

R2 - Västtrafik Services Improvement

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Version History

Version	Date	Authors	Summary
R1	22.09.2025	Oskar Meyer, Ludwig Alexandersson, Dipto Dey, Praveen Alavala, Jörn Fischbach	High level-description: Goal and Scope, Business Case and Stakeholder Map, Core Functionality, Non-functional Requirements
1.0.0	24.09.2025	Ludwig Alexandersson, Oskar Meyer, Jörn Fischbach	Added the Version History
1.0.1	25.09.2025	Oskar Meyer	Added Creativity sessions to appendix
1.1.0	02.10.2025	Ludwig Alexandersson, Jörn Fischbach	Added all User functional requirements
1.1.1	02.10.2025	Ludwig Alexandersson	Added all existing system and software requirements
1.1.2	03.10.2025	Ludwig Alexandersson	Addressed feedback regarding Goal and scope.
1.2.0	04.10.2025	Oskar Meyer	Added Data requirements and super-section User requirements
1.2.1	04.10.2025	Dipto Dey	Added traceability matrix linking Business Goals → User Requirements → Functional Requirements → Software Requirements (Business → User → System)
1.3.0.	04.10.2025	Jörn Fischbach	Added all PLanguage descriptions to the four most important NFRs
1.4.0	05.10.2025	Jörn Fischbach	Added Quality grid for Non-functional requirements. Aggregated, wrote about, and visualized our Proposed Prioritization.
1.4.1	05.10.2025	Dipto Dey	Did 100 Dollar method prioritization from the perspective of IdP
1.4.2	05.10.2025	Jörn Fischbach	Added release plans (first and second), and linked them to PLanguage description of NFRs.
1.4.3	05.10.2025	Ludwig Alexandersson	Updated context diagram
1.4.4	05.10.2025	Praveen Alavala	Added Detailed Data Requirements

1 High-level Description

The requirements document defines the objectives and scope for improving Västtrafik’s digital services. The primary goal is to define requirements that will enhance the user experience of Västtrafik’s app and web service through new features. The requirements document assumes that the reader possesses some familiarity with Västtrafik’s current platforms and features (e.g., route planning, ticketing). Hence, the document will not describe all existing functionality in great detail. An explanation of which domains will be excluded and the technical scope of our project will be provided in more detail in subsection 1.1.

1.1 Goal and Scope

The software project scope is to extend Västtrafik’s current mobile and web product, as described in section 1. The project aims to extend features related to transportation information, route planning, and better payment workflows. These extensions are intended to resolve identified issues, such as unclear alternatives during disruptions, restricted payment options and poor guidance for new users, among others. Furthermore they are directed to help the commuters and newcomers in their traveling by adding clarity and reliability to the product. The document will specify both product-level and domain-level requirements, however, the specifications in this document are unaware of the inner workings of the outer-domain systems. E.g., we do not go into detail about payment service providers such as PayPal, or sensor-data providers such as Västra Götalands regionen (VGR), as we lack information about such systems. Nonetheless, the authors will draw knowledge from outer-domain system common use-cases and interfaces, as observed on websites or apps, and make broad assumptions about the functionality that these systems will likely offer. Concluding, this document’s scope is primarily tailored to the inner-domain, specifically the Västtrafik Application Programming Interface (API) and the Västtrafik application/website, and only partially explores/mentions the outer-domain systems.

The goal is to try and fix pain points experienced by commuters and newcomers using Västtrafik’s software service platform. For example, vague ticket information regarding student tickets, and unreliable real-time information. This project, therefore, believes that addressing these pain points will increase platform satisfaction and user count, which will increase ticket sales, which in turn will generate more revenue. As Västtrafik AB is a non-profit company, the additional revenue could be reallocated to internal Västtrafik investments, e.g., to improve the interconnectivity of Göteborg’s public transport. However, the revenue reallocation for the nonprofit company is outside of the scope of our project and will not be discussed in more detail.

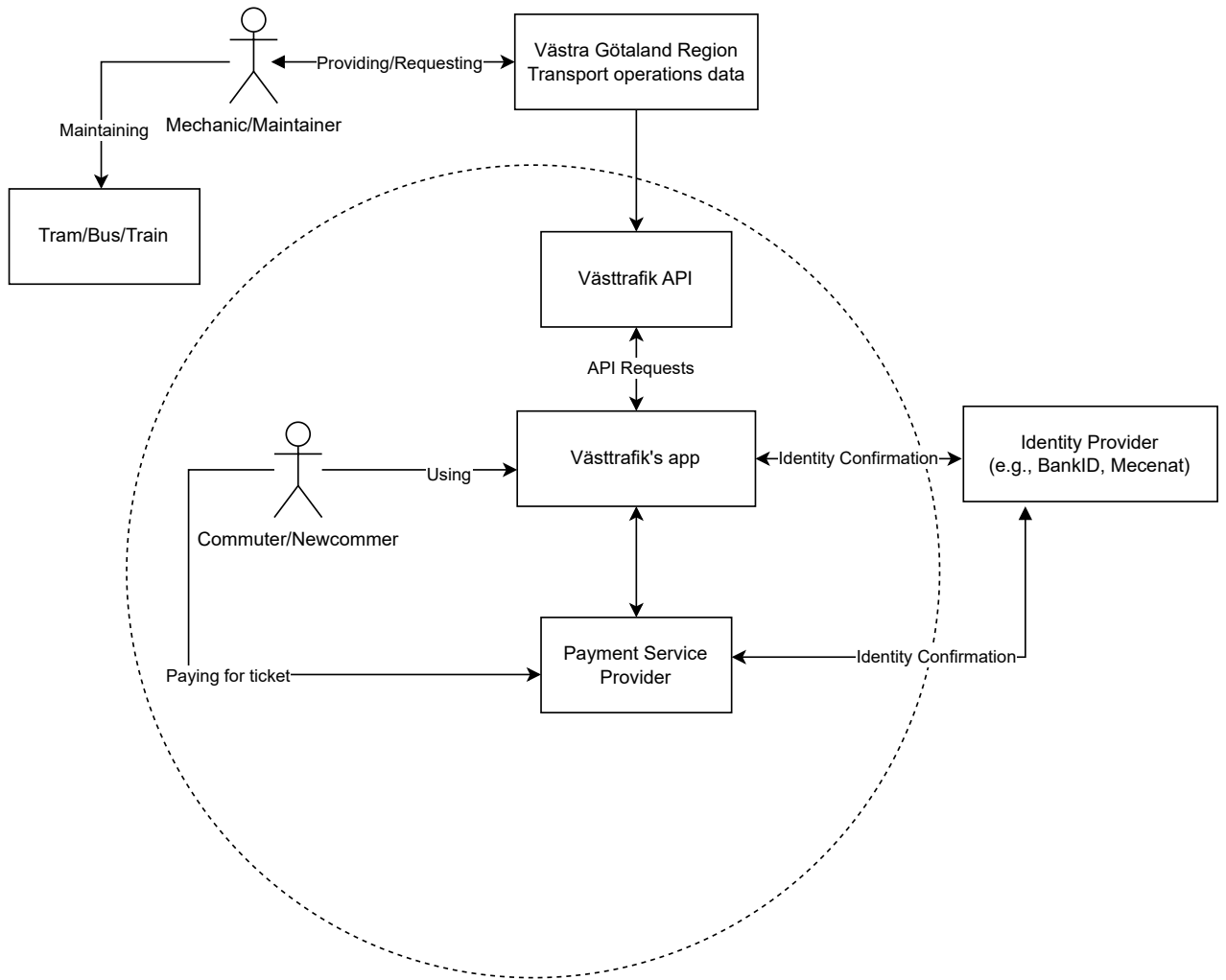


Figure 1: Context diagram over product interfaces

1.2 Business case and Stakeholder Map

Two main categories of users will be using the software. First, there are the main users of the software, who are commuters: frequent riders using Västtrafik's bus and tram lines. It follows that these users will often rely on the app or website for daily commutes and route planning. Secondly, there are the occasional users; e.g., event attendees, tourists, newcomers who use the service less frequently. These users need improved onboarding, easy

payments, and better information. Within these user categories are groups such as students and teenagers, who are eligible for discounts. Thus, in-app guidance on eligibility for said discounts and proof of eligibility (such as showing a digital student ID) are required. Moreover, people without a Swedish identity number face an additional barrier. They cannot create accounts and, therefore, cannot save tickets they have paid for.

Västtrafik AB who is the sole sponsor of this project, is owned by VGR [1]. The overall goal with Västtrafik AB is that sustainable travel should become the norm and increase throughout VGR. To achieve this goal, Västtrafik bases its entire business concept on easy access to sustainable travel and attractive public transportation that meets all travel groups. In other words, Västtrafik is a company that focuses on customer relations. Specifically, they have created seven foundational pillars to help guide their decisions about customer relations. [2] [3], these are:

1. We have sustainability as base
2. We create value
3. We ensure reliable delivery
4. We develop and are driven by societal challenges and customer needs
5. We influence based on knowledge
6. We collaborate with others
7. We do it together

Västtrafik's goal more recently has been focused on restoring travel to 2019 levels. Moreover, the organization has had discussions about its self-financing level, which is currently around 47% of their income. Because of this, Västtrafik is trying to implement two multi-year programs, "framtidens biljettköp", and "framtidens trafikinformation" [3]. The program "framtidens biljettköp" is about improving and changing Västtrafik's ticket system. As of today, Västtrafik says the current system will reach its final lifespan within a few years. The second program, "framtidens trafikinformation", is also a remuneration of Västtrafik's current system. Västtrafik says that the system has a great need to be harmonized and more automated to ensure better information to customers, and flexibility in handling traffic information. The future of Västtrafik's investment plan for 2026 to 2030 means that ticketing and information systems will receive an investment of 541 million SEK [4].

Name	Relationship	Representative	Sentiment / Power
Commuter	Primary user	General travellers	Sentiment: High, Power: Low
Newcomer	Secondary user	Occasional riders, tourists, newcomers	Sentiment: High, Power: Low
Västra Götaland Region	Operational data provider	Regional Transport Authority	Sentiment: Neutral, Power: High
Payment Service Provider	Processes ticket purchases	Banks	Sentiment: Positive, Power: Low
Identity Provider	User authentication	Västtrafik (BankID / SSO)	Sentiment: Neutral, Power: Medium
Fleet Maintenance	Maintenance data provider	Maintenance staff / contractors	Sentiment: Positive, Power: Medium

Table 1: Stakeholder map

Commuters (Primary Users): Commuters are the most typical travelers who rely on the transport system for daily movement to work, school, or other essential activities. They are a constant demand driver, and in their feedback, they technically describe how reliable and usable the system is. When considered as individuals, their power is low, but taken as a whole, the users have high influence because user satisfaction is important in building reputation and/or adoption of the service.

Newcomers (Secondary Users): They might include visitors, newcomers, and residents who may have recently been relocated and are using the services less frequently. For Västtrafik, engaging these groups is important: while they may not represent the core customer base, their early impressions can strongly influence reputation through word-of-mouth. To address their needs, the requirement emphasizes accessibility, smooth onboarding, particularly via a user-friendly digital channel. They do not have much power on their own, but the participation of newcomers becomes key to attracting different sets of users.

Regional Authorities (Västra Götaland Region): The Regional Authorities are essential because they are the ones who regulate the whole system, finance the system for development and improvement, and provide operational data. They guarantee efficient operations, sustainability goals, and adherence to public policies. Their choices have an immediate impact on the organization and the provision of services. Regulatory and financial control give them a lot of power, but they usually have a neutral attitude and prioritize stability and long-term governance.

