LET’S LINK

Project 2

Music e-marketplace platform - *Let’s Link*

Project 2
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Version 1.0 from 26 October 2022

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Date:	26 October 2022

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Management Summary

The creation of music has really evolved in the last few years, and this is partly thanks to new technologies such as Digital Audio Workstation format, or DAW [1], which allows to work on sounds on the computer. Whether it is the writer, the performer, the beat maker, the producer, the engineer, the record company, the editor, the video maker, the artist, and the CREATOR.

With this as the background, the focus of this work is to create a platform that combines the features of a social network and an e-marketplace, where members can interact with each other and offer their services and digital products. In the context of this project, this platform will serve in a musical context, even if in the future, this could be applied to many other fields than music. The specific goal of this work is to lay the groundwork for the overall platform. The intention is to then realize this platform as a project for the Bachelor thesis.

Contents

1 Introduction

In this section we introduce the project first, then we quickly go through the actual situation and the problems. Then, we explain our overall objectives of the Let's Link platform and our specific objective and what we will deliver at the end of BT3041 Project 2. We also go through the vision of the solution and how we will monetize it represented in the business model canvas.

1.1 Background

The appearance of new players in the music industry has shaken up the habits of consumers and producers alike. Since the arrival of streaming platforms like Spotify, music tends to be consumed in digital form.

This phenomenon can also be observed among music producers. Thanks to the popularization of the Digital Audio Workstation format, or DAW [1], it is now possible to create music without any specific hardware but only with a computer and the needed software. Today you can even have this music production software on your mobile phone. This makes music creation accessible to everyone.

After talking with different actors in the field of music production, several hypotheses have been confirmed, most notably the difficulty in generating a first income from this activity. There is globally a difficulty to acquire a credibility with the various potential customers, to find a secure and reliable means to proceed to an exchange between the customer and the seller (the definition of the customer and the seller will be made more precise in a subsequent chapter).

One might think that a general online sales platform could solve these problems, but the platform itself only solves a part of the challenge. In addition to the technical capabilities, time, and financial investment are required for its development, and it is necessary to implement strategies to attract traffic to the site, such as advertisements, links on forums, etc.

This is where Let's Link comes in, a dedicated e-marketplace and music platform. Music creators, (whether they are engineers, beatmakers, etc.) can create an account for free and start selling their digital music and offering their services online. The advantage of this marketplace is that by grouping different artists on the same platform, users will be able to browse through the different profiles to find digital goods or possible collaborations with other musical artists.

1.2 Objectives

The long-term, overall objective is to create an e-marketplace platform that brings together different actors in the field of music production. For now, the actors of this platform can be classified into 2 groups: the buyers, and the sellers.

The objective with is deliverable of BT3041 Project 2 listed here:

Topic	Description
Objective	
O01	Start the project Let's Link in a way that ensures its long-term success and prepare the implementation phase for Bachelor thesis
Deliverables	
D01	A clear documentation about the project including: – research from user perspective – List of requirements to achieve the MVP

	– Implementation velocity to get an accurate view of the scope that is feasible during Bachelor thesis
D02	Implementation source code with technology stack and architecture to achieve the MVP functionality
D03	BT3041 Project 2 requirements – Presentation – Upload

Table 1

The specific objective of BT3041 Project 2 is to start the project in a way that ensures its long-term success. This includes providing clear documentation about the project, preparing the implementation phase, and acquiring the required knowledge by hands-on exercises with the technology that will be used in the Bachelor thesis to implement the solution. Additionally, by starting with early software development it will be possible to measure the implementation velocity, to get an accurate view of the scope that is feasible during the Bachelor thesis.

1.3 Vision

We use this section to detail a bit more the unique value proposition we determined in the Business plan Lean Canvas section. The main idea is that this contains a merger between the product and the market to achieve a product/market fit.

As the future Let's Link platform is more than a product that can be realized during project 2 and bachelor-thesis alone, this is a start-up idea. Therefore, the following diagram shows a big picture that summarizes the actual vision and unique value proposition of Let's Link. This is just the basis idea and as the project goes on this could change based on the user and market needs. For project 2 and bachelor thesis this will focus on Music part only but in the future, it could be a place where all kind of art skills can take place.

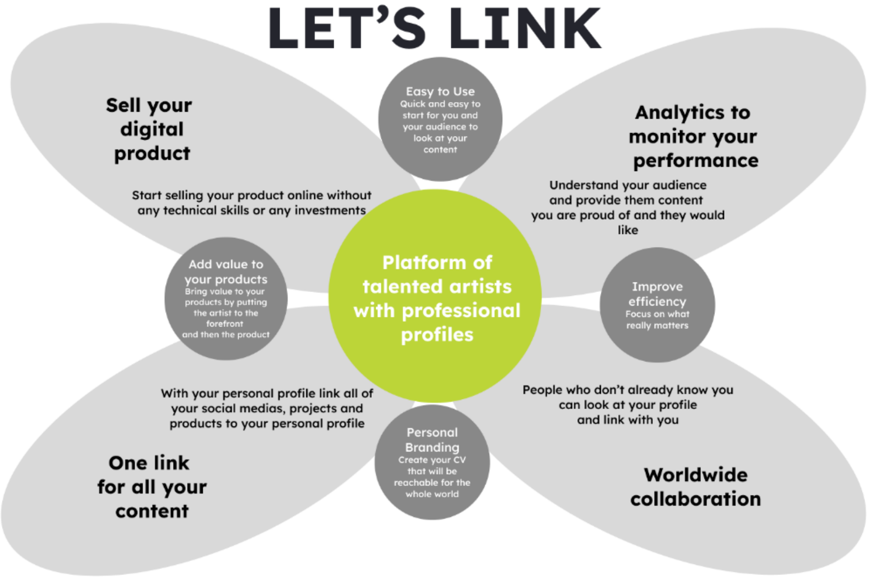
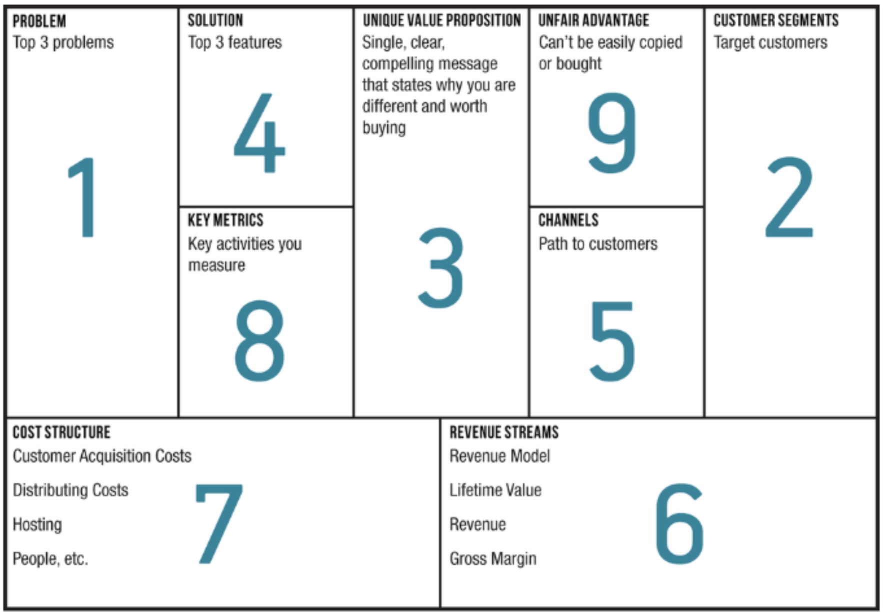

LET'S LINK
Sell your digital product
Start selling your product online without any technical skills or any investments
Easy to Use
Quick and easy to start for you and your audience to look at your content
Analytics to monitor your performance
Understand your audience and provide them content you are proud of and they would like
Add value to your products
Bring value to your products by putting the artist to the forefront and then the product
Platform of talented artists with professional profiles
Improve efficiency
Focus on what really matters
With your personal profile link all of your social medias, projects and products to your personal profile
People who don't already know you can look at your profile and link with you
Personal Branding
Create your CV that will be reachable for the whole world
One link for all your content
Worldwide collaboration

Figure 1

1.4 Business Model (Lean Canvas)

To help us more clearly focus on the solution, and to communicate with external stakeholders, we started by creating the “lean” version of the Business Model Canvas. [2]

This canvas consists of a 1-page adapted business model where on the left is the product part and market part on the right. In the middle is the unique value proposition, e.g., our product. The full details about how to create this canvas are very well explained in *Running Lean* from Ash Maurya [3]. We followed the recommended order to fill up the 9 cells. This means starting from the problem and finishing with the unfair advantage, as shown in the following diagram.



Lean Canvas is adapted from The Business Model Canvas (http://www.businessmodelgeneration.com) and is licensed under the Creative Commons Attribution-Share Alike 3.0 Un-ported License.

Figure 2 Lean Canvas template from Running Lean book [3].

