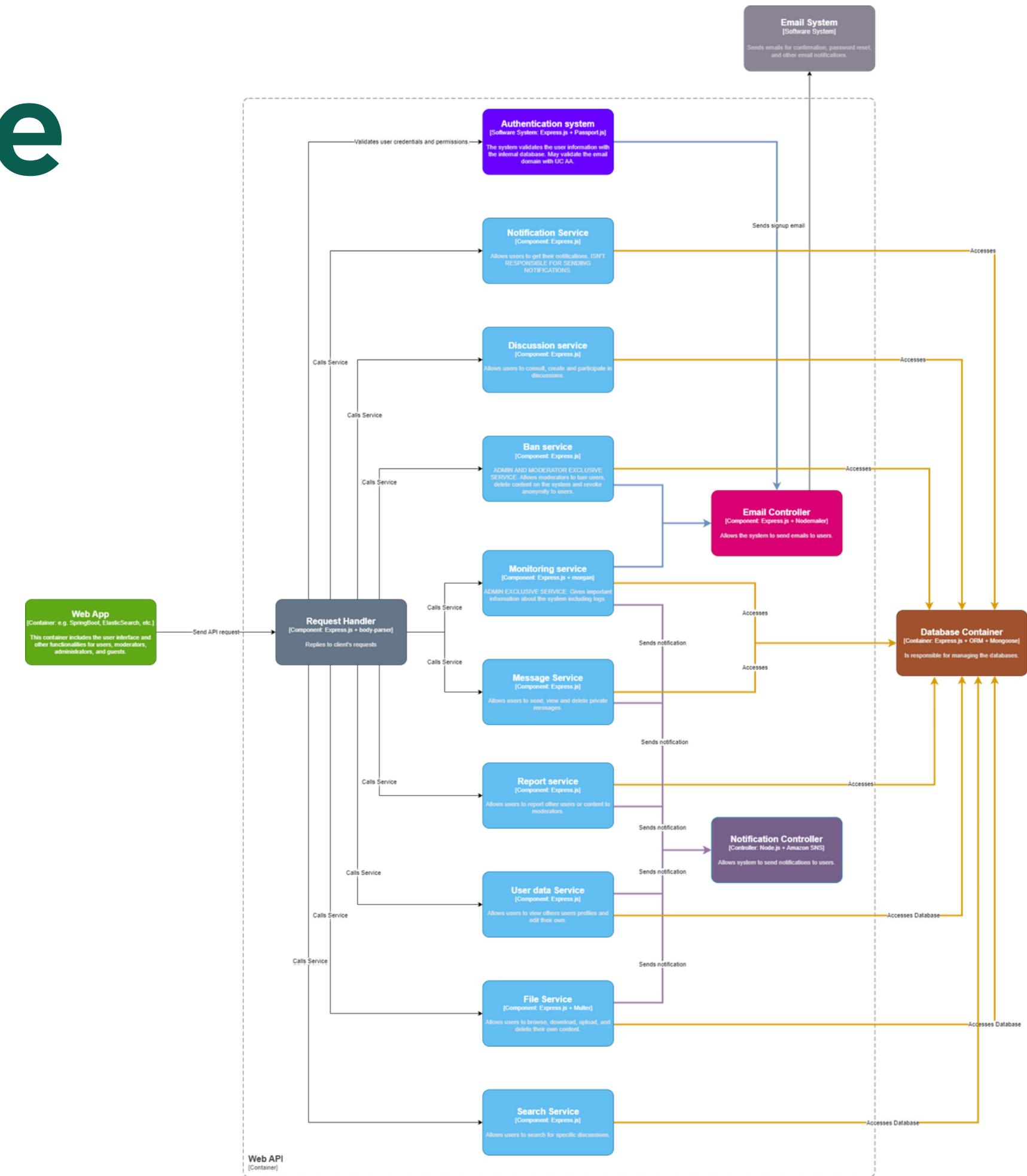
Architecture Containers



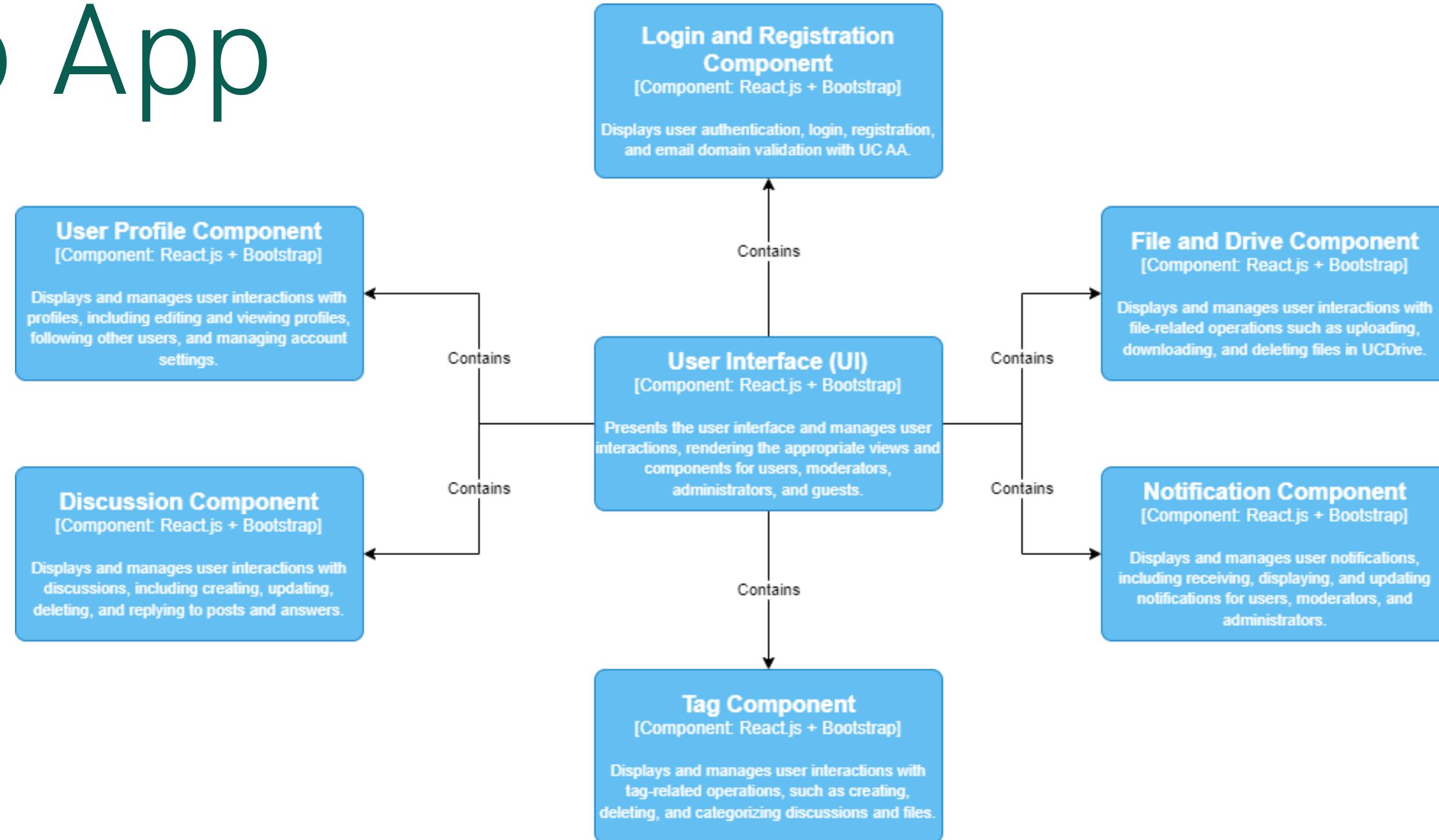
3. Containers



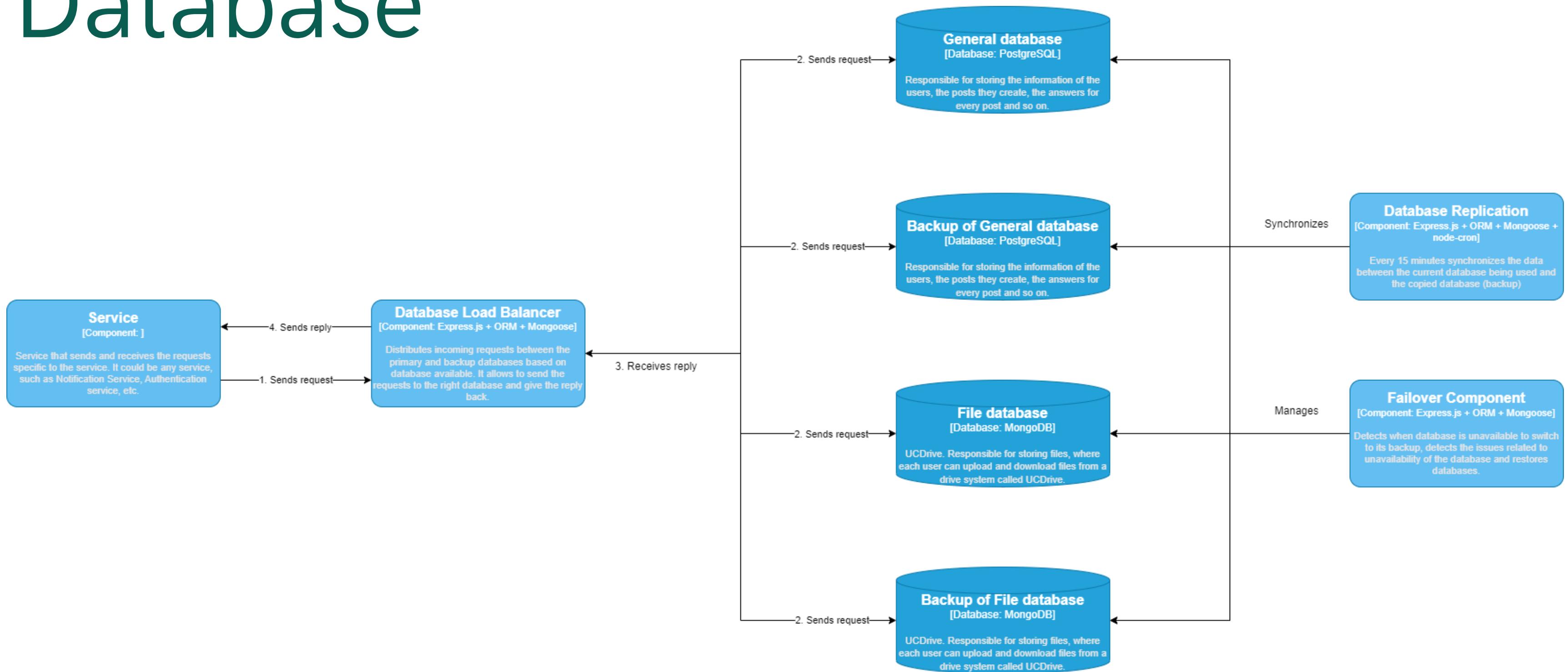
Architecture Web API



Architecture Web App



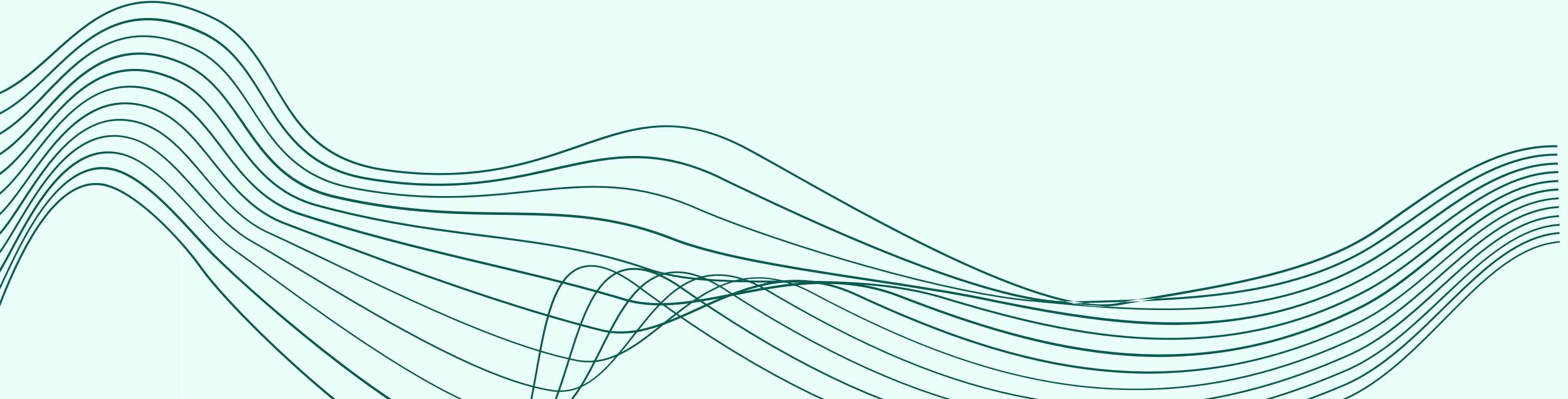
Architecture Database



4. Drivers



4.1. Quality Attributes



Drivers

03

Quality Attributes - Scenario and Validation

ID	Name	Description	Scenario	Validation	Priority
RQ2	[Authentication] Unauthorized Access	The system must not allow any unauthorized access to the website.	During normal operation, if a user without login tries to access a specific URL, the authentication system should redirect the user to the login page and not allow access to the website without the realization of a successful login.	A3, A4, A6, A8, A24, A28, A29, A30, A75, A77	High

Req ID	Req Name	Arch ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
RQ2	[Authentication] Unauthorized Access	A77	Authentication System	When a user makes a request, the authentication component validates the user credentials or token before executing the request. Any unauthorized access will be redirected to the login page.	<p>It's a popular and safe method for authenticating users in websites. It's simple to implement and there are multiple libraries and technologies to help the process.</p> <p>A3 stores the sign up information of the user to be later accessed; A8 forwards the request and receives the reply; A28 signs up the user using the A75 UC AA system to validate the email and sends a confirmation email with the Email controller; A29 validates the users token and permissions; A30 authenticates the user and generates the tokens.</p>