Banks / Payment Service Providers: The consumer's ticket-buying process is handled by the bank. They are essential in terms of seamless and safe payment, which should be reliable for the user. They are vital partners since their function supports the platform's revenue flow. Their systems would disrupt the entire ticketing process in the event of a failure. As avoiding this failure is also in their best interest, they only have low influence on the Västtrafik alone. As there are multiple alternative payment services available, a single payment service failure has not too grave of an impact.

Identity Providers (e.g., BankID / SSO): They are responsible for handling secure authentication for users and ensuring a trusted service to the consumers. Their role is pretty crucial as they are going to protect users' private information. Since they oversee a vital point of entry into the ecosystem, are rather monopolistic, and service outages have the potential to completely prevent access, they have medium power.

Fleet Maintenance Staff (Maintenance Data Providers): Maintenance staff are responsible for ensuring that buses, trams, and ferries are safe and reliable to use. Through the provision of real-time maintenance details, they have a direct influence on service continuity and safety. Their operations reduce breakdowns and delays and have an indirect influence on commuter satisfaction. They have medium power since the operation efficiency is dependent on them.

Business goals

In this project it is really hard to directly improve Västtrafik's ticket sales through marketing or finding a market gap, etc. Thus we have focused all of our goals to improve the customers satisfaction, leading to more sold tickets.

A1: Enhance current travel system. The current system has quite a lot of space for innovation and extra features, such as being able to show height meters for trips by foot/bicycle, show temperature for the given vehicle and provide real time notifications about alternative routes. These together with developing a more robust and fail-safe system would improve the overall user experience, leading to higher customer satisfaction.

A2: Reintegrate the ticket system with improved functionality.

There are many apparent flaws within the current integration for the ticket and account system, such as: Not being able to create an account without a Swedish identification number. There is no function to "check in" your ticket or have the ticket on a physical card as well, so you are unable to show your ticket upon inspection if your phone runs out of battery.

A3: Integrate a review system for rides.

Almost every system used by a paying customer has a way of reviewing the provided product, since it often provides more clarity to other customers and information for the owners. We believe that a review-function (even if it results in mostly negative reviews) provides more clarity to the users and a more reasonable expectation of the ride they plan on using. This would also allow Västtrafik to collect more data regarding the users thoughts on routes, etc.

A4: Improve planning-system.

There is a lot of opportunity to improve existing planning system as well as adding new features, such as machine learning. Currently the system only supports searching one route, while it would be helpful to plan your return at the same time. This could be explored even further with machine-learning, recognizing your travel patterns, notifying you when for example, the last tram is leaving from campus to your home.

A5: Support integration with Mecenat.

Currently there is no real student ticket, instead the customer buys the youth ticket and upon inspection they show their Mecenat card. The problem arising from this is that students that are unfamiliar with the app, might buy a youth ticket without knowing about the Mecenat card requirement. If they have not recieved their Mecenat card yet, they might end up buying the wrong ticket due to not being eligible for the youth ticket yet. Introducing the option of a student ticket that automatically checks if you have a Mecenat card associated with the user’s email would simplify the process. It would also simplify the process for the workers scanning your ticket, who no longer need to check for your Mecenat card upon ticket inspection.

A6: Route planning should get smarter.

The existing system has plenty of areas that can be improved, for example showing ”connecting” rides with negative transfer/connection time. The route planner sometimes prompts the user to walk absurd distances, or not show adequate alternatives.

Goal Category	ID	Description	Verifiability
Product-level			
	A1	Enhance current travel system.	Reasonably verifiable
	A2	Reintegrate the ticket system with improved functionality.	Reasonably verifiable
	A3	Integrate a review system for rides.	Easy to verify
	A4	Improve planning-system.	Reasonably verifiable
Domain-level			
	A5	Support integration with Mecenat.	Support available, quality is subjective
Quality-level			
	A6	Route planning should get smarter.	Hard to verify

Table 2: Business goals categorized by category

1.3 Core functionality

The improved Västtrafik service will make traveling easier, safer, and more convenient for passengers. It will also help Västtrafik get useful information to improve their services. The main functions are divided into four parts, explained below using simple user stories.

Convenience and Route Planning

- **User Story 1:** As a passenger, I want the app to show height meters and alternative routes (walking, biking) so I can plan my trip better.
- **User Story 2:** As a passenger, I want to see how full the bus or train is and the temperature inside, so I can have a more comfortable trip.
- **User Story 3:** As a passenger, I want to get notifications and alternative routes if there are delays or roadblocks, so I can reach my destination on time.
- **User Story 10:** As a passenger, I want to get presented my most common trips when I open the app, so I can navigate the app faster.

Security and Payment Options

- **User Story 4:** As a passenger, I want to log in with my email instead of needing a Swedish identification number, so everyone, including international students, can use the app.
- **User Story 5:** As a passenger, I want to pay for tickets in different ways exmaple paypal, so it is easier and faster to buy them.
- **User Story 6:** As a passenger, I want the app to work with Mecenat for student tickets, so I can get discounts without problems or delays.

Reporting and Communication

- **User Story 7:** As a passenger, I want to report problems like damages or inconveniences on buses or trams, so Västtrafik can fix them.
- **User Story 8:** As a driver, I want to report traffic problems, roadblocks, or route changes, so the app can inform passengers quickly.

Operational Data and Analytics

- **User Story 9:** As Västtrafik, we want real-time data about passengers and vehicles, so we can make schedules better, improve efficiency, and handle problems faster. Besides these, we deduced the following non-functional requirements:

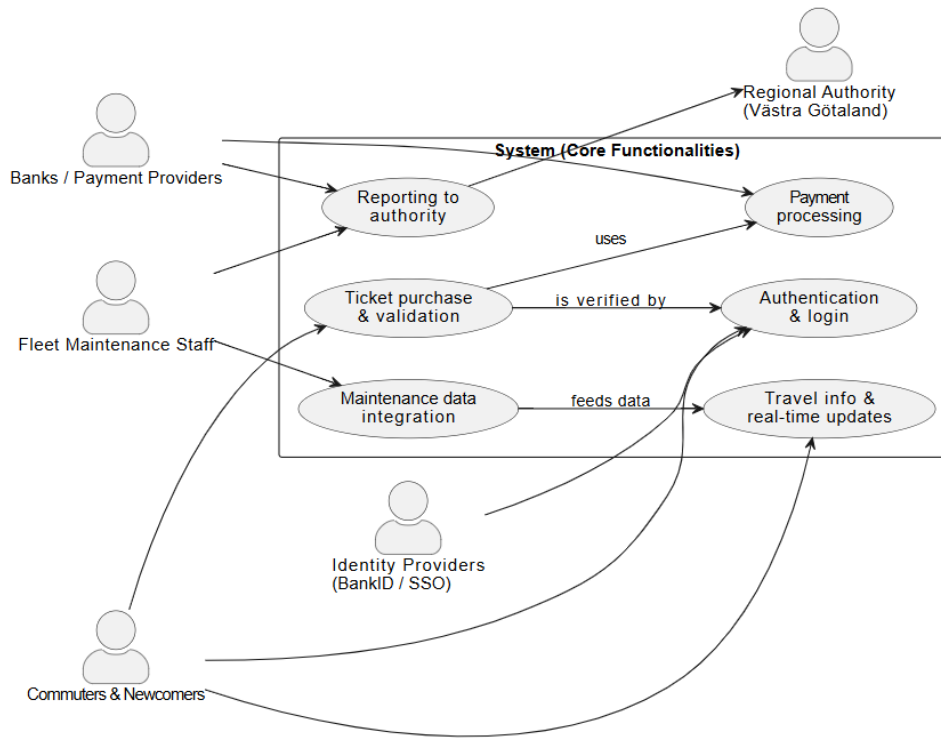


Figure 2: Use case diagram

This core functionality is based on the project requirements and business goals. It addresses the main problems passengers face, improves user experience, and gives Västtrafik useful information to make public transport better.

1.4 Non-Functional Requirements

There are plenty of constraints put on this project that are outside the projects control. Examples of the most notable are: Not being able to access Västtrafik's database, Swedish privacy laws, not knowing Västtrafik's current infrastructure, having limited time and resources. Besides these constraints, we continue with the list of non-functional requirements below:

1.4.1 Non-Functional Requirements List

- Reliability & Availability (Critical):

NFR 1: The app shall provide accurate, up-to-date travel information. These include bus positions, disruptions, and passenger loads.

NFR 2: System uptime shall be at least 99.5% to ensure commuters can depend on the app.

User stories:

As a commuter, I want arrival times updated every 30 seconds such that I can trust the app.

As a tourist, I want to be alerted about disruptions in real-time, otherwise I might miss connections.

⇒ **A1: Enhance travel system:** Robust real-time data

⇒ **A4 & A6: Improve and make route planning smarter:** Reliable alternatives

- **Usability & Accessibility (High Priority):**

NFR 3: The app shall be intuitive for commuters and newcomers, with a clear ticket-purchase process-walkthrough (e.g., not being able to buy a student ticket without proving student discount eligibility).

NFR 4: Multilingual support lowers entry barriers for international tourists and students.

User stories:

As an exchange student, I want to log in via email so I can buy, view, and most importantly recover lost digital tickets without a Swedish ID.

As a tourist, I want the app in English so I don't have to rely on external translations.

⇒ **A2: Reintegrate ticket system:** Reduce confusion

⇒ **A5: Mecenat/student integration:** Simplify onboarding and ticket scanning

- **Performance & Responsiveness (High Priority):**

NFR 5: Core functions (ticket purchase, route planning, reporting) shall respond within 3 sec.

NFR 6: The system shall scale up to match higher loads of rush hours and major events.

User stories:

As a commuter, I want routing information to load within 3 seconds so I don't miss my connection.

As an event attendee, I want the app to function if many others use it at once.

⇒ **A4: Improve planning system:** Fast queries

⇒ **A6: Smarter route planning:** Real-time computation

- **Security & Privacy (Critical):**

NFR 7: Storage of account and travel data must comply with GDPR.

NFR 8: Secure logins (BankID, SSO, email) also allow users without Swedish ID.

NFR 9: Multiple secure payment channels.

User stories:

As a student, I appreciate Mecenat integration into the ticket buying process, so that I do not have switch apps during ticket check and I also feel secure in having an already Mecenat-approved ticket.

As a parent, I want that my child's location data is handled w.r.t. the current laws, so that I can allow my child to use the app.

⇒ **A2: Reintegrate ticket system:** Inclusive authentication

⇒ **A5: Mecenat support:** Safeguard student identity

- **Transparency & Trust (Medium Priority):**

NFR 10: Ticket validity and system status (delays, bus crowding) shall be communicated to users.

This prevents missing rides and further builds trust.

User stories:

As a commuter, I want to see occupation of a bus so I can choose alternatives if necessary.

As a tourist, I want clear ticket validity info so I don't risk a fine.

⇒ **A2: Ticket reintegration:** Ticket clarity

⇒ **A3: Review system:** Open communication

⇒ **A6: Smarter planning:** Clear communication for alternative routes

- **Interoperability (Medium Priority):**

NFR 11: External payment- and identity providers are integrated (BankID, Mecenat, payment services like PayPal).

NFR 12: The app allows for interoperability by using third-party map systems (Google/ Apple Maps), instead of the default Västtrafik integrated map.

User stories:

As a student, I want Mecenat integrated so I can activate my discount directly in the app.