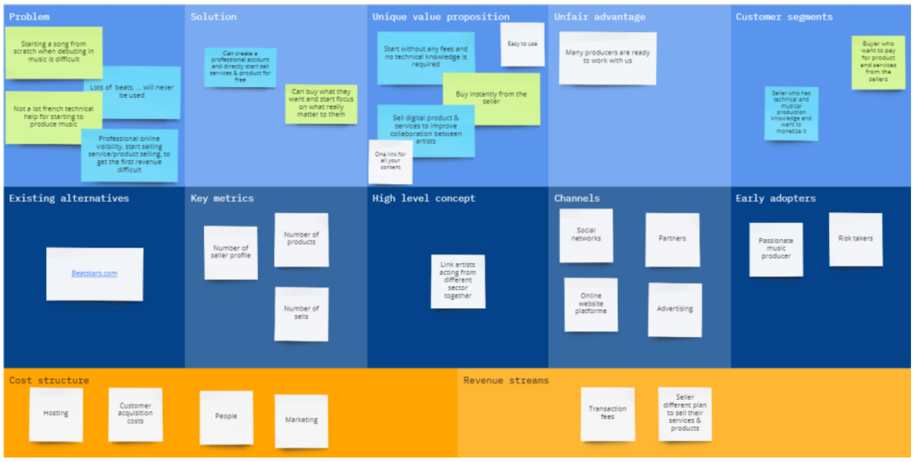

Problem
Starting a song from scratch when debuting in music is difficult
Lots of beats, ... will never be used
Not a lot french technical help for starting to produce music
Professional online visibility, start selling service/product selling, to get the first revenue difficult
Solution
Can create a professional account and directly start sell services & product for free
Can buy what they want and start focus on what really matter to them
Unique value proposition
Start without any fees and no technical knowledge is required
Easy to use
Buy instantly from the seller
Sell digital product & services to improve collaboration between artists
One link for all your content
Unfair advantage
Many producers are ready to work with us
Customer segments
Buyer who want to pay for product and services from the sellers
Seller who has technical and musical production knowledge and want to monetize it
Existing alternatives
Beatstars.com
Key metrics
Number of seller profile
Number of products
Number of sells
High level concept
Link artists acting from different sector together
Channels
Social networks
Partners
Online website platforme
Advertising
Early adopters
Passionate music producer
Risk takers
Cost structure
Hosting
Customer acquisition costs
People
Marketing
Revenue streams
Transaction fees
Seller different plan to sell their services & products

Figure 3

The results are tabulated more clearly in the following table:

N° cells	Section	Content
1	**Problem**	Starting a song from scratch when debuting in music is difficult

		Lots of beats, ... will never be used
		Not a lot of French technical help for starting to produce music
		Professional online visibility, start selling service/product selling, to get the first revenue difficult
	Existing alternatives	Existing alternatives Beatstars.com
2	**Customer segments**	Buyer who wants to pay for product and services from the sellers
		Seller who has technical and musical production knowledge and want to monetize it
3	**Unique Value Proposition**	Easy to use
		Start without any fees and no technical knowledge is required
		Buy instantly from the seller
		Sell digital product & services to improve collaboration between artists
		One link for all your content
4	**Solution**	Can create a professional account and directly start sell services & product for free
		Can buy what they want and start focus on what really matter to them
5	**Channels**	Social networks
		Partners
		Online website platforme
		Advertising
6	**Revenue streams**	Transaction fees
		Seller different plan to sell their services & products
7	**Cost structure**	Hosting
		Customer acquisition costs
		Development
		Marketing

8	**Key metrics**	Number of products
		Number of seller profile
		Number of sells
9	**Unfair advantage**	Many producers are ready to work with us

Table 2

2 Project organization

The goal of this Chapter is to provide clarity on the different people involved. In what follows, we list the stakeholders, the overall planning, the risks identified and how we deal with them.

2.1 Stakeholders

This table lists the key people involved and their roles in Project 2.

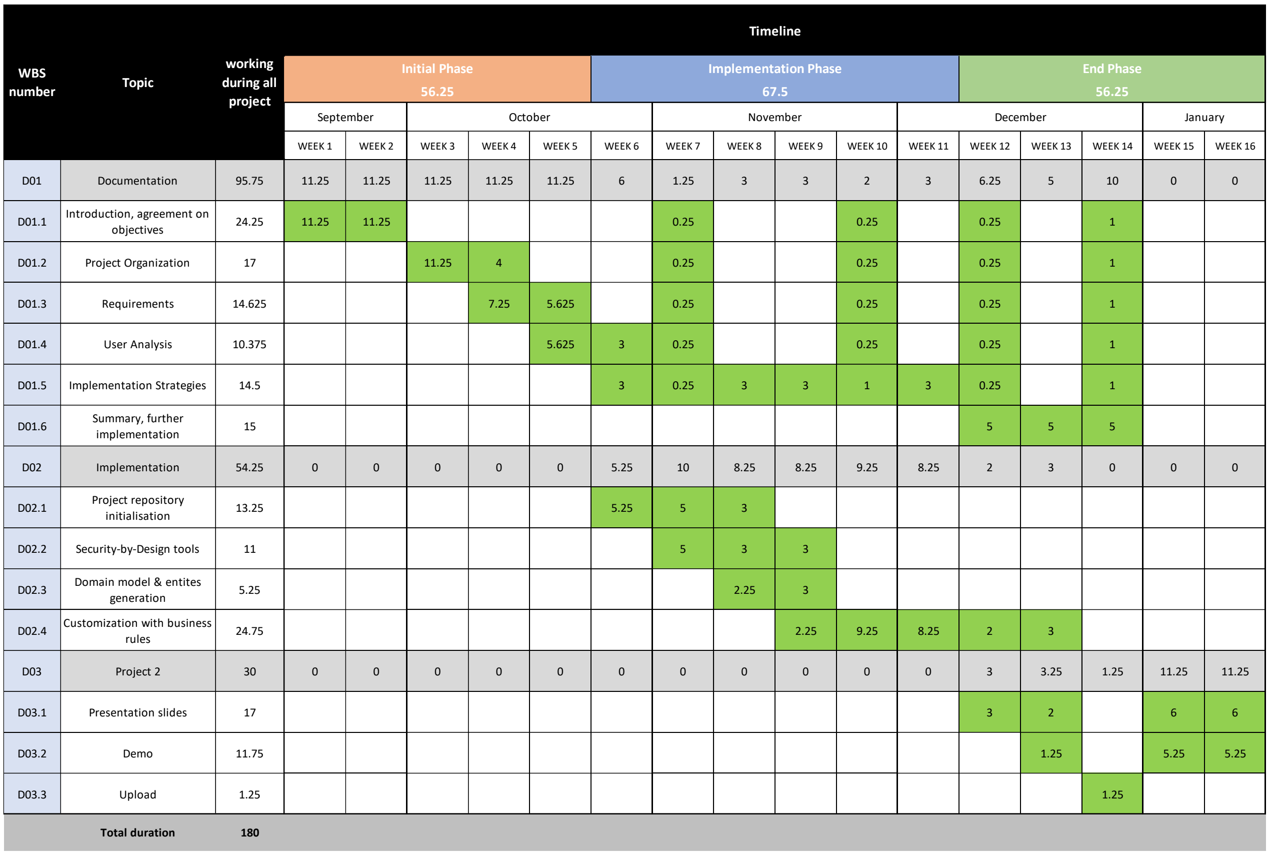
Name of stockholder	**Kenneth Ritley**	**Alexandre Kage**	**Christopher Frick**
Project 2 role	Advisor	Early adopters	Student
Scrum role	Agile Coach	Product Owner (PO)	Developer
Role in project	– project advisor	– help by testing and giving feedback	– To improve skills in developing and managing a project – To lay the groundwork for a possible start-up based on this project – To prepare for the Bachelor-thesis module

Table 3

2.2 Planning

The goal of Project 2 to is first to lay the necessary groundwork for the Bachelor thesis, including creating a minimal e-marketplace website using full stack web-development technologies. Some of the elements present in this report and result of Project 2 are key inputs for the Bachelor thesis.

The intended timeline for Project 2 is shown in the following diagram.