Drivers

03

Quality Attributes - Scenario and Validation

ID	Name	Description	Scenario	Validation	Priority
RQ9	[Privacy] Anonymity Enabling	The system must ensure user privacy when anonymity is enabled.	During normal operation, if a user makes a publication with the anonymity enabled, the system should not allow other users to see any personal information. Other users will see a generic phrase or word referring to the fact that the user has activated anonymity.	A3, A4, A6, A8, A25, A52, A59	High

Req ID	Req Name	Arch ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
RQ9	[Privacy] Anonymity Enabling	A59	Edit user settings	The discussion get component is responsible for the loading of the discussion. If the user had anonymity activated, it hides the username and changes it to a generic response.	This simplifies the implementation of the user anonymity to the public and only administrators with direct access to the database will be able to get the usernames. A52 allows administrators to revoke the anonymity of any user; A59 allows users to change settings so that they can enable anonymity.

Drivers

03

Quality Attributes - Scenario and Validation

ID	Name	Description	Scenario	Validation	Priority
RQ10	[Recoverability] Restore Data	The system must be able to restore data in case of data loss or corruption of the main storage.	During normal operation and every 5 minutes, the system copies the data from one database to another. When the database data is lost or corrupted, the second database becomes the main one and the first database must be fixed. Once fixed, the second database copies the data from that database to the other.	A3, A5, A7, A18, A22, A66	High