As a commuter, I want to use Apple Maps so I can navigate in a familiar map system.

⇒ **A5: Mecenat integration**

⇒ **A6: Smarter planning:** Better routing in between rides via already omni-present mapping systems

- **Maintainability & Scalability (Medium Priority):**

NFR 13: The APIs are developed to be modular and the documentation supports future feature development (e.g., review system, AI-driven suggestions).

This enables continuous improvement without large rewrites.

User stories:

As a developer, I want modular APIs so we can add features without breaking existing ones.

As a system operator, I want easy monitoring so I can keep the app stable as usage grows.

<i>Quality / Non-functional Factors</i>	Critical	Important	As usual	Unimportant	Ignore
Reliability & Availability	X				
Usability & Accessibility		X			
Performance & Responsiveness		X			
Security & Privacy	X				
Transparency & Trust			X		
Interoperability			X		
Maintainability & Scalability			X		

Table 3: Quality Grid

- ⇒ **A1: Enhanced travel system:** Enables system to sustainably grow
⇒ **A3: Review system:** Future extensibility

The rationale behind our prioritization was derived the following way: Most important are the reliability, usability, and security of the app, as they are directly tied to the adoption of the app, the reduced entry barriers of the app and the trust in the app, respectively. Second-most important was the performance and transparency, as they are important for the commuter satisfaction and therefore customer retention. Last, less important than the others, is the interoperability and maintainability. They are long-term goals, which aim for adaptability and ecosystem integration.

2 User Requirements Specification

This section describes both requirements and prioritization. First, it details the data requirements, focusing on extending Västtrafik's database, specifying the tables (As seen in Figure 3) needed to fulfill the functional requirements. Meaning, that functional requirements were established first, with data requirements being derived from them subsequently. Secondly, the document describes the functional requirements and links them to their respective business goal. Additionally, they are traced in section 4. Finally, the section details performance requirements and prioritization summary, explaining how the requirements were ranked. For prioritization, the top ten and the hundred-dollar methods were chosen as they were less complex to implement and are oriented towards stakeholders. For details regarding how prioritization went for each stakeholder, see Appendix B.

2.1 Data requirements

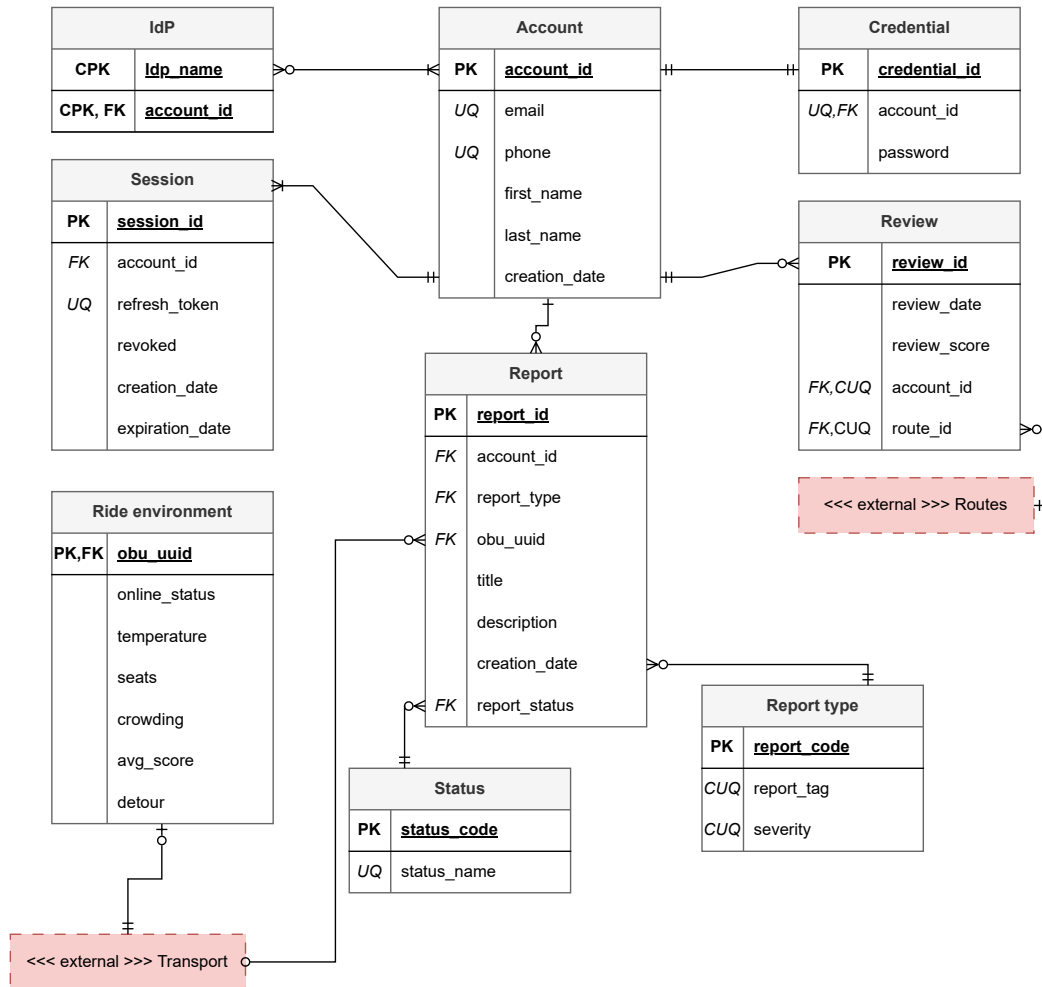


Figure 3: High-level Entity Relationship Diagram: Västtrafik Database Changes

Data dictionary

Class: Ride environment

Ride environment is a snapshot of the ride experience for Västtrafik's transit vehicles. Ride environment therefore includes, operational status (detours and crowding), comfort (temperature, seats), and service (passenger score).

Examples

- Temperature is gathered from the OBU every X minutes. User clicks on a transport and gets temperature from the database.
- User searches for routes on Västtrafik's services, each entry has a review score and number of reviews gathered from the database.
- When a user clicks on a transport to see it's arrival time, they see that the transport has a tag indicating that it is taking a detour.

Attributes

obu_uuid:	<i>String, FOREIGN KEY.</i> A unique identifier from the on-board unit (OBU), provided the first time the OBU connects to the Västtrafik servers.
online_status:	<i>Boolean, BOOLEAN.</i> True or false indicating if the bus is connected to the Västtrafik servers (from an OBU response).
temperature:	<i>Number/Empty, INT8/NULL.</i> Degrees Celsius inside the bus periodically from the OBU. Empty if not provided.
seats:	<i>Number/Empty, UINT8/NULL.</i> A non-negative number of seats from the OBU if available, otherwise empty.
crowding:	<i>Number/Empty, ENUM/NULL.</i> An enum indicating how crowded the riding environment is. Shall be based on usage metrics.
avg_score:	<i>Number/Empty, UINT8/NULL.</i> 0–100 average review score from users. Is empty if no reviews.
review_num:	<i>Number, UINT.</i> A non-negative number of user reviews, zero if none.
detour	<i>Boolean, BOOLEAN.</i> Indicates if the driver has activated detour mode on the vehicle.

Class: IdP

An IdP object is a table that contains details about accounts and their identity providers.

Examples

- A user decides to create an account, and links their email with a Meccant ID.

Attributes

idp_name	<i>Text, ENUM.</i> Name of identity provider linked to an account. idp_name shall be based on which identity provider the user is able to link to the account. Valid values are exclusively Mecenat and BankID.
account_id:	<i>Text, FOREIGN KEY.</i> Account id is a unique identifier used to see which IdPs have been linked to which accounts.

Class: Review

A review describes which *account* rated it and which route was rated.

Examples

- A user with an account creates review on a route.
- A user with an account wants to view their reviews. The review score and review date for each route is fetched from the database and displayed in the front-end.

Attributes

review_id:	<i>Number, IDENTITY.</i> A unique increasing number generated from an account creating an review.
review_date:	<i>String, TIMESTAMP.</i> A date showing when an account left a review. If the review is changed, this date will be updated with the new date. The date will generated when inserted into Västtrafik's database.
review_score:	<i>Number, UINT8.</i> A number from 0 to 100 (Cannot be negative, or NULL) that represents the score that an account gave to the route. The score will be created from account input.
account_id:	<i>String, FOREIGN KEY.</i> A UUID that connects the review to the account that made the review.
route_name:	<i>String, FOREIGN KEY.</i> A string holding the route name of the transport. Cannot be NULL or empty string.

Class: Sessions

A session is a period of time of which an authenticated user can use an account and the tickets connected. Moreover, the session is kept alive by tokens that acts as proof of identity until the session expires or ends.

Examples

- When a user opens the app and is already logged in, the app checks for a valid access token. If its not valid it tires to get another one.

Attributes

Session_id:	<i>String, UUID.</i> A randomly generated UUID for a session refresh token. Will be generated when a user requires a new refresh token.
account_id:	<i>String, UUID.</i> A UUID connected to the account that has the session.
refresh_token:	<i>String, TEXT.</i> The refresh token is hashed by the server when a user logs in and does not have a refresh token or their old token has expired.
revoked:	<i>Boolean, BOOLEAN.</i> A boolean value indicating if the refresh token has been blocked. Is set by a developer with access to the database.
creation_date:	<i>String, TIMESTAMP.</i> The date showing when the session was created.
expiration_date:	<i>String, TIMESTAMP.</i> The date when the refresh token and the session expires. If it is expired the user will need to log in again.

Class: Credential

The credential stores the authentication details that allow a user to log into an account.

Examples

- A user creates an account with a password and email. The password is stored in the credential table.

Attributes

credential_id:	<i>String, UUID.</i> A UUID generated from when a user creates an account.
account_id:	<i>String, FOREIGN KEY.</i> A UUID that references the account with the password. One account can only have one password credential.
password:	<i>String, TEXT.</i> A hashed password a user shall use to login to their account. Provided by user when they create the account or when they change it.

Class: Report

An account makes a report and tries to describe a specific problem with the transport.

Examples

- A user notices that the window at the back of the bus is broken. Creates a report to Västtrafik regarding this problem.

Attributes

account_id:	<i>String, FOREIGN KEY.</i> A UUID connected to the account that made the report.
report_type:	<i>Number, FOREIGN KEY.</i> A foreign key containing the report code. The code is based on what type of report the account made.
obu_uuid:	<i>String/Null, FOREIGN KEY/NULL.</i> The report is linked to a specific transport via a UUID generated from the transport option selected during report submission. However, can be null if the account did not select a transport.
title:	<i>String/Null, TEXT/NULL.</i> Title of the report imputed at during report submission. Can be null if the submitted report does not contain any title.
description:	<i>String/Null, TEXT/NULL.</i> Provide additional information about the report. Entered by the account that submitted the report. Can be null if no additional description is needed.
creation_date:	<i>String, TIMESTAMP.</i> Automatically record the date when the report is submitted.
report_status:	<i>Number, FOREIGN KEY.</i> Report status is a status code that determines the status tag visible in the app, editable only by support staff. Status code is required but may be empty

Class: Status

Status indicates whether support is working on a user's report.

Examples

- A user notices that the window at the back of the bus is broken. Creates a report to Västtrafik regarding this problem. A support staff marks the report indicating that they are working on it.

Attributes

status_code:	<i>Number, SERIAL.</i> A code linking to a status. New codes are added by developers.
status_name:	<i>String, TEXT.</i> A text label displayed within the app to indicate a reports current status. Tags are manually added to report by support staff.