WBS number	Topic	working during all project	Timeline															
			Initial Phase 56.25					Implementation Phase 67.5						End Phase 56.25				
			September		October				November				December				January	
			WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14	WEEK 15	WEEK 16
D01	Documentation	95.75	11.25	11.25	11.25	11.25	11.25	6	1.25	3	3	2	3	6.25	5	10	0	0
D01.1	Introduction, agreement on objectives	24.25	11.25	11.25					0.25			0.25		0.25		1		
D01.2	Project Organization	17			11.25	4			0.25			0.25		0.25		1		
D01.3	Requirements	14.625				7.25	5.625		0.25			0.25		0.25		1		
D01.4	User Analysis	10.375					5.625	3	0.25			0.25		0.25		1		
D01.5	Implementation Strategies	14.5						3	0.25	3	3	1	3	0.25		1		
D01.6	Summary, further implementation	15												5	5	5		
D02	Implementation	54.25	0	0	0	0	0	5.25	10	8.25	8.25	9.25	8.25	2	3	0	0	0
D02.1	Project repository initialisation	13.25						5.25	5	3								
D02.2	Security-by-Design tools	11							5	3	3							
D02.3	Domain model & entites generation	5.25								2.25	3							
D02.4	Customization with business rules	24.75									2.25	9.25	8.25	2	3			
D03	Project 2	30	0	0	0	0	0	0	0	0	0	0	0	3	3.25	1.25	11.25	11.25
D03.1	Presentation slides	17												3	2		6	6
D03.2	Demo	11.75													1.25		5.25	5.25
D03.3	Upload	1.25														1.25		
	Total duration	180																

Figure 3

The anticipated scope for the Bachelor thesis will be refined after the learnings made in Project 2, but a possible scope looks as shown in the following diagram.

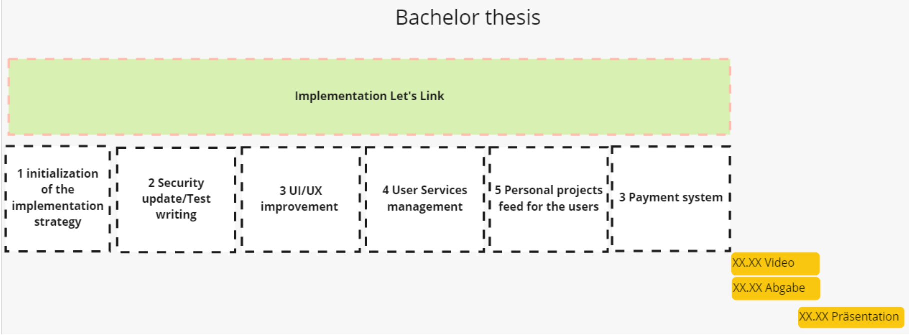

Bachelor thesis
Implementation Let's Link
1 initialization of the implementation strategy
2 Security update/Test writing
3 UI/UX improvement
4 User Services management
5 Personal projects feed for the users
3 Payment system
XX.XX Video
XX.XX Abgabe
XX.XX Präsentation

Figure 4

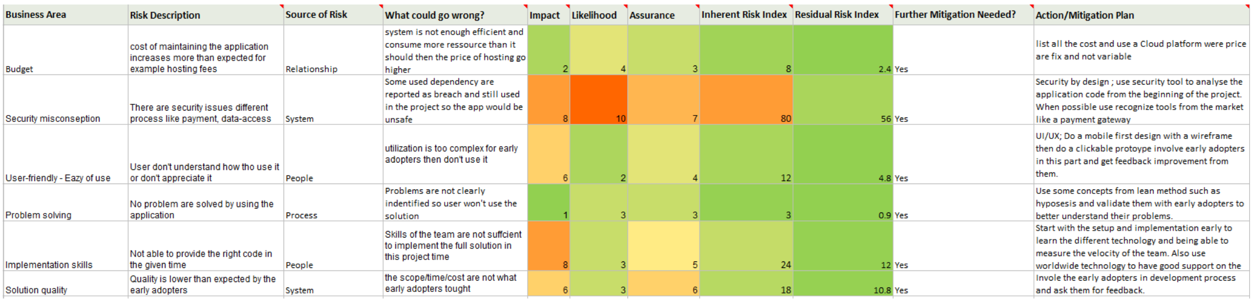
2.3 Risks

In any professional software project, to maximize the chance of success, it is very important to take an early look at the various factors that can prevent success, and to develop the appropriate strategies to deal with them. This is known as risk analysis.

This Chapter discusses our approach to risk assessment and the strategies we developed to address the major risks.

2.3.1 Risk assessment

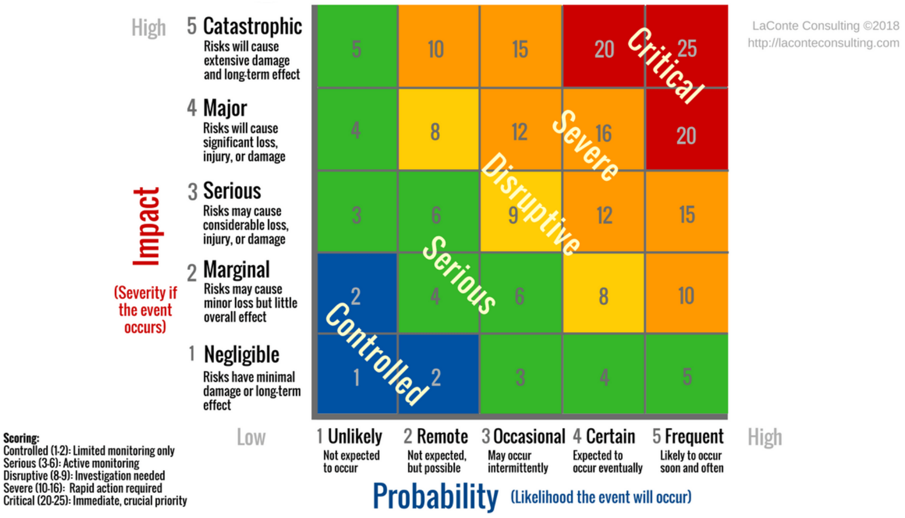
The identified risks are just overall project risks, and they could be more specified and will need to be revaluated in the future. When estimating their impact and likelihood, we noticed that all estimations are relative. Independently of their score we determined specific actions to reduce any impacts to this project.



Business Area	Risk Description	Source of Risk	What could go wrong?	Impact	Likelihood	Assurance	Inherent Risk Index	Residual Risk Index	Further Mitigation Needed?	Action/Mitigation Plan
Budget	cost of maintaining the application increases more than expected for example hosting fees	Relationship	system is not enough efficient and consume more ressource than it should then the price of hosting go higher	2	4	3	8	2.4	Yes	list all the cost and use a Cloud platform were price are fix and not variable
Security misconseption	There are security issues different process like payment, data-access	System	Some used dependency are reported as breach and still used in the project so the app would be unsafe	8	10	7	80	56	Yes	Security by design ; use security tool to analyse the application code from the beginning of the project. When possible use recognize tools from the market like a payment gateway
User-friendly - Eazy of use	User don't understand how tho use it or don't appreciate it	People	utilization is too complex for early adopters then don't use it	6	2	4	12	4.8	Yes	UI/UX; Do a mobile first design with a wireframe then do a clickable protoype involve early adopters in this part and get feedback improvement from them.
Problem solving	No problem are solved by using the application	Process	Problems are not clearly indentified so user won't use the solution	1	3	3	3	0.9	Yes	Use some concepts from lean method such as hyposesis and validate them with early adopters to better understand their problems.
Implementation skills	Not able to provide the right code in the given time	People	Skills of the team are not suffcient to implement the full solution in this project time	8	3	5	24	12	Yes	Start with the setup and implementation early to learn the different technology and being able to measure the velocity of the team. Also use worldwide technology to have good support on the
Solution quality	Quality is lower than expected by the early adopters	System	the scope/time/cost are not what early adopters tought	6	3	6	18	10.8	Yes	Involе the early adopters in development process and ask them for feedback.

Figure 5

With this information, it is possible to generate a risk severity matrix and place risks into it. Here is a model of a risk severity matrix [4]



Impact	1 Unlikely	2 Remote	3 Occasional	4 Certain	5 Frequent
5 Catastrophic	5	10	15	20	25
4 Major	4	8	12	16	20
3 Serious	3	6	9	12	15
2 Marginal	2	4	6	8	10
1 Negligible	1	2	3	4	5

Scoring:
Controlled (1-2): Limited monitoring only
Serious (3-6): Active monitoring
Disruptive (8-9): Investigation needed
Severe (10-16): Rapid action required
Critical (20-25): Immediate, crucial priority

High
Risks will cause extensive damage and long-term effect
Risks will cause significant loss, injury, or damage
Risks may cause considerable loss, injury, or damage
Risks may cause minor loss but little overall effect
Risks have minimal damage or long-term effect
Impact
(Severity if the event occurs)
Critical
Severe
Disruptive
Serious
Controlled
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Low
Not expected to occur
Not expected, but possible
May occur intermittently
Expected to occur eventually
Likely to occur soon and often
High
Probability
(Likelihood the event will occur)

Figure 6 (Source [4])