Req ID	Req Name	Arch ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
RQ17	[Recoverability] Restore Data	A27	Failover Component	If an issue is detected, the monitoring system will log the event and send a notification to the administrators alerting to the situation. Depending on the severity, an email can be sent to the administrators.	By having an automatic system, it's possible to alert the administrators if any issue is detected, without the need for manual verification. A45 allows moderators and administrators to view monitoring stats and execute some functionalities; A46 keeps information about the databases, like status, capacity, utilization, errors, etc, so that administrators are always informed of errors occurring in the databases; A47 allows to keep information about failed login attempts, abnormal activity and other things that might impact security, such as DDoS attempts or SQL injections; A48 keeps information about the platform like the number of requests per hour, server capacity, list of all errors and warnings and so on, which might prove useful to administrators if some changes must be made to the system or new requirements must be made.

Drivers

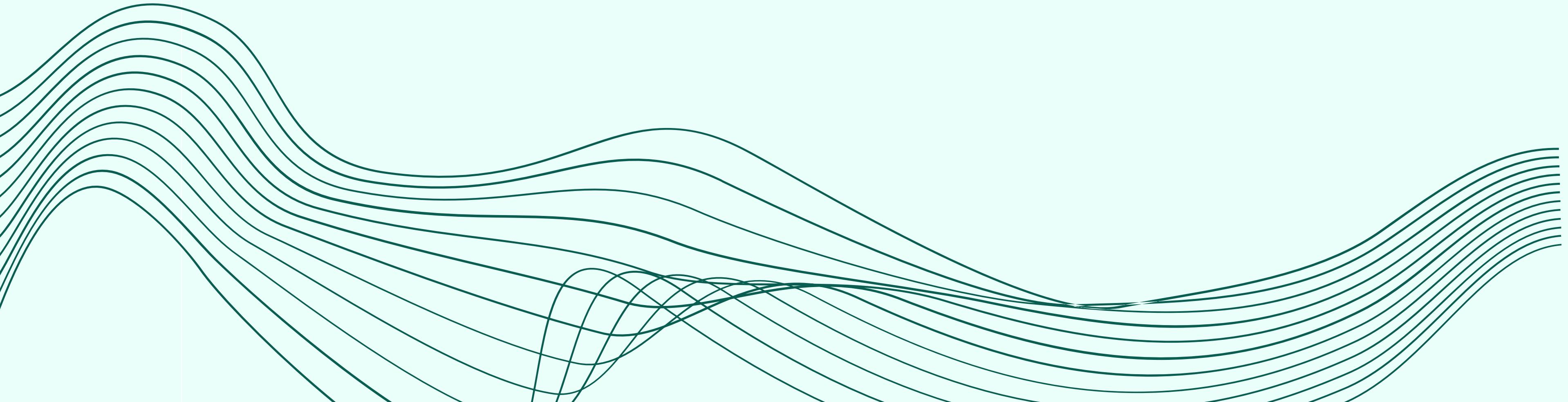
03

Quality Attributes - Scenario and Validation

ID	Name	Description	Scenario	Validation	Priority
RQ3	[Availability] 99% Uptime	The system should have a uptime of 99% during school periods.	During normal operation and during school periods, a user may access the website and the system should respond to the request successfully 99% of the time.	A78	Medium