Class: Report type

Report type categories incidents by severity and type of issue.

Examples

- A user notices that the window at the back of the bus is broken. Creates a damage report with high severity.
- A user sees a broken seat and creates a low-severity damage report.

Attributes

report_code:	<i>Number, SERIAL.</i> A code linking to a report type. New codes are added by developers.
report_tag:	<i>String, TEXT.</i> Selects the type of issue or topic the user is reporting.
severity:	<i>String, ENUM.</i> Severity level selected by the user when submitting the report.

Class: Account

An account lets a user save their tickets and access them across all of their devices. Moreover, the account table contains the meta data related to the account.

Examples

- A user wants to log into their account to access their purchased tickets. Then they choose to enter their email and password to log in.
- A user has not linked their account to Mecenat. When they purchase a student ticket, they will receive a warning that they have not linked their account to Mecenat. Also, stating that the user shall be able to show a valid Mecenat ID.

Attributes

account_id:	<i>String, UUID.</i> Account ID is a UUID that is generated when a user creates an account.
email:	<i>String, TEXT</i> During account creation the email address should be validated and shall match a defined email regex pattern.
phone:	<i>String, VARCHAR(16)</i> A user can sign up using a phone number. If the user does so, it shall follow a defined regex pattern, just like email.
first_name:	<i>String, TEXT.</i> The user's first name is entered during account creation.
last_name:	<i>String, TEXT.</i> The user's last name is entered during account creation.
creation_name:	<i>String, TIMESTAMP.</i> Contains the date the account was created. Is automatically created when submitted to the database.

2.2 Functional requirements

Provide a list of features or task descriptions that give detail to the core functionality in Part 1 (High-Level Description). Make sure that each functional requirement relates to business value and its importance to particular stakeholders as well as project success. You could consider user stories here, but the section should provide more detail than Section 1.3. Perhaps use the user stories in Section 1.3 as the Task Name of your task descriptions and then add the additional information for a task description, task and support, or even screens and prototypes (but then, perhaps start working on your UI Prototype in Section 3.2 and rather provide strong tracing to the screens in that prototype instead to these task descriptions). Rely on L4 content to shape the content here.

FR 1: The system shall allow passengers to plan a trip by supporting Task 1.

Task 1	Plan trip with alternative routes - User Story 1
---------------	--

Purpose:	Support route planning by including walking, biking and elevation data.
Business goal:	A1
Trigger:	User searches for a route.
Pre-condition:	User has internet connection.
Frequency:	Users might use this daily.
Sub-tasks:	<ol style="list-style-type: none">1. User selects route2. Show user available travel alternatives3. User selects specific trip4. Show user the details of selected trip
Example Solution:	Display routes that do not include Västtrafik's transportation such as walking and biking, along with elevation data.
Variants:	<ol style="list-style-type: none">1a. Display "No elevation data available" if there is no elevation data available.

FR 2: The system shall allow passengers to check ride environment(temperature, crowding) by supporting Task 2.

Task 2	Display ride environment - User Story 2
Purpose:	Support route planning by displaying temperature and crowding data for each ride in route.
Business goal:	A1, A4, A6
Trigger:	User searches for a route.
Pre-condition:	User has internet connection.
Frequency:	Users might use this daily.
Sub-tasks:	<ol style="list-style-type: none">1. User searches for route.2. Show user available travel alternatives, alongside temperature and crowding data.
Example Solution:	Display crowding and temperature, along with the route.
Variants:	<ol style="list-style-type: none">1a. If a route is selected, the temperature and crowding data is shown for all rides in selected route.

FR 3: The system shall allow users to create an account with email or phone number by supporting Task 3.

Task 3	Account creation with either email or phone number or both - User Story 3
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Purpose:	Support account creation for users without a Swedish identification number.
Business goal:	A2, A3
Trigger:	User tries to create an account.
Pre-condition:	User has either an email or a phone number or both.
Frequency:	Users might use this once.
Sub-tasks:	<ol style="list-style-type: none">1. User tries to sign up2. Prompt user to input either email or phone number or both along with a password3. User inputs either email or phone number or both along with a password4. Create users account5. Automatically log in to the created account
Example Solution:	Add alternatives to identification number that relies solely on either email or phone number or both.

FR 4: The system shall notify users with an alternative route, if checked-in route is disrupted by supporting Task 4.

Task 4	Notify users if route is disrupted - User Story 4
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Purpose:	Aid user if their checked-in route is disrupted.
Business goal:	A1
Trigger:	Users checked-in route gets disrupted.
Pre-condition:	User has checked-in on the route.
Frequency:	Users might use this daily.
Sub-tasks:	<ol style="list-style-type: none">1. User selects route2. Show user available travel alternatives3. User selects specific trip4. Show user details of selected trip4. User checks-in to specific trip
Example Solution:	As soon as Västtrafik gets the information about a disruption, the users get notified, and presented an alternative trip to their destination.
Variants:	<ol style="list-style-type: none">1a. If there are no trips to users destination, display other forms of local transportation, along with walking and biking paths.

FR 5: The system enables users to pay with different payment services, e.g., PayPal, by supporting Task 5.

Task 5	Allow option to pay via PayPal - User Story 5
Purpose:	Add more versatile payment option, to support non-Swedish users.
Business goal:	A2
Trigger:	Payment of any ticket is initiated by the user.
Pre-condition:	<ol style="list-style-type: none">1. User is logged in.2. User has internet connection.
Frequency:	Users might use this daily.
Sub-tasks:	<ol style="list-style-type: none">1. Display yellow PayPal button.2. User clicks the button.3. User is automatically routed to pay via PayPal site.4. User uses PayPal account that is already logged-in on his device, or newly logs into PayPal.4. User is directed back to the payment screen after PayPal payment has been confirmed.5. User is redirected to the "Tickets" tab, where his newly bought ticket is displayed.
Example Solution:	Västtrafik integrates Paypal as a payment option, Paypal handles the internal payment process and vouches for the liquidity of the user.

FR 6: The system supports Mecenat student IDs, integrates its validity check into Västtrafik itself, by supporting Task 6.

Task 6	Integrate support of Mecenat Student ID checks into Västtrafik - User Story 6
Purpose:	<ol style="list-style-type: none">1. Avoid buying youth discount tickets for students without being eligible for it.2. Facilitate ticket checks: Removes the need to present the Mecenat App alongside the youth tickets for students.
Business goal:	A2, A5
Trigger:	User selects to buy any duration of the youth ticket.
Pre-condition:	User selects "I am a student" instead of "I am between 7-19 years old".
Frequency:	Users might use it once per half-year.
Sub-tasks:	<ol style="list-style-type: none">1. User selects youth ticket.2. User is prompted two options: "I am between 7-19 years old." and "I am a student."3. User selects "I am a student" and is prompted with two options: "Link Västtrafik with Mecenat" or "I have physical proof of eligibility (e.g., school ID)".4. User selects "Link Västtrafik with Mecenat".5. User is redirected to Mecenat, where he has to explicitly confirm his wish to link to Västtrafik.6. User is directed back to Västtrafik, where his ticket is marked with a checkmark indicating the user's full eligibility.
Example Solution:	Design the multi-staged questions as sequential pop-ups. Then, redirect to Mecenat.

FR 7: The system allows the user to report problems on the current ride (damaged seats, damaged screens normally showing the route, etc.) by supporting Task 7.

Task 7	The user can press on a report button on the ride that he last searched for. This opens a report form which can be filled out and sent - User Story 7
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Purpose:	It improves the quality of using Västtrafik's services, as damages can be repaired quicker and damaged busses / trams can be substituted in the meantime.
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Business goal:	A1, A3
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Trigger:	User experiences and inconvenience during the ride.
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Pre-condition:	<ol style="list-style-type: none">1. User has searched for a route and is viewing it on their phone.2. Some form of damage / inconvenience is present on the current bus / tram ride.
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Frequency:	Users might use this once a month.
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Sub-tasks:	<ol style="list-style-type: none">1. User sees the damage.2. User clicks on the report button on the current ride.3. User enters a gravity on a scale of 1-10.4. User enters the location inside the bus or tram: front/ middle / back and left/ center/ right.5. User enters a short description (at least one word).6. User hits "submit" button to submit the report.
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Example Solution:	A user which sees a damaged seat navigates the app and hits the report button. Afterwards, he enters all fields. This can be done very quickly. He submits the report.
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FR 8: The system allows the driver to report traffic problems, roadblocks and general rerouting information by supporting Task 8.

Task 8	The driver is able to press a single button in order to report that route changes are being made - User Story 8
Purpose:	It serves to inform non-Swedish proficient users. Users who cannot speak Swedish will not understand the message from the driver through the vehicle's speakers, and instead can rely on the app information.
Business goal:	A1
Trigger:	Driver presses the rerouting button.
Pre-condition:	A traffic problem like an accident or a general roadblock.
Frequency:	Drivers might use this once every two weeks.
Sub-tasks:	<ol style="list-style-type: none">1. Driver presses the rerouting button2. The signal is received at Västtrafik's datacenter and relayed to all smartphones who currently view the route.3. As the app already receives 1-minute interval route data, it will receive this signal within 1 minute.4. The app then displays a warning "Currently being rerouted, pay attention to next stops."5. Any non-Swedish user now knows to pay attention and can get off the bus on the next stop.
Example Solution:	Example Solution
Variants:	<ol style="list-style-type: none">1a. Optionally, a push notification can be sent by the Västtrafik app, to gain user's attention even if running in the background.

FR 9: The system shall allow the user to check-in on a trip by supporting Task 9.

Task 9	The user should be able to check-in on a trip to receive live-updates affecting that trip - User Story 3
---------------	--

Purpose:	This allows Västtrafik to send live-updates about disruptions and provide alternative routes, while additionally providing Västtrafik crowding data.
Business goal:	A1
Trigger:	User clicks "check-in" button on the selected trip.
Pre-condition:	User has selected and views the details of a trip.
Frequency:	Users might use this daily.
Sub-tasks:	<ol style="list-style-type: none">1. User checks in2. Disruption is reported externally or from the driver to Västtrafik3. Västtrafik passes this information to the checked-in user by a notification.
Example Solution:	Add a check-in button for each trip, which adds the user to a pool of users that should be notified with updates affecting the trip.
Variants:	<ol style="list-style-type: none">1a. Add a check-in button for a specific portion of the trip.

FR 10: The system shall recommend the user trips if he opens the app.

Task 10 The app suggests the user a start and stop which the app calculated as highly probable - User Story 10.

Purpose: Regular users / commuters have a certain daily/ weekly/ in general periodic behavior of searching for routes. Potentially spare the user of searching for regular routes.

Business goal: A4

Trigger: User opens app after 20 minutes of inactivity.

Pre-condition: User has used the app in the past, at least once.

Frequency: Users might use this daily.

Sub-tasks:

1. User (re-)opens the app.
2. The app draws information from a light-weight locally trained machine model by querying it with date information and location information.
3. The machine learning model's response of the highest likely route start and stop location is directly displayed to the user as "Recommended route", under the "start" and "stop" search fields.
4. The user can directly use the start and stop location of the proposed route by clicking on it and viewing the search results of all currently available results.

Example Solution: Add three toggle switches in the app options:

1. Use local machine learning to predict routes.
 - 1.1. Use time information to predict routes.
 - 1.2. Use location information to predict routes.