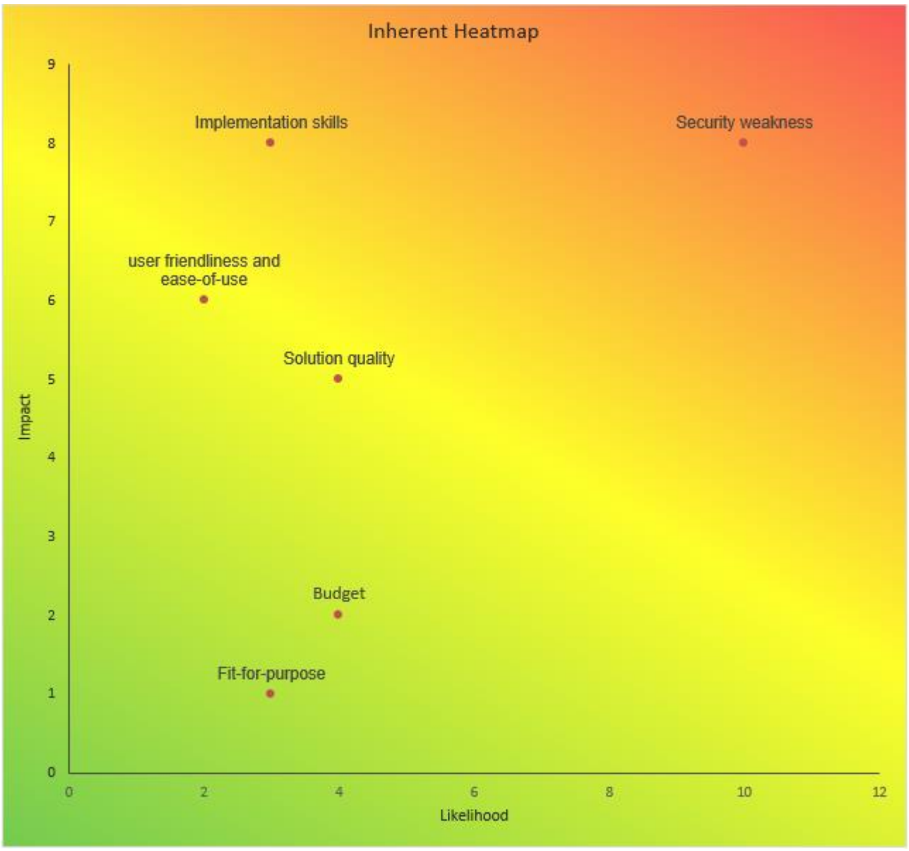


Figure 7

2.3.2 Strategies for dealing with the risks

Here is a summary of the risks in an approximated ordered list from most critical to controlled risk for the business, as well as the strategies for dealing with the risks:

- **Critical**: The most critical risk of this project is that a significant **security weakness** is introduced, and this becomes a showstopper for an e-business platform. Our strategy is to reduce this: using DevSecOps [5] practices and appropriate tools (e.g., ZAP, Snyk, etc.).
- **Severe**: **Implementation skills** are not known at the start of this work, and therefore it is initially impossible to estimate the development efforts. Our strategy to avoid this is to determine the average implementation velocity during Project 2, in order to set the right goals for Bachelor Thesis.
- **Disruptive**: We should be careful with the **User-Friendly- Ease-of-use** and **solution quality.** Our strategy to avoid this risk is to take an agile approach, getting feedback from Early Adopters early in the development cycle; these are prospective users with a good understanding of the business.
- **Controlled**: **Problem solving,** and **budget** risk will be accepted for the moment but still need to be addressed long-term. To reduce impacts from the budget, we can also easily reduce the expenses of this project to a domain name and cloud provider platform; the rest will be developed internally or with free tools available on the market

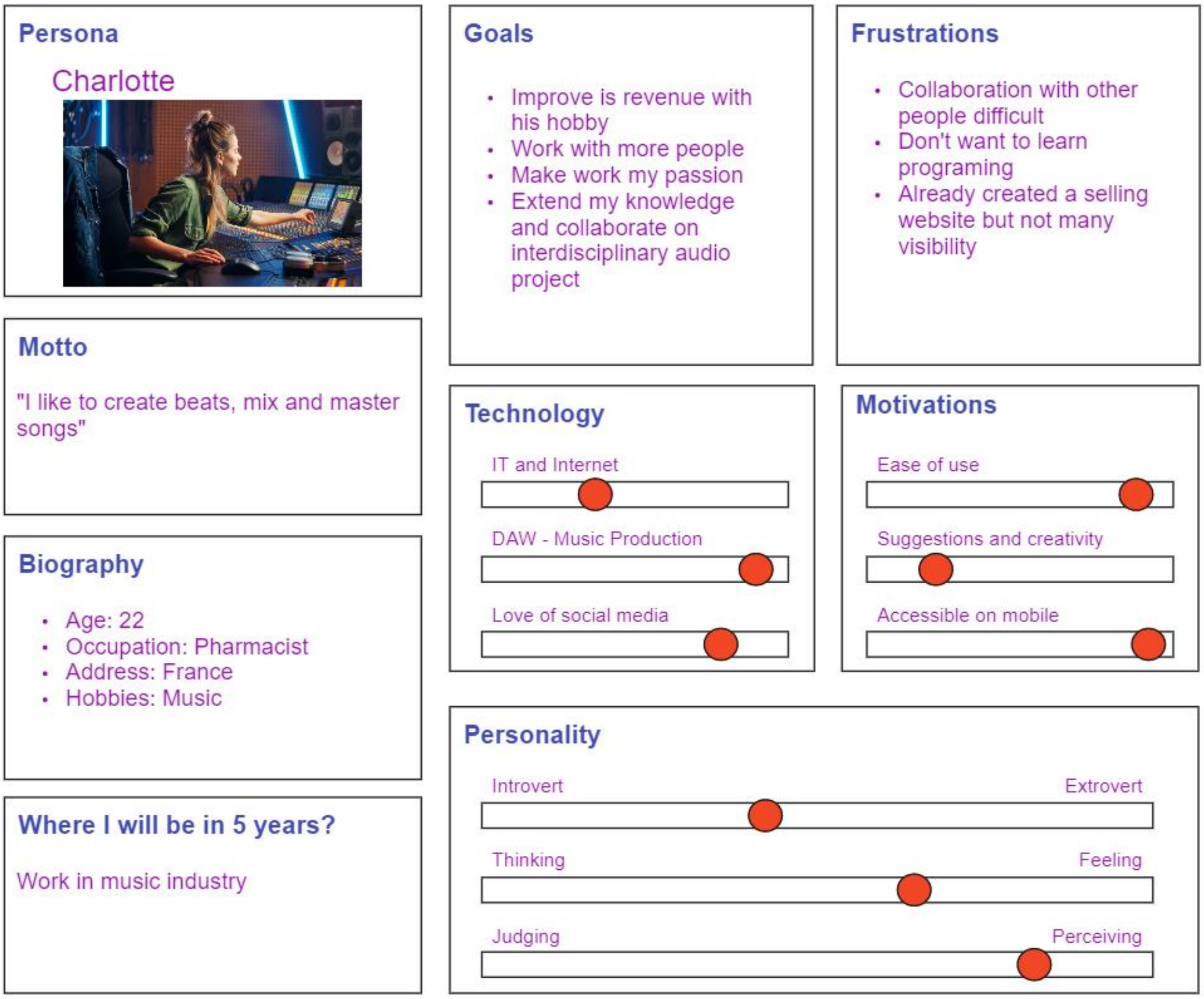
There should be one Lean Canvas for each target customer. As my target customers are acting in the same "industry" we choose to merge the 2 canvases in one and differentiate elements with their color. Our customers group identified are the buyers and the sellers and here is the following result we got.

3 User Analysis

In this Chapter we discuss how we characterized the users, so that we can design an optimal user experience. Here we took a traditional approach, namely, for each identified user group we created a user persona, a user experience journey, a story maps, a clickable prototype, and a clickable prototype navigation with most important screens of the application.

3.1 User Persona

The biggest difference between the sellers and the buyers is their technical know-how as well as their goals and frustrations that overall complement each other. Additionally, the seller has also a technical knowledge that the buyer does not have, as well as a motivating commercial interest, and therefore the seller would be willing to pay for the e-marketplace services.