Req ID	Req Name	Arch ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
RQ17	[Availability] 99% Uptime	A78	Monitoring System	The monitoring service logs all errors, malfunctions or downtime of the system. It also has the ability to automatically reset the containers if one of them goes down. Administrators are notified of any problem and must act accordingly in case a container does not start automatically.	This way the system has the capability to auto restart and try to recover from errors, improving the availability. It only needs human intervention in more severe cases. A48 monitors and keeps information about the platform, which for this case would essentially be a list of errors and warnings; A78 has a AWS script that periodically pings the Web App, Web API and Database containers, so that after 3 failed pings it sends an email to the administrators notifying of some failure.

4.2. Functional Requirements



Drivers

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Functional Requirements

ID	Name	Description	Validation	Priority
UC2	File upload and download	The user should be able to upload and download files to a cloud storage called UCDrive	A3, A5, A7, A8, A16, A18, A22, A25, A64, A66	High

Req ID	Req Name	Arc h ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
UC2	File upload and download	A16	File service	The File Service Component includes all the functionalities required for the download, delete, upload and approval of files. These are Tree Structure controller, Download controller, Delete controller and Upload controller that will work on a non relational database. The Upload controller sends a notification to the moderators to approve the content before making it visible to the public.	This structure isolates the file service (UC drive) from the rest of the platform and minimizes dependencies to work properly while fulfilling the requirements. Inside A3 , the A5 and A7 and is there the files are kept, while A8 handles all requests for storing or retrieving files from the database; A25 distributes the requests to the available databases and receives the reply back; A64 and A66 allow users to download and upload content.

Drivers

03

Functional Requirements

ID	Name	Description	Validation	Priority
UC5	Reply of reply	The user should be able to reply to an answer's reply (thread system)	A3, A4, A6, A8, A18, A25, A39	High

Req ID	Req Name	Arc h ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
UC5	Reply of reply	A10	Discussion service	The create reply component inside the Discussion service allows a thread system.	This way, the create reply component is only responsible for the replies to discussions or to other replies. A4 and A6 store the information of the discussion, with A8 handling the requests and A25 balancing them; A39 is essential, as it allows the user to add a reply to an existing discussion.

Drivers

03

Functional Requirements

ID	Name	Description	Validation	Priority
UC11	View discussions	The user sees a list of discussions in the home page. The user can filter the discussions by relevance, recency, tags and subjects.	A3, A4, A6, A8, A10, A18, A20, A25, A37, A70	High

Req ID	Req Name	Arc h ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
UC11	View discussions	A10	Discussion service	The Discussion service loads several discussions on the user homepage depending on the tags they follow.	This service can be reused in several ways, on the homepage, the search results and for a specific discussion. To view the discussion, we need to access A4 or A6 with the help of A8 and A25 to handle and balance requests; A37 is what allows to fetch the discussion and A70 also fetches the discussions based on the search/filters typed or established.

Drivers

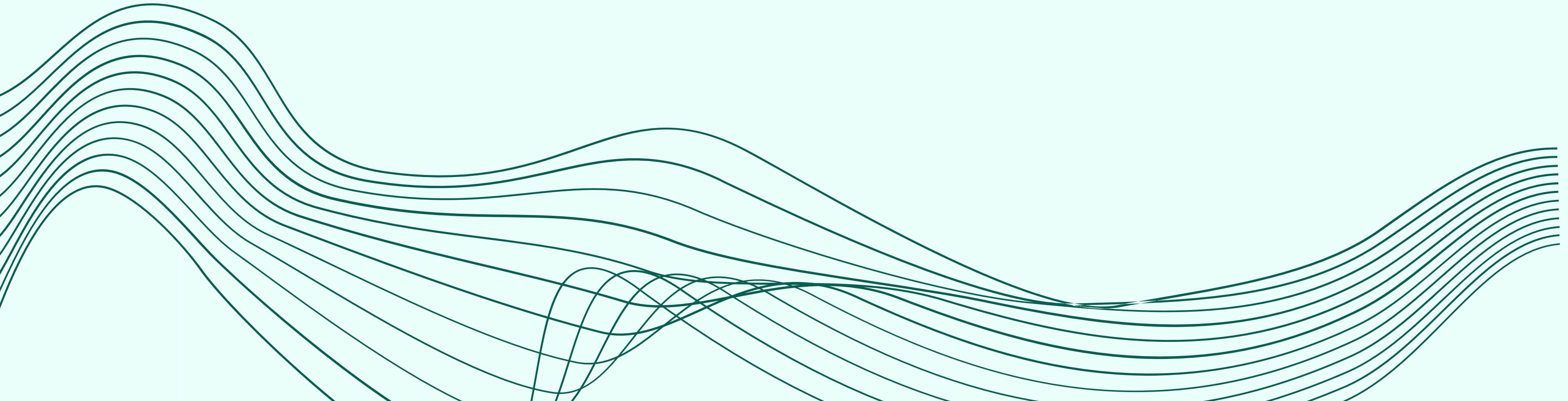
03

Functional Requirements

ID	Name	Description	Validation	Priority
UC17	Ban user	The moderator bans a user temporarily or permanently.	A3, A4, A6, A8, A11, A18, A25, A44, A53, A71, A74	High

Req ID	Req Name	Arc h ID	Arch Name	How (ASR->ARCH)	Why (ARCH->ASR)
UC17	Ban user	A11	Ban service	The ban service provides the ability to penalize or ban the user. This service is only available to moderators or administrators.	Isolating this service allows for greater security in with users can access it and allows for a more modular structure. The information about the user being banned is kept in A4 and A6 , with A8 and A25 handling and balancing the requests. Thanks to A44 the moderators can take a decision about the report that was made, which in this case would be a ban strike, and automatically apply a ban if the maximum number of strikes has been reached. A53 is what allows moderators (or administrators) to ban and unban other users or content. When a user is banned, he's notified via email thanks to A74 and A71 .