2.3 Detailed Performance Requirements, Specific Quality Requirements, Constraints

Based on your prioritization in Section 1.4, Use PLanguage or similar to describe (only) the important quality attributes (or: non-functional requirements) in detail. Depending on your project and the rest of this document, there are a lot of good options: - Consider tracing to or from functional requirements or data requirements to describe quality in context. - Consider moving some detailed quality requirements to a new Section in Section 3, especially if they relate to internal qualities directly connected to the system.

Based on Table 3, the two critical nonfunctional requirements are *reliability and availability* as well as *security and privacy*. Below, we described how to quantify NFR 1 and NFR 2 which are related to *reliability and availability*, NFR 8 which belongs to *security and privacy*, and lastly NFR 7 which belongs to *performance and responsiveness*, the third important NFR category of our analysis.

NFR 1 Up-to-date travel information [NFR1.InfoAvailability]	How fast is new information available in the app
SCALE	Time from information generation (e.g. accident) to visibility in the app: 0-2 min, 2-5 min, 5-10 min, 10-15 min, 15+ min
METER	Measured in 5 real time scenarios. Accident times can be acquired after recognition of accident.
MUST	Bias towards 0-10 min.
WISH	2-5 min or faster.
PLAN	5-10 min.
PAST	No data on information availability from the past.

Table 4: NFR 1 – in PLanguage

NFR 2 System Uptime [NFR2.SysUptime]	Which percentage of all planned uptime is the system usable/reachable
SCALE	System uptime: 99.75%, 99.5%, 99%, 98%, 97%, less than 97%
METER	Measured over three intervals: Short term (30 days), Mid term (182 days), Long term (365 days). Take the minimum over all three periods.
MUST	Bias towards 99%.
WISH	99.75%.
PLAN	99.5%.
PAST	No data on system uptime public from the past.

Table 5: NFR 2 – in PLanguage

NFR 8 Secure logins [NFR2.SecureLogins]	How secure are the user authentication processes
SCALE	Experiment: Hire white-hackers to target the authentication process: Either they <i>could spoofed a user</i> , or they <i>could not spoof a user</i> .
METER	Hire 5 freelancers (white-hackers) for the following times: 3h, 5h, 8h, 10h, 12h.
MUST	Could not spoof a user.
WISH	Could not spoof a user.
PLAN	Could not spoof a user.
PAST	No data on hacking attacks on Västtrafik from the past.

Table 6: NFR 8 – in PLanguage

NFR 5 Core function's responsiveness [NFR5.PerfResponsiveness]	How fast does the system respond
SCALE	0.5s, 1s, 1.5s, 2s, 3s, 4s, 5s, 5+s
METER	Test Query route and test purchase ticket and test file report 1000 times each. Build the (joint) maximum over all tasks.
MUST	5s.
WISH	1.5s.
PLAN	3s.
PAST	No public data on responsiveness of Västtrafik from the past.

Table 7: NFR 5 – in PLanguage

2.4 Proposed Prioritization

Make explicit how functional requirements were prioritized. Use the subsections here to provide guidance to the supplier about priorities.

Do not hesitate to also reveal here the analysis (e.g., 100 dollar method) and its results.

The following tables show the aggregated results of our two used prioritization methods: 100\$ as well as Top-Ten List:

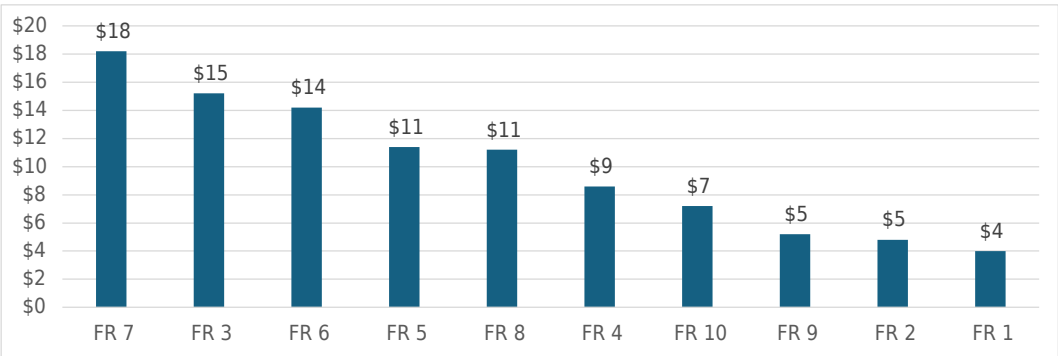


Figure 4: 100\$ bill method for FRs. Averaged over the following five stakeholders: *Commuters, Västra Götalands Regionen, Fleet Maintenance Staff, Newcomers, Identity Providers*

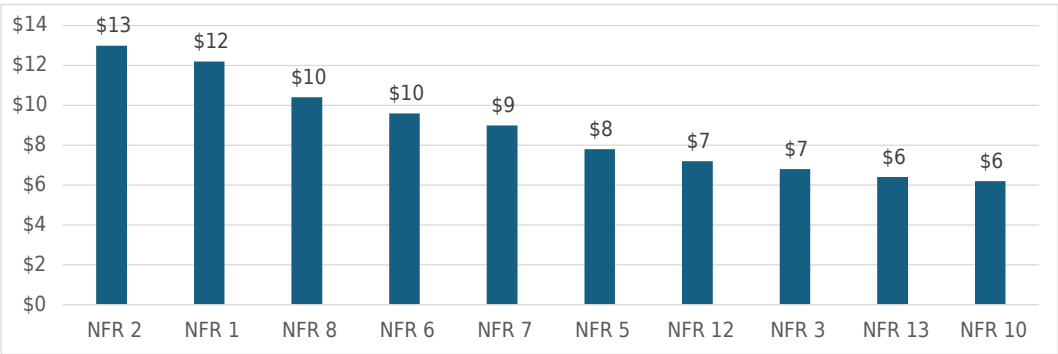


Figure 5: 100\$ bill method for NFRs (cut-off after the 10th highest value). Averaged over the following five stakeholders: *Commuters, Västra Götalands Regionen, Fleet Maintenance Staff, Newcomers, Identity Providers*

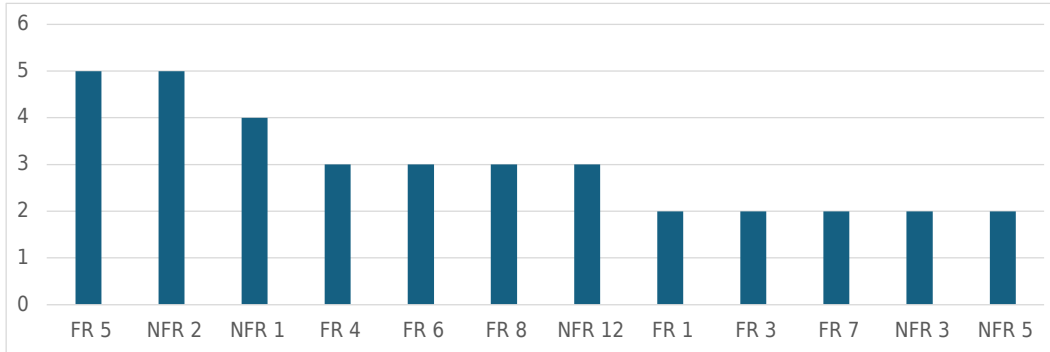


Figure 6: Top Ten method: (cut-off after the 10th highest occurrence). Representative for the following five stakeholders:

Commuters, Västra Götalands Regionen, Fleet Maintenance Staff, Newcomers, Identity Providers

These three graphs show the result of our two employed prioritization methods. The exact data of each stakeholders evaluation as well as the full aggregated dataset can be found in Table 4.3. For the aggregation of each method and instance, we used an equal weight for all stakeholder groups. The results show the following. For functional requirements, FR7, FR3, and FR6 are valued the most by the 100\$ method, view Figure 4. For non-functional requirements NFR 2, NFR 1, and NFR 8 are valued the most by the 100\$ method, view Figure 5. These do not correspond with the results of the Top Ten prioritization. It's top three are FR 5, NFR 2, and NFR 1, view Figure 6. The only outlier is FR 5, which doesn't occur in the top three of the FR, but is placed on rank 4. We therefore decided to focus further on the following functional and non-functional requirements:

Functional requirements

1. FR 7 report form
2. FR 3 acc with email/phone nummer
3. FR 6 Mecenat ID integr.

Non-functional requirements

1. NFR 2 system uptime
2. NFR 1 info availability
3. NFR 8 secure logins without Swedish ID

Although FR 5 occurred in the top ten list of every stakeholder, it is valued substantially less (-3\$) than its competitor on rank three of 100\$ bill ranking for Functional requirements.

2.4.1 Next release

The next release of Västtrafik should implement FR 7 and FR 3, as well as NFR 2. NFR 2 should align with Table 5.

2.4.2 Second release

The second release of Västtrafik should implement FR 6 as well as NFR 1 and NFR 8. NFR 1 should align with Table 4, and NFR 8 should align with Table 6.

2.4.3 Future releases (optional)

NOTE: We will probably omit this in R3. Kept here for possible later usage.

Describe which requirements not to cover in the first two releases. Note, that these could still be important requirements, but perhaps, based on interdependencies and relation to business goals / priorities of certain stakeholder groups, they might not be urgent. Make sure that a reader can understand your decisions.

3 System Requirements

In this part, more detail is provided and requirements are specified from the perspective of the system. Requirements are much closer to specific solution ideas or design decisions.

Modern agile projects may rely on the actual artifact instead, e.g. early version of the software itself instead of prototypes, the data base schema instead of data requirements, and automated tests of some sort. Such projects often suffer from a lack of overview and fail to properly include UX experts in the development or to maintain their data schemas or effective test suites. However, in a typical, fast-paced agile project, this content may get outdated too quickly. Especially low level functional requirements then become cumbersome to maintain. For a supplier, this level of requirements can be crucial to maintain: How are the customer requirements thought to be covered?

For the scope of this course, it is our goal to show some awareness for this perspective, especially to avoid unrealistic requirements in Part 1 and 2. You may focus and provide such detailed requirements only for certain parts.

3.1 System requirements

Detailed requirements from the perspective of a system. This could be feature requirements (“The system shall...”), consider EARS notation (<https://alistairmavin.com/ears/>) If no more detailed requirements can be reasonably added, consider providing acceptance tests

instead (Section 3.4)

SR-ID	System req.	SWR-ID	Software req.	FR-ID
SR1.1	The system shall display the available trips, including trips by foot and bike for chosen route.	SWR1.1	The software shall know the available trips for the chosen route.	FR1
SR1.2	The system shall display elevation data corresponding to the route.	SWR1.2	The software shall have access to elevation data for given trip, through google maps.	FR1
SR2.1	The system shall display the temperature and crowding data corresponding to trips.	SWR2.1	The software shall have access to the temperature and crowding data to every vehicle(?).	FR2
SR3.1	The system shall allow users to create an account with email, phone number or Swedish identification number	SWR3.1	The software shall create a new account with the given input and update the database accordingly.	FR3
SR4.1	The system shall notify users if their checked-in route gets disrupted	SWR4.1	The software shall get live updates regarding disruptions affecting Västtrafik	FR4
SR4.2	The system shall present available alternative routes to the users destination	SWR4.2	The software shall try to find alternative routes to the users destination	FR4

3.2 UI Prototype

<TODO: insert screen for SWR1.1. Suggestions: Three toggles above route list: one for by foot, one for by bike, one for bus/tram. Toggling it interleaves the bus/tram routes with the checked option.>

<>

Sketch the most important UI elements of the project, e.g. screens. Arrange them to show how core functionality and critical attributes are supported. An idea that might work for you is to rely on an activity diagram syntax and replace the activities with prototype screens.