Persona

Charlotte

Goals

- Improve is revenue with his hobby
- Work with more people
- Make work my passion
- Extend my knowledge and collaborate on interdisciplinary audio project

Frustrations

- Collaboration with other people difficult
- Don't want to learn programing
- Already created a selling website but not many visibility

Motto

"I like to create beats, mix and master songs"

Technology

IT and Internet

DAW - Music Production

Love of social media

Motivations

Ease of use

Suggestions and creativity

Accessible on mobile

Biography

- Age: 22
- Occupation: Pharmacist
- Address: France
- Hobbies: Music

Personality

Introvert – Extrovert

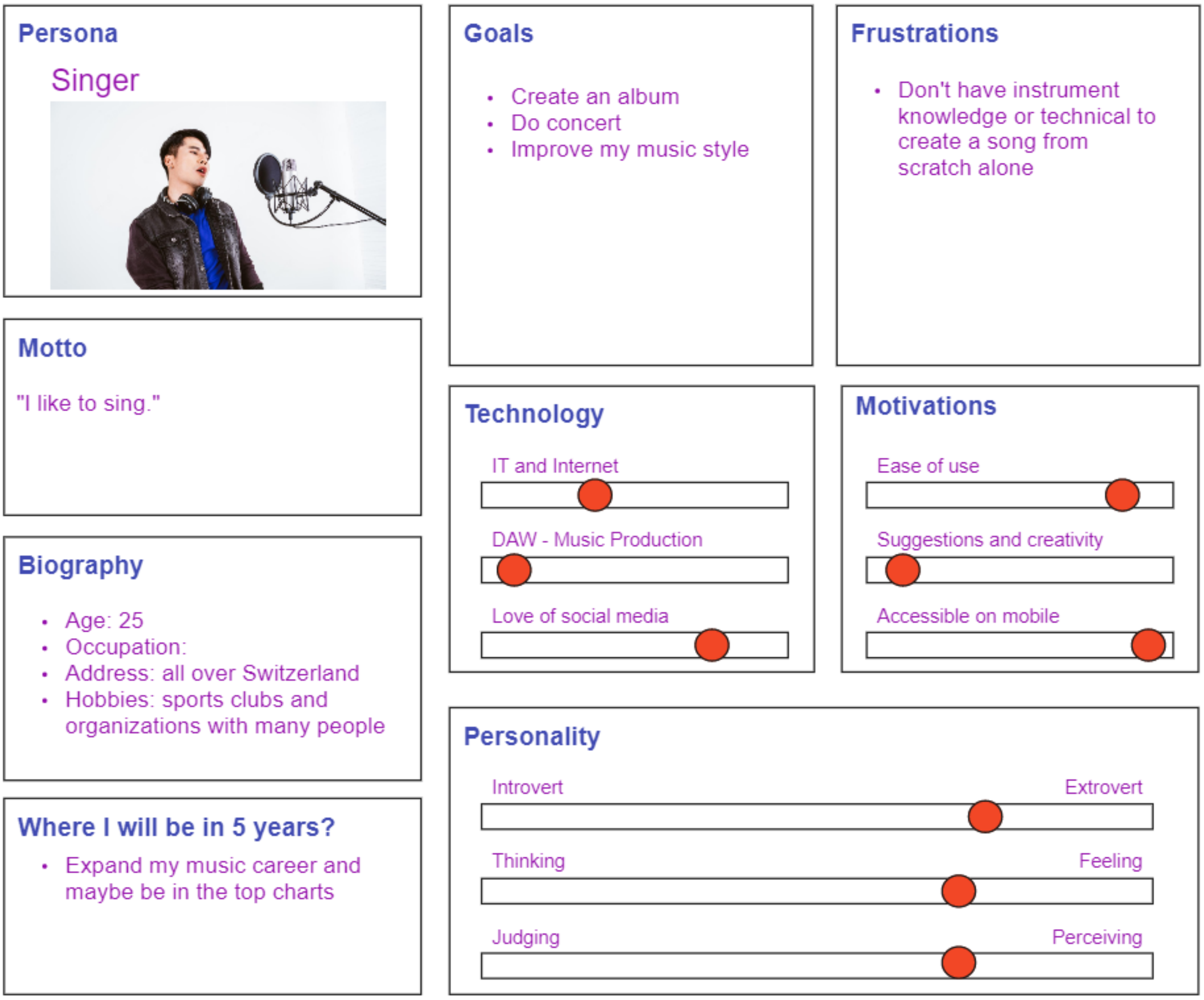
Thinking – Feeling

Judging – Perceiving

Where I will be in 5 years?

Work in music industry

Figure 8



Persona

Singer

Motto

"I like to sing."

Biography

- Age: 25
- Occupation:
- Address: all over Switzerland
- Hobbies: sports clubs and organizations with many people

Where I will be in 5 years?

- Expand my music career and maybe be in the top charts

Goals

- Create an album
- Do concert
- Improve my music style

Frustrations

- Don't have instrument knowledge or technical to create a song from scratch alone

Technology

Motivations

Personality

Figure 9

3.2 User Experience Journey

We start the user journey before the user starts using the application, in order to consider how the user finds the application and starts using it. For all these processes we focus on the emotion of the user, as this will help us design the best experience.

The two key results are shown in the following diagram.

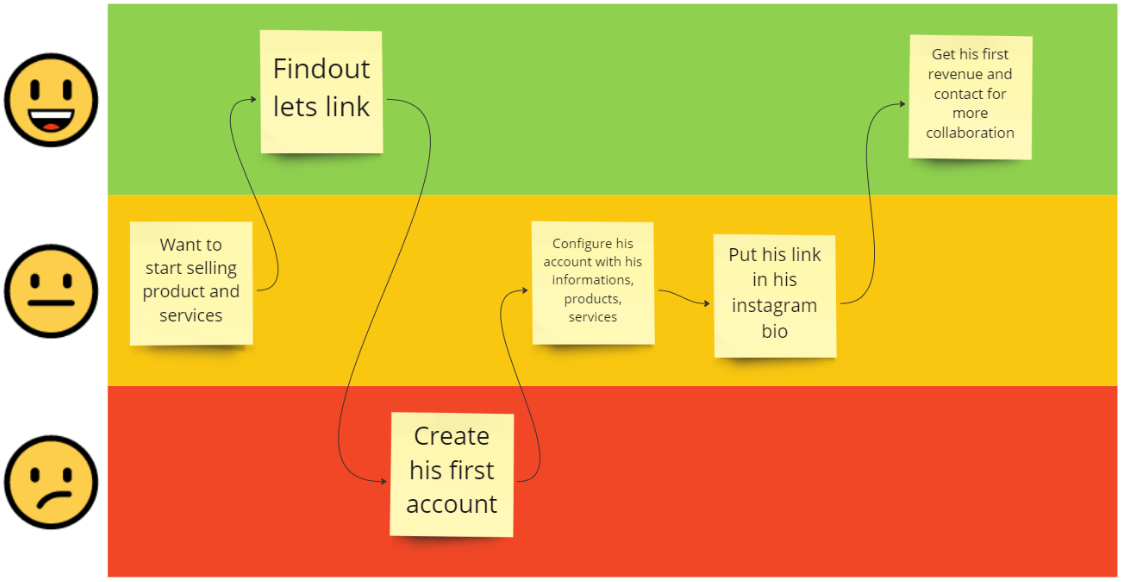

Findout lets link
Get his first revenue and contact for more collaboration
Want to start selling product and services
Configure his account with his informations, products, services
Put his link in his instagram bio
Create his first account

Figure 10 Seller Experience Journey

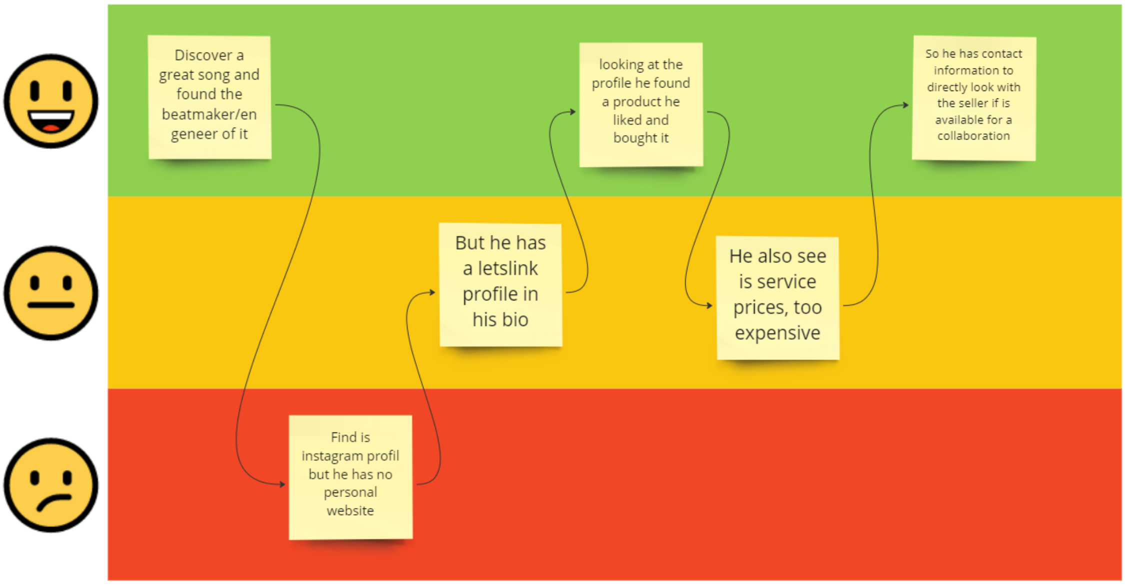

Discover a great song and found the beatmaker/en geneer of it
looking at the profile he found a product he liked and bought it
So he has contact information to directly look with the seller if is available for a collaboration
But he has a letslink profile in his bio
He also see is service prices, too expensive
Find is instagram profil but he has no personal website

Figure 11 Buyer Experience Journey

This will welp us improve the quality of the solution by trying to reduce the pain and frustration of the user.