4.3. Business Constraints



Drivers

Business Constraints

03

ID	Name	Description	Priority
BC1	Availability	The system should ensure it should have a 99% availability during class periods. Outside class periods, the availability can drop to 95%, as user activity is expected to be lower.	Medium
BC2	Scalability	The system should be able to handle 5% of the UC community during class periods. The capacity should increase to 20% during exam periods.	Medium
BC3	Time to market	The system should be deployed in the beginning of the next academic year, i.e., September 2023, which is 5 months from now.	Medium

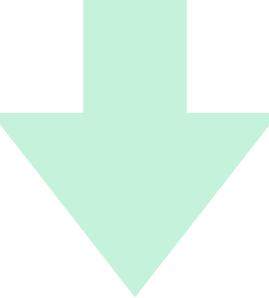
Can't be really implemented

Drivers

Business Constraints

03

ID	Name	Description	Priority
BC1	Availability	The system should ensure it should have a 99% availability during class periods. Outside class periods, the availability can drop to 95%, as user activity is expected to be lower.	Medium



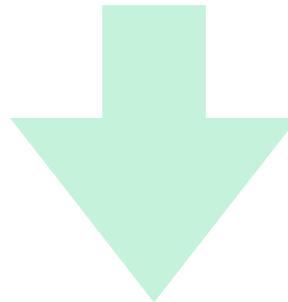
ID	Name	Description	Scenario	Validation	Priority
RQ3	[Availability] 99% Uptime	The system should have a uptime of 99% during school periods.	During normal operation and during school periods, a user may access the website and the system should respond to the request successfully 99% of the time.	A78	Medium

Drivers

Business Constraints

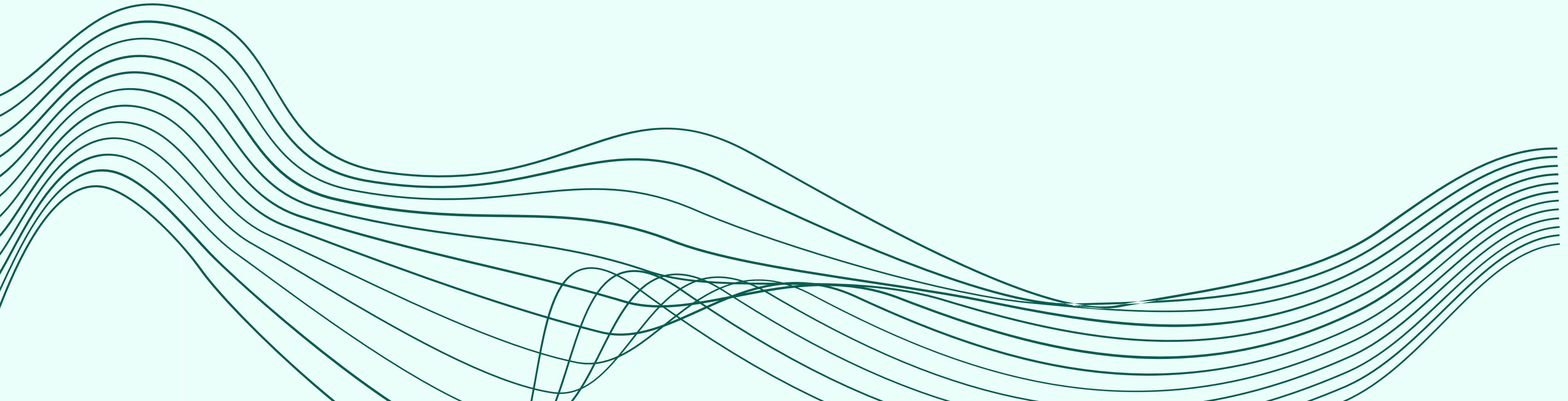
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ID	Name	Description	Priority
BC2	Scalability	The system should be able to handle 5% of the UC community during class periods. The capacity should increase to 20% during exam periods.	Medium



ID	Name	Description	Scenario	Validation	Priority
RQ12	[Scalability] Handling Concurrent Users	The system should be able to handle up to 2000 concurrent users without crashing or slowing down.	During normal operation, the system should be able to handle up to 2000 concurrent users without crashing or slowing down. When there are more than 2000 concurrent users, the system should degrade its performance and maintain its functionality as much as possible. If the response time exceeds 2 seconds, the system should be considered slow and require improvements	A8, A31	Medium

4.4. Technical Constraints



Drivers

03

Technical Constraints

ID	Name	Description	Priority
TC1	Authorization	The system must only accept emails with the university domain: student.uc.pt and teacher.uc.pt.	High
TC2	Extensibility	The system must contemplate Dropbox, Git and Google Drive integration.	Medium
TC3	Portability	The system must ensure the platform can only be accessed via Mozilla, Chrome, Safari, Brave, Edge and Opera on a computer or phone.	High

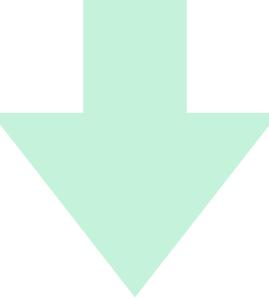
Wasn't implemented

Drivers

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Technical Constraints

ID	Name	Description	Priority
TC1	Authorization	The system must only accept emails with the university domain: student.uc.pt and teacher.uc.pt.	High



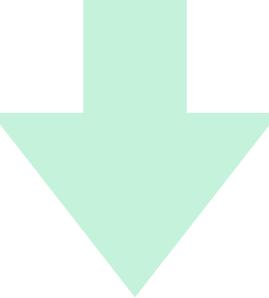
ID	Name	Description	Validation	Priority
UC9	uc.pt domain names restriction	Limit the use of the platform only to registered users with uc.pt domain names	A3, A4, A6, A24, A28, A75, A77	High