3.3 Detailed Data Requirements

This section specifies the main data handled by the Västtrafik system, its properties, and constraints as needed. Each data item directly supports one or more functional requirements and is based on user needs identified through interviews and tasks.

Data Item	Purpose	Constraints	Linked FR / Task
User Account	Stores user credentials and identification details for app access.	Can be created via email, phone, or Swedish ID; password required; unique user ID; auto-login after creation.	FR3 / Task 3
Ticket	Stores information about tickets purchased by users and their validity for rides. Supports payments through different services like PayPal to allow non-Swedish users to buy tickets.	User must be logged in. After payment via PayPal, the ticket is automatically linked to the user account and displayed in the “Tickets” tab. Supports different ticket types (student, adult).	FR5 / Task 5
Route Information	Includes available travel options for a trip, including walking, biking, and public transport.	Shall include estimated times and elevation data; updated when user searches for a route.	FR1 / Task 1
Temperature Data	Records the current temperature inside each vehicle.	Real-time updates; numeric format in Celsius; Shall refresh at least every minute.	FR2 / Task 2
Crowding Data	Shows how full a bus or tram is.	Real-time updates; numeric percentage or category (low, medium, high); linked to route and vehicle ID.	FR2 / Task 2
Route Disruption Notification	Stores information about delayed or disrupted trips.	Shall trigger notifications immediately for checked-in users; include alternative route suggestions.	FR4 / Task 4
Mecenat Student Verification	Validates student eligibility for discounted tickets.	Shall link to external Mecenat system; store verification result; used only if student ticket selected.	FR6 / Task 6
Passenger Issue Report	Collects user reports about ride issues such as damaged seats or screens.	Includes severity (1–10), location in vehicle, description; timestamped; linked to route and user account.	FR7 / Task 7
Driver Rerouting Report	Captures rerouting or traffic issues reported by drivers.	Single-button input; transmitted to all affected users; timestamped; integrated with route data.	FR8 / Task 8

3.4 Acceptance Tests (Optional)

Describe how to determine whether the product is acceptable with respect to core functionality and critical attributes. This is not a focus within this course, but should be a concern in a real world project. This can be a useful alternative, if no more detailed requirements

can be reasonably added in Section 3.1

4 Traceability

Traceability helps us trace each requirement to its source and monitor it until it is satisfactorily accomplished. First, we start off with high-level business goals (A1-A6), which are then refined into user requirements (FR1-FR9) detailing what Västtrafik, commuters, and newcomers need from the system. Subsequently, these user requirements are taken down further into system requirements (SR) and software requirements (SWR), describing how the system shall behave and what technical solutions must be engineered. This chain of traceability thereby helps us check user needs, assess how requirements changes affect other elements, and ensure that all business objectives have been addressed.

4.1 Business Goals → User Requirements

Business Goal	Descriptions	User Requirement(s)	Rationale
A1	Enhance current travel system (robust real-time data, new features)	FR1, FR2, FR7	Improves daily usability and robustness
A2	Reintegrate the ticket system using improved functionality	FR3, FR5, FR6	helps to expand the accessibility and reduce user confusion.
A3	Integrate a review system	FR3, FR5, FR6	Providing a transparency system and a feedback loop.
A4	Planning system Improvement	FR3, FR5, FR6	Helps to improve reliability on the journey.
A5	Builtin Mecenat or system to validate student through mecenat	FR6	Easier for validation and on-boarding
A6	Smarter and better route planning	FR1, FR4	Long-term improvements in terms of personalization.

Table 8: Traceability map 1

4.2 User's Functional Requirements \rightarrow Software Requirements

User's Functional Requirement	System Requirement	Software Requirement	Notes
FR1	SR1.1, SR1.2	SWR1.1, SWR1.2	Supports A1, A4, A6
FR2	SR2.1	SWR2.1	Supports A1
FR3	SR3.1	SWR3.1	Supports A2
FR4	SR4.1, SR4.2	SWR4.1, SWR4.2	Supports A4, A6
FR5	SR3.1	SWR3.1	Supports A2
FR6	SR3.1	SWR3.1	Supports A2, A5
FR7	SR4.1	SWR4.1	Supports A1, A3
FR8	SR4.2	SWR4.2	Supports A4
FR9	SR4.1, SR4.2	SWR4.1, SWR4.2	Supports A3
FR10	None yet	None yet	Supports A1

Table 9: Traceability map 2

4.3 Traceability Matrix (Business \rightarrow User \rightarrow System)

Goal	User Requirements (FR)	System Requirement(SR)
A1	FR1, FR2, FR7	SR1.1, SR1.2, SR2.1, SR4.1
A2	FR3, FR5, FR6	SR3.1
A3	FR7, FR9	SR4.1
A4	FR1, FR4, FR8	SR1.1, SR1.2, SR4.1, SR4.2
A5	FR6	SR3.1
A6	FR1, FR4	SR1.1, SR1.2, SR4.2

Table 10: Traceability matrix

A Elicitation Documentation

A.1 Semi-structured interviews

Table 11: Interviewees summary

Interviewee ID	Age	Västtrafik usage	Role	Platform
I1	21	Sometimes	Commuter	IOS
I2	22	Frequently	Commuter	IOS
I3	22	Frequently	Commuter	IOS
I4	53	Sometimes	Commuter	IOS

A.1.1 Interview I1 Questions and Answers

Date: 2025-09-18

Question 1: How often do you use Västtrafik’s mobile app or website?

Answer 1: Not often, but when I studied, I used it almost every day.

Question 2: What kind of feature do you use the most on Västtrafik’s app or website?

Answer 2: Checking the bus times or buying tickets is what i mostly use it for, nothing else really.

Question 3: What kind of feature do you use the least on Västtrafik’s app or website?

Answer 3: Everything else in the app, route planning, yeah I do not use it that much.

Question 4: Have you experienced any problems using Västtrafik’s app or website? If so, please explain why.

Answer 4: The main issue is the inaccurate bus times, it shows 5 minutes left, but I do not know if it is the bus driver who just skips the stop, but sometimes the bus has already passed my stop. Even if it says 5 minutes left. I don’t trust them because the bus often doesn’t arrive as scheduled.

Question 5: What’s one feature that Västtrafik is missing?

Answer 5: Real-time GPS tracking for buses. If you tap on the time, it should show a live map of the bus location. For the bus I am going to take.

Question 6: Walk me through your average time using the app. Typical route? are you looking through routes?

Answer 6: First I check the bus time, then I buy a ticket. I prioritize arrival time and total travel time. I don’t care about extra stops unless they delay me. If an route requires

more walking but a shorter travel time, I will choose that route.

Question 7: Was there something confusing in the app? For example, the first time you used it?

Answer 7: No

Question 8: Have you ever missed something due to the app not giving you enough information. Do you trust the information the service provides you with?

Answer 8: Generally I do not trust the information in the app, and I have missed buses due to inaccurate information. Its not the app, it is just that sometimes the bus driver just skips my stop even if i am standing there.

Question 9: Any feature that you would like to see in the app or website?

Answer 9: No, nothing that I can think of, sorry.

Question 10: How does the app feel? Smooth? Funky? easy to understand the layout?

Answer 10: It's functional. I only use two sections: routes and bus times.

Question 11: Have you used or know of any services similar to Västtrafik's app or website? If so, how does it compare? Do they have a feature that Västtrafik does not have?

Answer 11: No I have not used any.

Question 12: If Västtrafik's app or website did not exist, what would you be using instead to find routes or buy tickets?

Answer 12: I probably would have had to memorize the bus schedules or buy tickets in advance. I'd use Google Maps, but it only shows bus stops, not how to get there.

Question 13: Would you like to see a rating system for the bus drivers? how would you like to see it implemented? Could there be any problems with a rating system?

Answer 13: Fake rating could be a problem but I would like to see who's driving the bus and rate them.

A.1.2 Interview I2 Questions and Answers

Date: 2025-09-18

Question 1: How often do you use Västtrafik's mobile app or website?

Answer 1: Every time I take the bus, I use the app, usually twice a day even on weekends. I often use it if I want to go to the city.

Question 2: What kind of feature do you use the most on Västtrafik's app or website?

Answer 2: Looking at the routes and bus times.

Question 3: What kind of feature do you use the least on Västtrafik's app or website?

Answer 3: The "avgångs tavla" I would say.

Question 4: Have you experienced any problems using Västtrafik's app or website? If so, please explain why.

Answer 4: If swish is down, I get an "extra" ticket for 90 minutes, but I get that ticket when I open the app. So if I open it before to check the bus times, my free ticket is often invalid when I want to take the bus. In addition, often buses are not on time, and when they are not on time, the bus driver just sits and waits checking their phone. It happens every day at Amhult Resecentrum.

Question 5: What's one feature that Västtrafik is missing?

Answer 5: No, the app works just fine.

Question 6: Walk me through your average time using the app. Typical route? are you looking through routes?

Answer 6: I generally look at the app for 20 minutes max. I just use it to find the bus with the least time from A to B. I choose the bus with the shortest bus time, but if there is a bus that is late so that both buses arrive at the same time, I usually choose the one after because they have fewer people on board.

Question 7: Was there something confusing in the app? For example, the first time you used it?

Answer 7: No, i think the app is straightforward, just buy tickets and look at the routes. My biggest problem are the bus drivers.

Question 8: Have you ever missed something due to the app not giving you enough information. Do you trust the information the service provides you with?

Answer 8: I trust the buses with GPS, if I see the bus moving on the map. But if it does not move, it usally starts "teleporting" on the map.

Question 9: Any wild feature that you would like to see in the app or website?

Answer 9: I do not really know.

Question 10: How does the app feel? Smooth? Funky? easy to understand the layout?

Answer 10: No it feels good. The app satisfies my needs.

Question 11: Have you used or know of any services similar to Västtrafik's app or website? If so how does it compare? Do they have a feature that Västtrafik does not have?

Answer 11: No, I have never tried others.

Question 12: If Västtrafik's app or website did not exist, what would you be using instead to find routes?

Answer 12: I'd have no alternative, the app is quite essential for me.

Question 13: Does how full the bus is affect your bus choice?

Answer 13: Yes, if there are two buses that take the same time, then I will take the bus that is less full.

Question 14: Would you like to control or see the temperature in the bus?

Answer 14: I would like to see the temperature inside the bus, but I don't want people messing with settings.

Question 15: Notification system of when a predetermined bus comes?

Answer 15: Yes, it would probably be good sometimes.

Question 16: Would you like to see a bus rating system like Uber or Bolt.

Answer 16: Yes, very much.

A.1.3 Interview I3 Questions and Answers

Date: 2025-09-18

Question 1: How often do you use Västtrafik's mobile app or website?

Answer 1: I use it nearly every day.

Question 2: What kind of feature do you use the most on Västtrafik's app or website?

Answer 2: I search up the time for buses and routes, I also often use the feature where you can see the bus on the map with GPS.

Question 3: What kind of feature do you use the least on Västtrafik's app or website?

Answer 3: The time categories e.g., departure and arrival time.

Question 4: Have you experienced any problems using Västtrafik's app or website? If so, please explain why.

Answer 4: Yes I have had problems, I had the problem where you can't see where the bus is on the map.

Question 5: What's one feature that Västtrafik is missing?

Answer 5: Better integration with maps like Apple Maps. I want to see routes to stops

without switching apps. Västtrafik's system works poorly for streets if the place I want to travel to is far away from the nearest bus stop.