Based on the results above, we find the following outcomes:

(A) Seller

- Use an ads strategy to find good sellers and select them, so they don't have to search for a solution, we bring it to them
- Make the account creation with the minimal and easy steps
- Start by configuring early adopter's profiles during development process

(B) Buyer

- Try to centralize as much as possible artist on the platform in order the user can directly find artist there

– Set a minimal / maximal price policy

These ideas will make the platform a better place for the buyers and sellers, but it is not the goal to implement these in the MVP created for Project 2.

3.3 Story Maps of project 2

To represent how our users will user our system, we used a technique known as Story maps. [6]

Story maps (also known as user-story mapping) is a Lean UX mapping method. Popularized by Jeff Patton, this method is often used by Agile teams to avoid the traditional technical requirement of a waterfall project. It is a good way to have the big picture of how the digital product flows will fit together. There are 3 types of action with different granularities to produce a Story map:

1. **Activities** represent the high-level tasks that users aim to complete in the digital product.
2. **Steps** sit directly underneath activities and display in sequential order. They represent the specific subtasks that users will go through in the product to complete the activity above.
3. **Details** are the third level of the story map and describe the lowest-granularity interactions that the team anticipates users will experience to complete the step above. (Stack vertically underneath their respective steps in priority order from the top to bottom)

Here is just a graphical example of a story map below:

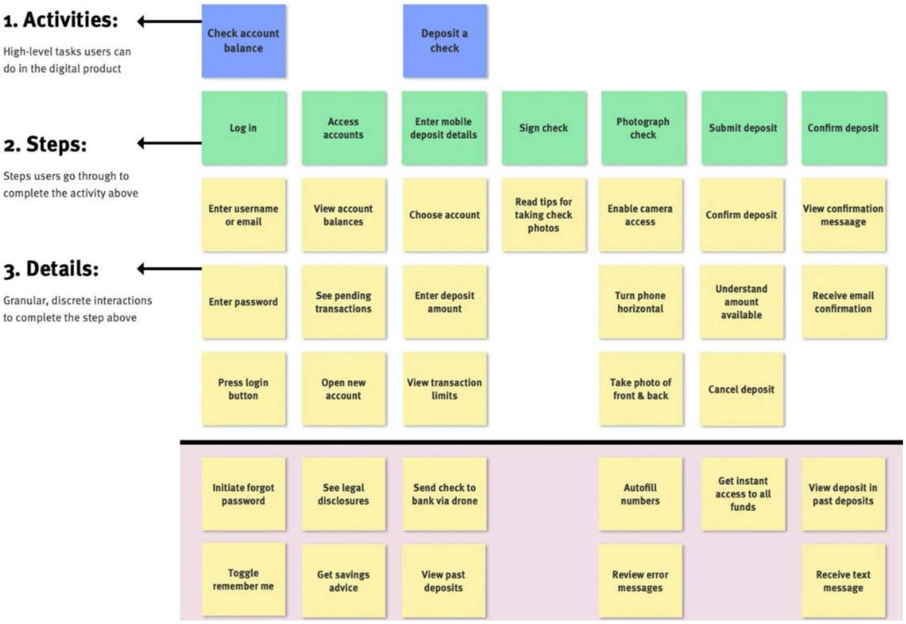


Figure 12 example from Nielsen Norman Group [6]

As result of using this method, we created 2 story maps, one for the seller and one for the buyer below:

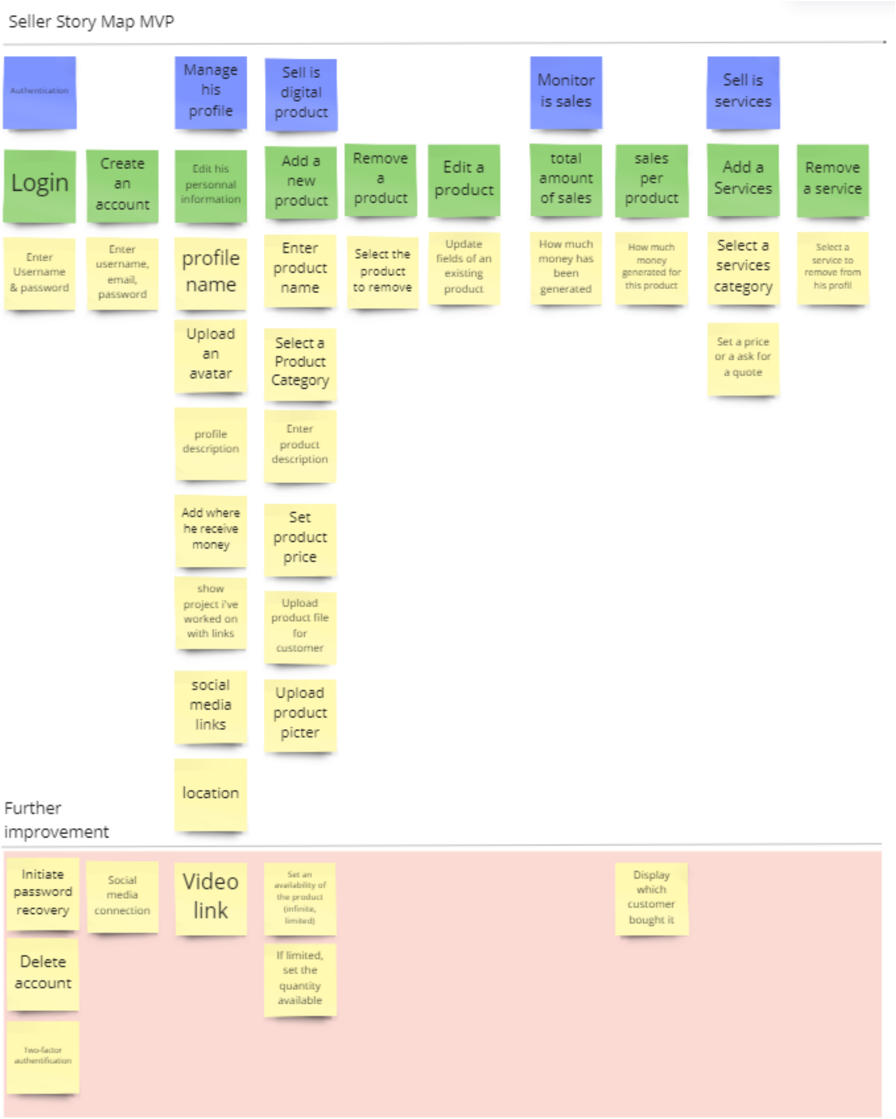

Seller Story Map MVP
Authentication
Manage his profile
Sell is digital product
Monitor is sales
Sell is services
Login
Create an account
Edit his personnal information
Add a new product
Remove a product
Edit a product
total amount of sales
sales per product
Add a Services
Remove a service
Enter Username & password
Enter username, email, password
profile name
Enter product name
Select the product to remove
Update fields of an existing product
How much money has been generated
How much money generated for this product
Select a services category
Select a service to remove from his profil
Upload an avatar
Select a Product Category
Set a price or a ask for a quote
profile description
Enter product description
Add where he receive money
Set product price
show project i've worked on with links
Upload product file for customer
social media links
Upload product picter
location
Further improvement
Initiate password recovery
Social media connection
Video link
Set an availability of the product (infinite, limited)
Display which customer bought it
Delete account
If limited, set the quantity available
Two-factor authentification