Drivers

Technical Constraints

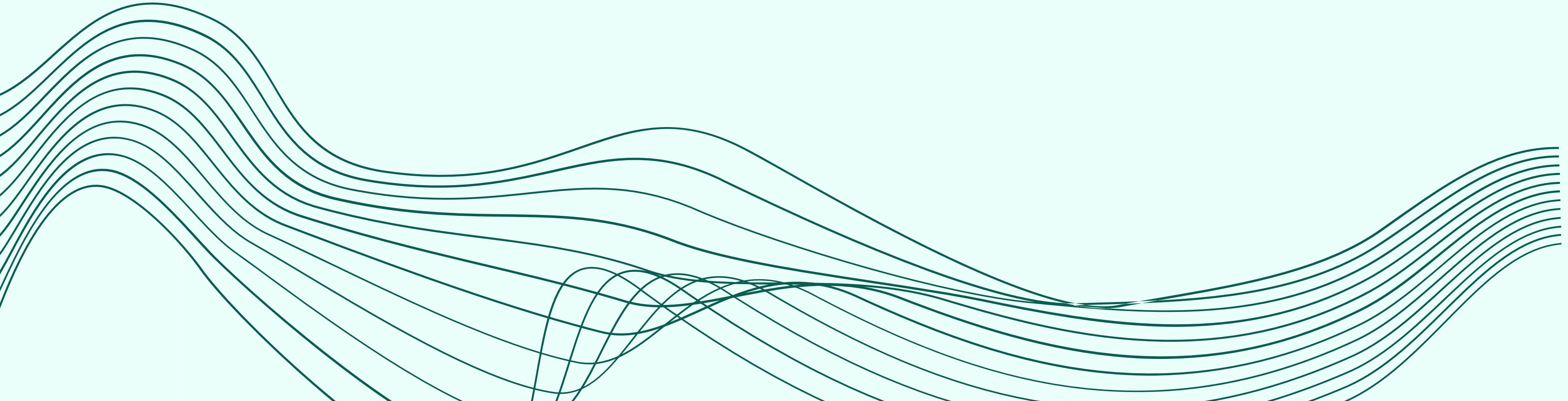
03

ID	Name	Description	Priority
TC3	Portability	The system must ensure the platform can only be accessed via Mozilla, Chrome, Safari, Brave, Edge and Opera on a computer or phone.	High



ID	Name	Description	Scenario	Validation	Priority
RQ8	[Portability] Browser Access	The system must be accessible in desktop and mobile devices through Mozilla, Chrome, Safari, Brave, Edge and Opera.	During normal operation, a user must access the website in the following search engines: Mozilla, Chrome, Safari, Brave, Edge and Opera. The system should be able to respond to any of this search engines correctly and allow the user to use the website.	A18	High

4.5. Risks and Issues



Drivers Risks

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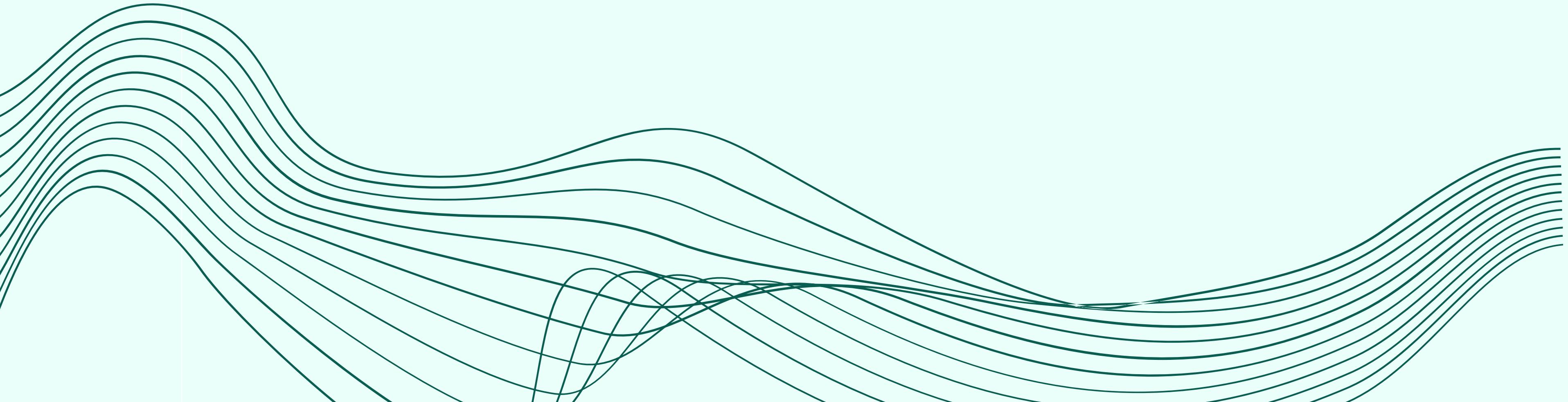
ID	Risk Description	Likelihood	Impact	Severity	Mitigation Plan
1	Database container goes down and the website becomes unresponsive.	2	5	10	Monitoring and restart system automatically detects this and sends a restart signal. If the signal fails sends an email notifying the administrators.
3	Database gets corrupted.	1	5	5	Request handler has a maximum number of requests per second. If that number is surpassed, some requests will be dropped.
4	Security breaches if any unauthorized user gains access to the platform. This can happen at user level, or administrator level.	3	5	15	Use of standard libraries for authentication that are open source and well tested. Also the use of temporary tokens and permissions checks aims to reduce the likelihood of a breach happening.

Drivers Issues

03

ID	Issue Description	Mitigation Plan	Status
1	The database container is too complex, it has too many components and it's confusing to understand how they work together.	Redo the view and research a better way to implement the components and technologies necessary.	Closed
3	Missing components to guarantee 99% uptime.	Implement a component or system that can restart the system if it goes down, notifies administrators and periodically verifies that the system is in good state.	Closed
4	Missing components to guarantee that the system restart within 2 minutes when it goes down.	Incorporate the Restart System inside the Monitoring System.	Closed