Question 6: Typical route? are you looking through routes? Do you choose routes based on certain criteria

Answer 6: I always take the bus with the shortest travel time. If an earlier bus saves time, I will take it. I avoid buses with extra stops unless they're significantly faster. If walking saves 10 minutes, I will walk. I don't choose buses based on proximity to my destination if they take longer.

Question 7: Was there something confusing in the app? For example, the first time you used it?

Answer 7: It is quite unclear when I pay to find what I can buy. If I search for a route and when it is open I get this screen pay for 90min and even though I have chosen student mode in the route section I still get the normal ticket price. There is no difference in price in the route ticket panel even though I have chosen student.

Question 8: Have you ever missed something due to the app not giving you enough information. Do you trust the information the service provides you with?

Answer 8: I do not trust the information because it says that it goes half past but it goes 23 minutes over. The best is that if it does that often I cannot see it on the GPS. So I end up waiting for a bus that has passed my stop. I think that the bus driver has disabled their transponder.

Question 10: How does the app feel? Smooth? Funky? easy to understand the layout?

Answer 10: Feels like a government's app, does not feel smooth but not funky. A "sosse" app

Question 11: Have you used or know of any services similar to Västtrafik's app or website? If so how does it compare? Do they have a feature that Västtrafik does not have?

Answer 11: In Stockholm I used a similar app, It was better, smoother, and easier to understand. But nothing noteworthy.

Question 12: If Västtrafik's app or website did not exist, what would you be using instead to find routes?

Answer 12: I would probably use Apple maps.

Question 13: Does how full the bus is affect your bus choice?

Answer 13: Yes but it depends on what time of day it is. Later in the day, when I'm going home, it does.

Question 14: Would you like to control or see the temperature on the bus?

Answer 14: No, I don't need it.

Question 15: Notification system of when a predetermined bus comes?

Answer 15: No I would not use it because I do not trust the information the app gives me.

Question 16: Would you like to see a bus rating system like Uber or Bolt.

Answer 16: Sure! More forums to complain, certain lines are garbage. There are people in Facebook groups who just write how awful X1 is.

A.1.4 Interview I4 Questions and Answers

Date: 2025-09-20

Question 1: How often do you use Västtrafik's mobile app or website?

Answer 1: At least once or twice a week.

Question 2: What kind of feature do you use the most on Västtrafik's app or website?

Answer 2: I mostly use the Timetable in the Västtrafik app and to pay tickets to travel with Västtrafik. I look at how buses and trams are running. I use the category so I know when it will arrive at a specific time.

Question 3: What kind of feature do you use the least on Västtrafik's app or website?

Answer 3: What I use the least on Västtrafik is the History and the receipt section.

Question 4: Have you experienced any problems using Västtrafik's app or website? If so, please explain why.

Answer 4: No, I've actually never had any problems with the Västtrafik app. It's worked great the times I've used the app.

Question 5: What's one feature that Västtrafik is missing?

Answer 5: What I miss in the Västtrafik app is that you get a notification about the status of the bus or tram. That is, is the bus delayed? Is it on time? Is there a lot of people on the bus? And more.

Question 6: Typical route? are you looking through routes? Do you choose routes based on certain criteria

Answer 6: The criteria I set when choosing a bus or tram are, number one, the tram or bus that arrives the fastest. Number two, is it a time when I know there are a lot of people on the bus. Then I take an earlier bus, when there are fewer people. Then it depends on the destination, where I'm going, which determines which bus I take.

Question 7: Was there something confusing in the app? For example, the first time you used it?

Answer 7: Since I'm not very used to taking the bus, I thought that when I take a trip, the ticket is only valid for that trip. For example, if I go from Ambult resecentrum to Järntorget, then one ticket is valid. And then when I continue from Järntorget to Salgrenska, I thought I had to buy another new ticket. But I've realized in retrospect that then that ticket is valid for 90 minutes, so it's valid within the same zone. But maybe that's obvious?

Question 8: Have you ever missed something due to the app not giving you enough information. Do you trust the information the service provides you with?

Answer 8: I trust the information the app gives me, but I also check the status of the tram or bus on the screens at the bus shelters or tram stops. And what is in the app doesn't always match the status on the screen at the stop.

Question 10: How does the app feel? Smooth? Funky? easy to understand the layout?

Answer 10: The feeling is that it is light and it is easy to switch between different functions in the app without it lagging in any way. Then I don't know if there is a setting on the app where you can choose different languages. It is in Swedish, but I don't know if you can switch so you can choose, for example, English, German, French. You should be able to do that.

Question 11: Have you used or know of any services similar to Västtrafik's app or website? If so how does it compare? Do they have a feature that Västtrafik does not have?

Answer 11: No, I don't know if there is any other way to find out how buses and trams are running. If there weren't paper timetables like there used to be, then you would have had to get one. And where you find that, i do not know.

Question 12: Does how full the bus is affect your bus choice?

Answer 12: Yes, it affects me a lot. And why does it? Well, it has to do with safety. Given the heavy traffic here in Gothenburg, the risk of accidents and serious injuries for passengers increases if it is an overcrowded bus. I try to look at other buses in the timetable because they have some kind of statistics on whether the buses are full at specific times.

Question 14: Would you like to control or see the temperature on the bus?

Answer 14: No, I don't have that need.

Question 15: Notification system of when a predetermined bus comes?

Answer 15: I don't need it, I just want to know that the bus is on time. I want some notification about that.

Question 16: Would you like to see a bus rating system like Uber or Bolt.

Answer 16: No I find no use in that.

A.2 Creativity Workshop

This appendix documents our groups' creativity sessions.

A.2.1 Brainstorming

For the brainstorming session, each group member independently tried to write as many features as possible for the project. Furthermore, it was important that no feature was evaluated during this part of the brainstorming session. After 15 minutes, the group gathered their ideas and evaluated them.

Group member	Features
Dipto Dey	Reward passengers who travels most, Scan your physical card onto your phone, Showing the optimal path to the destination, Personalized Travel Assistant, In-App SOS - purpose of immediate danger notification
Praveen Alavala	Be able to load a physical card through the app, Better in-app customer service, More logical reasoning regarding travel paths
Oskar Meyer	Temperature inside the bus, Dark mode, Ticket soon out of time notification, Bus speed, Water dispenser/ displayed in app
Ludwig Alexandersson	See how the bus looks like, Meccant icon UI thingy, Be able to press on the map to see routes
Jörn Fischbach	Report (line) system (dislike), Select based on scenic route, Like/dislike feature of evaluating trips, Set climate wish (temp) ->majority decision, Simulate the route by sliding a timeline

Table 12: A table showing each group member, and their respective features they came up with during brainstorming.

A.2.2 Hall of fame

For the Hall of Fame, the whole group chose a person, we would describe features related to Västtrafik. We did this for ten minutes. And just like brainstorming, we didn't evaluate

the features until we were done.

Famous person/Character	Features
Superman	Ticket sharing fraud alert, Personal assistant, Safety button that notifies Västtrafik, Custom alerts for favorite routes and stops
Jack Sparrow	Vehicle capacity, Smart notification system, Show google maps path for each walking path Automatically display backroute 30 mins after initial route ended, Animal free bus for allergic people,
Wolverine	Safe driving recognition, Hall of fame (best drivers), See what kind of bus, See the driver like uber, Being able to recharge a physical card thru the app

Table 13: A table showing Hall of Fame method

B Prioritization Data

Below is the full data of our prioritization. First, the aggregated results:

B.1 Aggregated Results

:

Functional Requirement	500\$
FR 7	91
FR 3	76
FR 6	71
FR 5	57
FR 8	56
FR 4	43
FR 10	36
FR 9	26
FR 2	24
FR 1	20

Functional Requirements

Non-Functional Requirement	500\$
NFR 2	65
NFR 1	61
NFR 8	52
NFR 6	48
NFR 7	45
NFR 5	39
NFR 12	36
NFR 3	34
NFR 13	32
NFR 10	31
NFR 4	24
NFR 9	21
NFR 11	12

Non-Functional Requirements

Table 14: 100\$ bill method. Averaged results of five stakeholders:
Commuters, Västra Götalands Regionen, Fleet Maintenance Staff, Newcomers, Identity Providers

Non- & Functional Req.	Top-Ten occurrences [0-5]
FR 5	5
NFR 2	5
NFR 1	4
FR 4	3
FR 6	3
FR 8	3
NFR 12	3
FR 1	2
FR 3	2
FR 7	2
NFR 3	2
NFR 5	2
NFR 6	2
NFR 7	2
NFR 10	2
NFR 13	2
FR 2	1
FR 9	1
FR 10	1
NFR 4	1
NFR 8	1
NFR 9	1
NFR 11	0

Table 15: Top Ten method. Averaged, includes following five stakeholders:
Commuters, Västra Götalands Regionen, Fleet Maintenance Staff, Newcomers, Identity Providers

Requirement	Commuter	VGR	Fleet Maintenance	Newcomer	Ident. provider
FR 1	X			X	X
FR 2			X		
FR 3	X			X	X
FR 4		X		X	
FR 5	X	X	X	X	X
FR 6	X			X	X
FR 7		X	X		
FR 8		X	X		
FR 9			X		
FR 10					
NFR 1		X	X	X	
NFR 2	X	X	X	X	X
NFR 3		X		X	
NFR 4				X	
NFR 5		X			
NFR 6	X		X		X
NFR 7	X			X	X
NFR 8	X				X
NFR 9	X				X
NFR 10		X			
NFR 11					
NFR 12	X		X		X
NFR 13		X	X		

Table 16: Top Ten method matrix. Includes following five stakeholders:
Commuters, Västra Götalands Regionen, Fleet Maintenance Staff, Newcomers, Identity Providers

Below follow all individual 100\$ bill assessments, FR and NFR for each stakeholder.