Figure 13

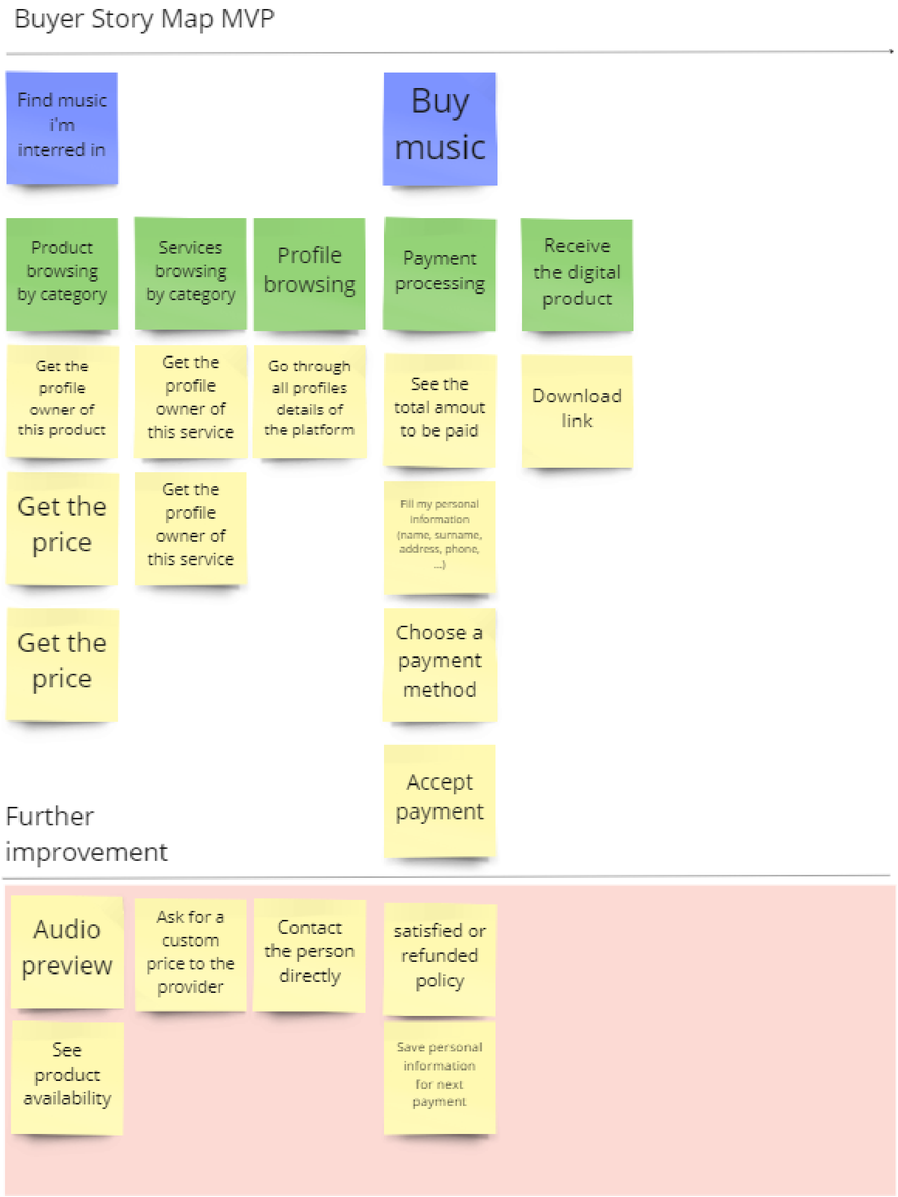

Buyer Story Map MVP
Find music i'm interred in
Buy music
Product browsing by category
Services browsing by category
Profile browsing
Payment processing
Receive the digital product
Get the profile owner of this product
Get the profile owner of this service
Go through all profiles details of the platform
See the total amout to be paid
Download link
Get the price
Get the profile owner of this service
Fill my personal information (name, surname, address, phone, ...)
Get the price
Choose a payment method
Accept payment
Further improvement
Audio preview
Ask for a custom price to the provider
Contact the person directly
satisfied or refunded policy
See product availability
Save personal information for next payment

Figure 14

3.4 Clickable prototype

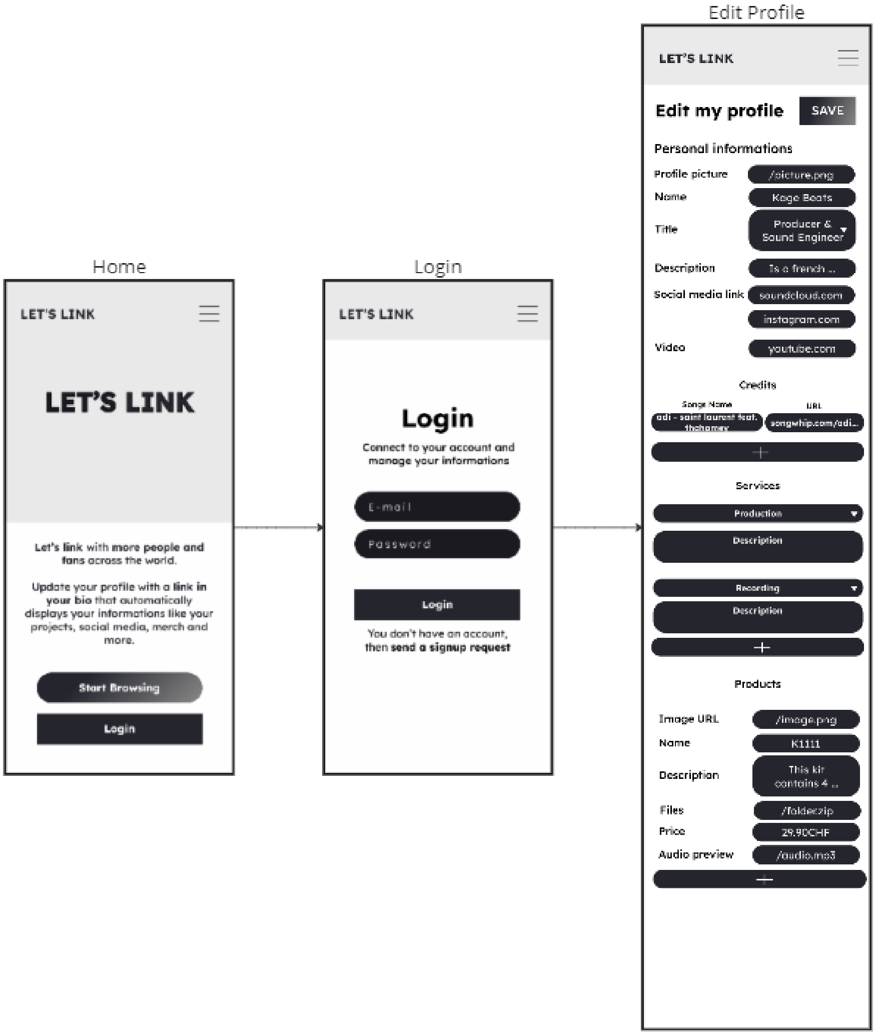
A clickable prototype has been made in collaboration with 3 early adopters. Their profile has been integrated into the application. This is useful because with the help of this prototype, we can have a better idea for the developer and the early adopters how will look the solution.

We designed a flow through the most important screen for the buyers and sellers.

3.5 User clickable prototype navigation

To create the prototype, we used a collaborative tool called Figma [7]. With one link we could in real-time change the application according to early adopter's feedback.

Below are the most important screens needed for buyers and sellers and a short description of what each user group can do.



Let's link with more people and fans across the world.

Update your profile with a link in your bio that automatically displays your informations like your projects, social media, merch and more.

Connect to your account and manage your informations

You don't have an account, then send a signup request

Profile picture: /picture.png
Name: Kage Beats
Title: Producer & Sound Engineer
Description: Is a french ..
Social media link: soundcloud.com
instagram.com
Video: youtube.com

adi - saint laurent feat. thehomey | songwhip.com/adi...

Image URL: /image.png
Name: K1111
Description: This kir contains 4 ..
Files: /folder.zip
Price: 29.90CHF
Audio preview: /audio.mp3

Figure 15 Seller screens

The Seller **can log in and create/edit his or her profile and add new products,** which is a basic functionality to be implemented during Project 2.