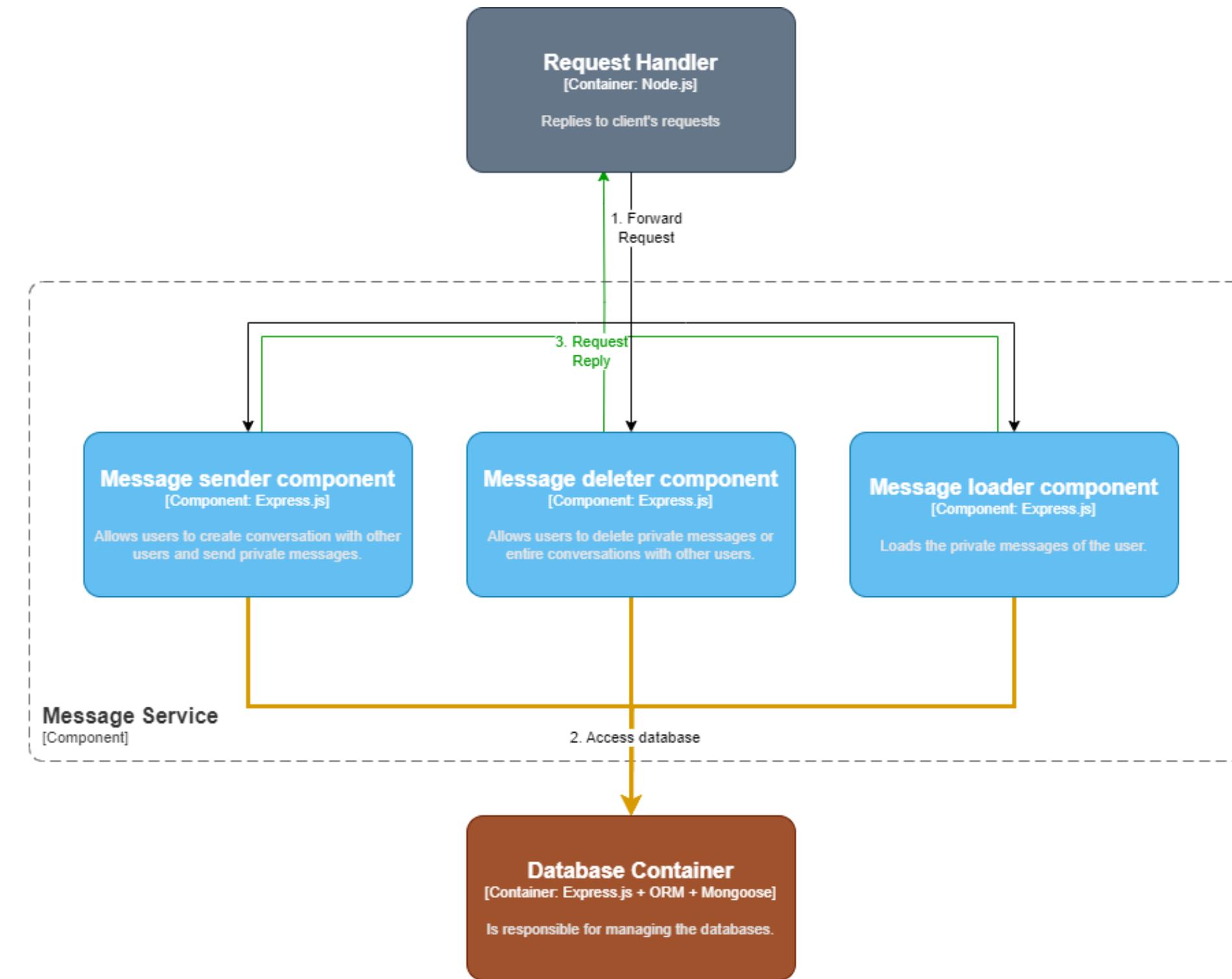
4.6. Dynamic Views



Drivers

Dynamic Views - Message Service

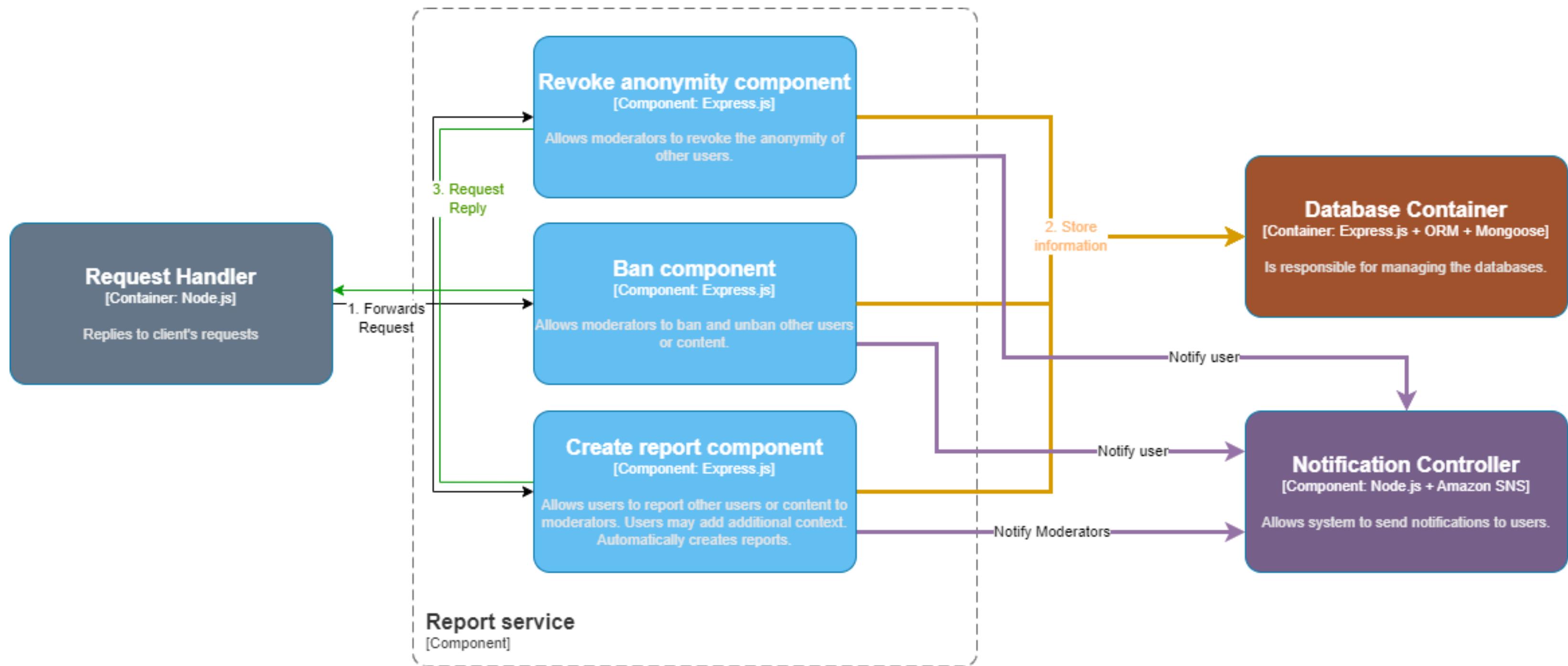
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Drivers