B.2 Commuter

\$	Req.	Short descript.	Rationale
28	FR 10	Route: AI recommends start/stop	Helps me every day.
13	FR 8	Route: Driver report route changes	Perfect for when i'm using headphones.
12	FR 6	Integr.: Mecenat ID	Mecenat annoys me. Relief.
11	FR 4	Route: Disruption, give alternative	Convenient, will also benefit me often.
11	FR 5	Pay: With PayPal	Neat, well-established in europe, alternative to BankID.
9	FR 9	Route: Check-in for live updates	Also nice for daily usage, but feature without check in already works.
8	FR 3	Login: Email /phone inst. of Swedish ID	It's alright. As a commuter, majority is Swedish / has Swed ID.
4	FR 7	Misc.: Problem report (e.g. damages)	Cool / nice, but most of the times I sit on a functional seat.
3	FR 1	Route: walk & bike & elevation	Nice, but for travel in the city, it does not make too much of a difference.
1	FR 2	Env.: Crowding & Temp	I mean yes, but i can't change these factors anyway.
100\$	Sum		

Table 17: 100\$ Method: Functional Requirements (Commuter perspective)

\$	Req.	Short descript.	Rationale (Commuter view)
21	NFR 1	Rel.: Up-to date info (abt. disturb.)	Important, when I use head-phones.
18	NFR 2	Rel.: System uptime $\geq 99.5\%$	If the system fails, i'm annoyed. Although I know my daily route by heart.
14	NFR 10	Transp.: Ticket validity & delay comm. clearly	That would be really important, esp. as a commuter.
11	NFR 12	Interop.: Third-party map system support	That would be great, I am familiar with apple maps.
9	NFR 5	Resp.: Core functions respond. Within 3s	As commuter, the uncountable times I use this, it has to respond quickly.
8	NFR 6	Perf.: System must scale to match high loads	Same reasoning as with NFR 2 and NFR 5.
4	NFR 8	Sec.: Secure logins without SWE ID	I would kind of appreciate it, but the majority of commuters have SWE ID.
3	NFR 3	Usab.: Intuitive, e.g. ticket purch walkthorugh	I know how the ticket system works. Mecenat Link would be nice tho.
3	NFR 7	Priv.: Acc. and travel data storage \rightarrow GDPR	This is a basic quality that has to be respected. I will sue otherwise.
3	NFR 9	Sec.: Secure Payment channels	This is a basic quality that has to be respected. I will sue otherwise.
3	NFR 11	Interop.: Add. Payment & Ident. Providers	I mean yeah, but I already have BankID connected, so I don't really care.
2	NFR 13	Maintain.: Modular API	Future features are always nice, but the current app is already great.
1	NFR 4	Acces.: Multilingual	It's available in swedish and english. That suffices.
100\$	Sum		

Table 18: 100\$ Method: Nonfunctional Requirements (Commuter perspective)

B.3 Västra Götalands Regionen

FR ID	Description	Allocated (\$)	Rationale (Västra Götalands Regionen)
FR8	Driver can easliy report route changes	28	VGR can more easily get information about possible problems occurring on the road.
FR7	Report forums for a passenger	25	Get more feedback about problems during rides. Increases operational effectivity
FR4	Notify users if route is disrupted	17	Makes taking public transportation smoother.
FR5	Allow option to pay via PayPal	13	Users has more options to buy tickets which increases the likelihood of them buying.
FR3	Account creating with phone or email	5	More accounts means more information that can be gathered about users. This means that VGR can track travel patterns better.
FR9	check-in trip	5	Be able to send out more information to users regarding problems.
FR1	Plan trip with alternative routes	3	Users can choose a more personalized route. Therefore, making public transportation more smooth.
FR6	Mecenat Student ID	2	Helps reduce ticket fraud.
FR10	Probable routes	1	Makes the user experience more smooth but does not help in operational efficiency.
FR2	Ride environment	1	The feature only helps users. Users may choose a route with less crowding. But this reduces operational efficiency as you want a lot of crowding on each bus to be more fuel efficient. Changes user travel patterns based on arbitrary data, and therefore makes it harder to predict user patterns.

Table 19: 100\$ Method: Functional Requirements (VGR perspective)

NFR ID	Description	Allocated (\$)	Rationale (Västra Götalands Regionen View)
NFR1	Accurate travel information	15	Providing good and reliable information requires that the system works well and is fast.
NFR2	99.5% uptime	15	Downtime means massive costs, reducing this is a top priority as a business stakeholder.
NFR5	Response time for core functions	15	Higher response times mean that the system is slow and might be scalable. Hinting at the system might have to be redesigned with a massive cost for VGR.
NFR10	Ticket validity and system status	12	Trust is an important aspect of businesses. Lower trust in VGR might mean lower passenger numbers with means less money.
NFR13	API documentation and modularity	8	Makes the system more sustainable, scalable, and reduces the chance of refactoring. Makes the system less expensive to develop and expand.
NFR3	Intuitive for commuters and newcomers	8	Reduces ticket fraud and therefore increases VGRs profits.
NFR11	More ways to pay and create accounts	10	More accounts means more data, and more ways to purchase tickets means more way to generate income.
NFR6	Scalability (handles rush-hour load)	5	Reduces downtime and makes the system more feature proof. Decreasing costs
NFR9	Secure payment channels	5	Security builds trust
NFR12	Interoperability by using third-party map systems	3	Makes users move away from VGR own developed systems but increase user satisfaction.
NFR4	Multilingual support	3	Increases user satisfaction but does not increase system reliability.
NFR8	Secure logins	3	Swedish users are the primary user base and with identity number we get more and better information. Introducing another way to login makes it harder for VGR to get information like average age and such.
NFR7	GDPR	2	Regulation compliance is mandatory, but GDPR requirements increase costs.

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Table 20: 100\$ Method: Nonfunctional Requirements (VGR perspective)

B.4 Fleet Maintenance

\$	Req.	Short descript.	Rationale
55	FR 7	Misc.: Problem report (e.g. damages)	Directly impacts maintenance by identifying when and what damage occurred.
10	FR 8	Route: Driver report route changes	Can give context for incidents or damage reports during trips.
10	FR 2	Env.: Crowding & Temp	Environmental data may help identify contributing factors to damage or wear.
10	FR 9	Route: Check-in for live updates	Allows maintainers to track crowding better when incidents are reported in real time.
3	FR 3	Login: Email /phone inst. of Swedish ID	Useful for access but not critical for maintenance activities.
3	FR 4	Route: Disruption, give alternative	Could in some rare cases help maintenance get a damaged vehicle repaired faster, but very rare.
3	FR 5	Pay: With PayPal	Financial methods don't impact maintenance much.
2	FR 6	Integr.: Mecenat ID	Minimal impact on fleet maintenance processes.
2	FR 1	Route: walk & bike & elevation	Very limited relevance for maintenance purposes.
2	FR 10	Route: AI recommends start/stop	Since it is personalized and local on the users device it will not affect the information about wear patterns on the vehicles.
100\$	Sum		

Table 21: 100\$ Method: Functional Requirements (Fleet Maintenance perspective)

\$	Req.	Short descript.	Rationale (Fleet Maintenance view)
20	NFR 6	Perf.: System must scale to match high loads	Maintainers must ensure safety and reliability as the fleet grows.
20	NFR 13	Maintain.: Modular API	Helps integrate maintenance tools and future-proof processes.
10	NFR 1	Rel.: Up-to date info (abt. disturb.)	Ensures maintenance reacts to disruptions quickly.
7	NFR 12	Interop.: Third-party map system support	Useful for external integrations with maintenance systems.
7	NFR 2	Rel.: System uptime $\geq 99.5\%$	System reliability is critical for continuous monitoring.
5	NFR 4	Acces.: Multilingual	Could in rare cases provide more data to work with, since there is more people interacting with the product.
5	NFR 5	Resp.: Core functions respond. Within 3s	Does not directly impact fleet maintenance, except it could decrease the time between incidents and report, very slightly.
5	NFR 7	Priv.: Acc. and travel data storage \rightarrow GDPR	Compliance with data handling during maintenance.
5	NFR 8	Sec.: Secure logins without SWE ID	Security in accessing maintenance-related data.
5	NFR 9	Sec.: Secure Payment channels	Indirect relevance through secure systems overall.
5	NFR 10	Transp.: Ticket validity & delay comm. clearly	Indirectly helps to time maintenance during service disruptions.
3	NFR 11	Interop.: Add. Payment & Ident. Providers	Minor relevance to maintenance systems.
3	NFR 3	Usab.: Intuitive, e.g. ticket purch walkthorough	Minimal relevance for maintenance operations.
100\$	Sum		

Table 22: 100\$ Method: Nonfunctional Requirements (Fleet Maintenance perspective)

B.5 Newcomer

FR ID	Description	Allocated (\$)	Rationale (Newcomer View)
FR3	Account creation with email or phone number	20	Newcomers without Swedish BankID need an easy sign-up process
FR6	Mecenat student ID integration	20	Important for international students verifying eligibility
FR5	Payment via PayPal or other services	15	Crucial for non-Swedish users to pay using familiar methods
FR4	Route disruption notification	10	Keeps new users informed and builds confidence
FR2	Display temperature and crowding info	10	Improves comfort and travel decision-making
FR1	Plan trip with alternative routes and elevation	10	Helps unfamiliar users find suitable and understandable routes
FR7	Passenger problem reporting	5	Enables user feedback and quality improvement
FR8	Driver problem reporting	5	Indirectly helps users through faster updates
FR9	Trip Check-in (live updates)	0	Not essential for newcomers; covered indirectly by notifications
FR10	Recommend Trips	5	Helps newcomers quickly find likely routes without searching manually

Table 23: 100\$ Method: Functional Requirements (Newcomer perspective)

NFR ID	Description	Allocated (\$)	Rationale (Newcomer View)
NFR3	Usability (intuitive design)	20	Most critical for onboarding and ease of navigation
NFR4	Accessibility (multilingual/inclusive UI)	15	Vital for tourists and international students
NFR1	Reliability (real-time accurate info)	15	Newcomers depend on accurate, up-to-date travel data
NFR7	Security (safe logins/payments)	10	Builds trust for first-time users
NFR5	Performance (response <3s)	10	Prevents frustration during trip planning
NFR2	Availability (uptime $\geq 99.5\%$)	10	Ensures consistent access for first-time users
NFR8	Privacy (GDPR compliance)	10	Protects identity and location data
NFR6	Scalability (handles rush-hour load)	5	Needed for smooth use during busy times
NFR9	Transparency (ticket validity info)	5	Helps newcomers avoid mistakes or fines
NFR10	Trust (clear system status & updates)	0	Indirectly helps, less visible for new users
NFR11	Interoperability (external providers)	0	Not essential for onboarding experience
NFR12	Third-party map integration	0	Not necessary for first-time usage
NFR13	Maintainability (future extensibility)	0	Internal system concern, not user-facing

Table 24: 100\$ Method: Nonfunctional Requirements (Newcomer perspective)

B.6 Identity Provider

FR ID	Description	Allocated (\$)	Rationale Identity Provider
FR3	Account creation with email or phone number	40	Main service of an IdP. using email and phone number, user will able to create account over there
FR6	Integration Mecenat	35	Another important service which helps international students verifying eligibility
FR5	Allow Payment via PayPal or other services	15	Crucial for non-Swedish users to pay using multiple payment methods
FR1	Plan trip with alternative routes example: walk or bike or elevation	2	Helps unfamiliar users find suitable and understandable routes but minimal relevance for IdP stackholder
FR4	Route disruption notification and give alternative	2	relavent to route finding which again minimal relevance
FR2	Display temperature and crowding info	2	Good feature to have but dont have any connection with me though
FR7	Passenger problem reporting (e.g. damages)	2	Nice feature, but currently i'm not going to care about this
FR9	Trip Check-in live updates	2	Not essential for me , although nice for some
FR8	Driver problem reporting (e.g. route changes)	0	Indirectly helps users not the relevancy is low
FR10	AI Recommend Trips	0	Truly helpful for newcomer, bt no connection is there with IdP

Table 25: 100\$ Method: Functional Requirements (Identity Provider perspective)

NFR ID	Description	Allocated (\$)	Rationale Identity Provider
NFR8	secure login with or without SWE ID or Bank ID	30	Top required, login needs to be conducted securely, including supporting various methods
NFR7	GDPR	25	Required, to store users' data must comply with GDPR
NFR2	Availability (uptime $\geq 99.5\%$)	15	Downtime means massive costs as IdP outage can top the whole system, so we need to ensure system availability (99.5 percent uptime)
NFR12	Third-party map integration	15	Another top required as the system is going to integrate with third-party service, so need to facilitate seamlessly
NFR6	Scalability (handles rush-hour load)	10	Needed for smooth use during peak load
NFR9	Secured payment channels	3	Indirect relevance through secure systems overall
NFR13	Maintainability (future extensibility)	2	Helps integrate maintenance tools and future-proof processes
All other NFR	Maintainability (future extensibility)	0	Internal system concern, not mandatory from the perspective of IdP

Table 26: 100\$ Method: Nonfunctional Requirements (Identity Provider perspective)

References

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