Dynamic Views - Report Service

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5. Process



1. Find the project

2. Define the Project Context

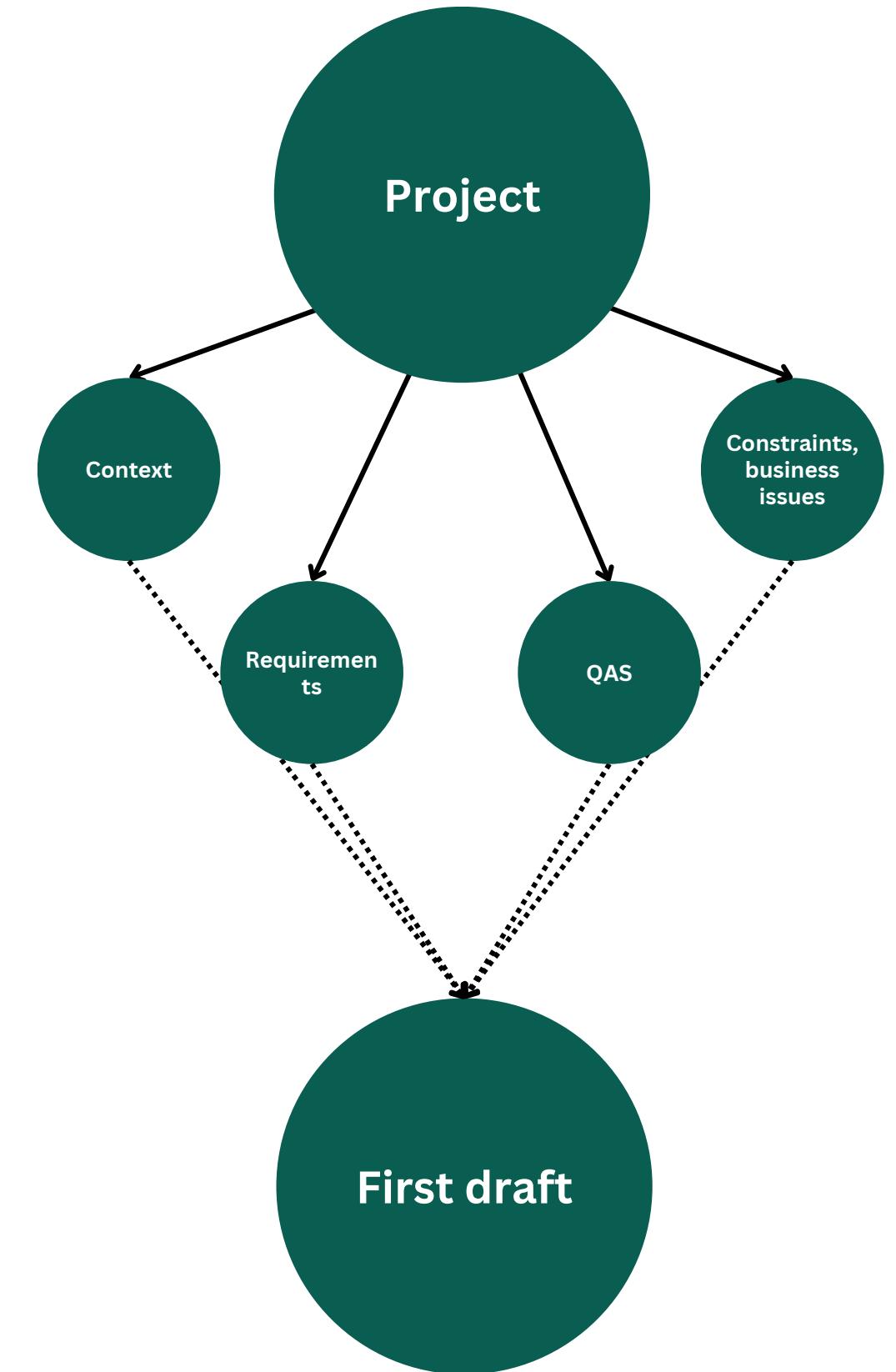
- 2.1. Define business goals: Time to Market, number of users and budget
- 2.2. Describe the already existing functional requirements

3. Requirements

- 3.1. Write some Quality Attribute Scenarios
- 3.2. Define the technical constraints
- 3.3. Write the non-functional requirements
- 3.4. Write every Quality Attribute Scenario for each non-functional requirement

4. Architecture - first draft

- 4.1. Make a first visual draft of how the architecture environment could look like
- 4.2. Create the Context view based on the Project Context and available examples online
- 4.3. Create the Containers view and search how the containers interact with each other
- 4.4. Create the Components and Sub-Components for every container and component
- 4.5. Search what technologies can be applied to each ARCH and how good they can be for our system
- 4.6. Review the architecture and look for comparable examples online
- 4.7. On the traceability matrix, create every relation between ARCH and ASR



5. Architecture - final draft

5.1. [trac.matrix] List issues and risks found in the first draft

5.2. [trac.matrix] Create the missing requirements

5.3. [C4] **Alteration:** Delete, create or update ARCH components from first draft

5.4. [C4] Create dynamic views

5.5. [trac.matrix] **Alteration:** For every component in ARCH:

5.5.1 List the technologies, why are they good, alternatives and how they help validate the associated component requirements

5.5.2 List every requirement the components helps to validate in any way

5.6. [trac.matrix] **Alteration:** For every REQ and UC in ASR:

5.6.1 List every ARCH that helps validate the requirement

5.6.2 Define the priority

5.7. [trac.matrix] **Alteration:** For every relation in Relations:

5.6.1 Update the main ARCH that helps validate the requirement

5.6.2 Explain how every component helps validate the requirement

5.8. [trac.matrix] Review the traceability matrix

5.9. [C4] Review the C4 model