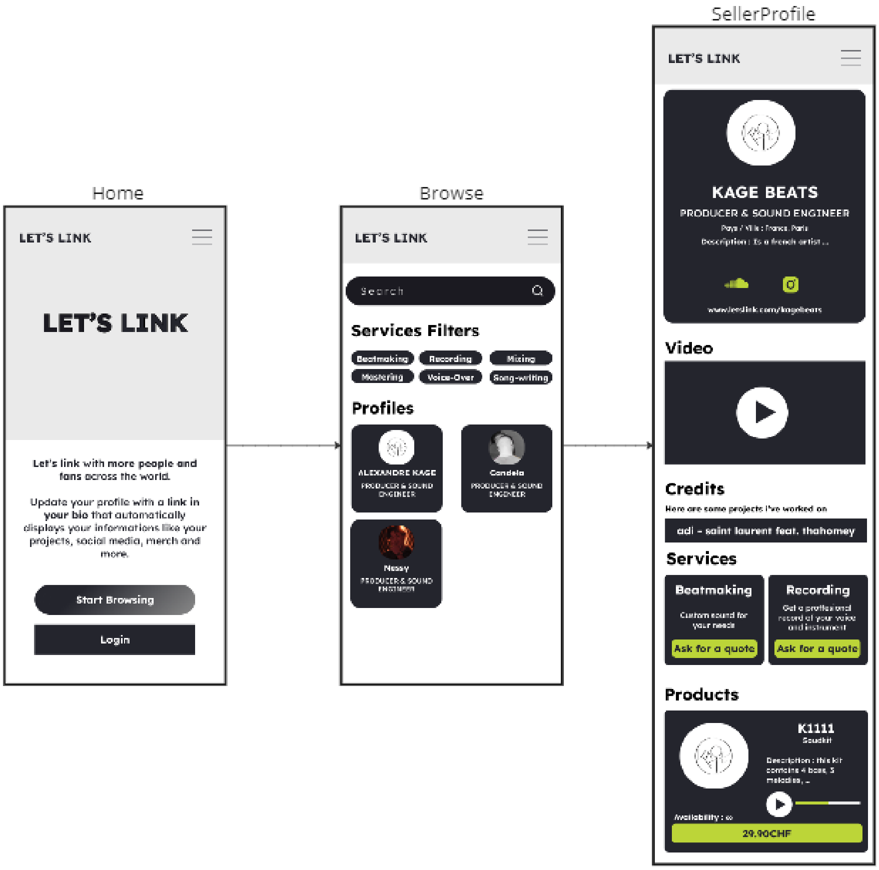

Home
LET'S LINK
LET'S LINK
Let's link with more people and fans across the world.
Update your profile with a link in your bio that automatically displays your informations like your projects, social media, merch and more.
Start Browsing
Login
Browse
LET'S LINK
Search
Services Filters
Beatmaking
Recording
Mixing
Mastering
Voice-Over
Song-writing
Profiles
ALEXANDRE KAGE
PRODUCER & SOUND ENGINEER
Candela
PRODUCER & SOUND ENGINEER
Nessy
PRODUCER & SOUND ENGINEER
SellerProfile
LET'S LINK
KAGE BEATS
PRODUCER & SOUND ENGINEER
Pays / Ville : France, Paris
Description : Is a french artist ...
www.letslink.com/kagebeats
Video
Credits
Here are some projects I've worked on
adi - saint laurent feat. thahomey
Services
Beatmaking
Custom sound for your needs
Ask for a quote
Recording
Get a professional record of your voice and instrument
Ask for a quote
Products
K1111
Soundkit
Description : this kit contains 4 bass, 5 melodies, ...
Availability : ∞
29.90CHF

Figure 16 Buyer screens

The Buyer can browse through sellers' profiles and display them in detail, with their products highlighted and easy to see.

4 Requirements

To identify the requirements, we are using a more agile method than the traditional approach. This agile approach has benefits, mainly because we see the same requirements but phrased as “user stories“ from the user’s perspective, and this will give us additional insight when we consider the implementation.

This Chapter describes how we identified the deliverables using a method called Impact mapping, our user stories, and the most important non-functional requirements. It also describes an approach that we will use, known as Secure-By-Design (SbD), to ensure that our future e-commerce platform has the highest possible security.

4.1 Impact Mapping

A modern approach in the field of user experience (UX) is a technique called Impact Mapping. This is a technique that was designed by Gojko Adzic (Adzic, *Impact Mapping*, 2012) [8] to identify which features are most essential in a software product. Specifically, each feature is looked at through the lenses of why, who, how, and what:

- Why – what is the specific goal of the project?
- Who – who are the users and actors?
- How – what behaviors identify the impact?
- What – what are the deliverables needed to achieve the impact (and therefore the business goals)

This is shown graphically in the following Figure 6 from [9] buildd website:

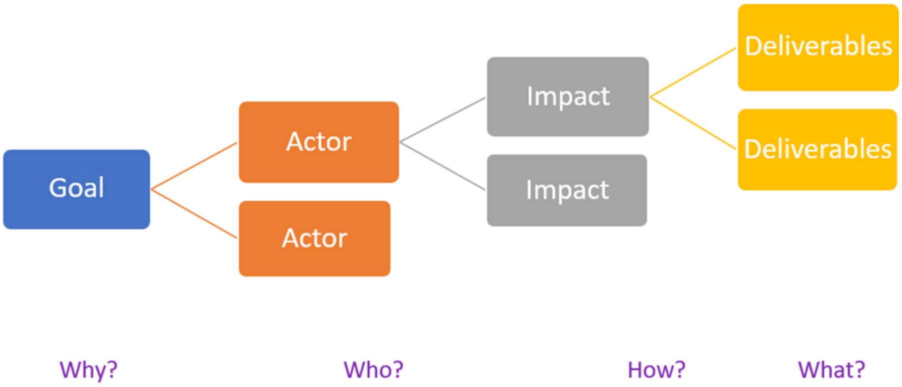


Figure 17 Source [9]

This technique has been applied to Let’s Link, with the results shown in the figure below.

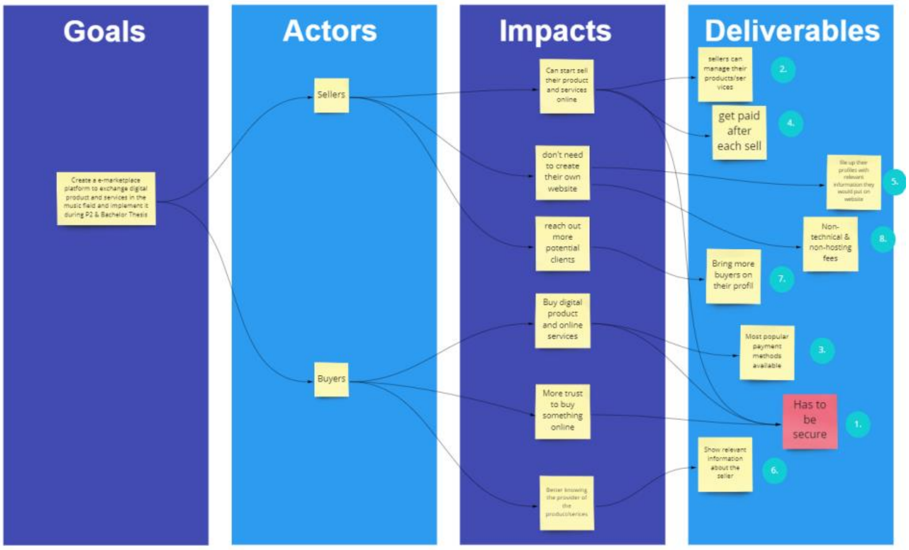
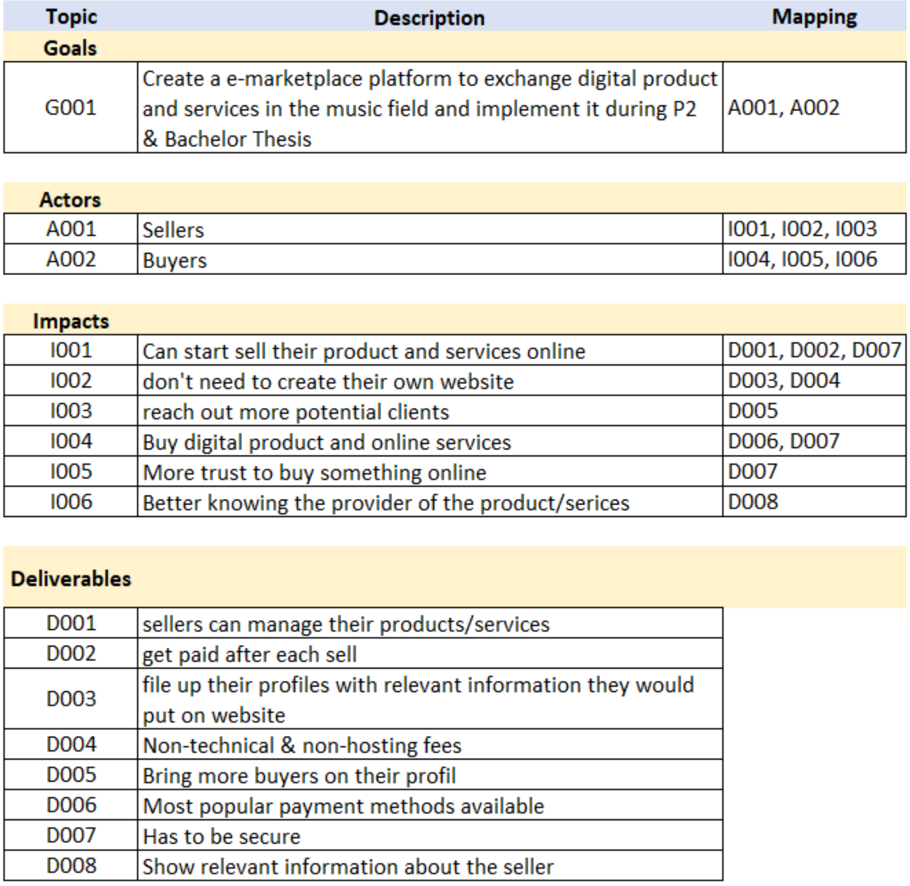

Goals
Actors
Impacts
Deliverables
Create a e-marketplace platform to exchange digital product and services in the music field and implement it during P2 & Bachelor Thesis
Sellers
Buyers
Can start sell their product and services online
don't need to create their own website
reach out more potential clients
Buy digital product and online services
More trust to buy something online
Better knowing the provider of the product/serices
sellers can manage their products/services
2.
get paid after each sell
4.
file up their profiles with relevant information they would put on website
5.
Non-technical & non-hosting fees
8.
Bring more buyers on their profil
7.
Most popular payment methods available
3.
Has to be secure
1.
Show relevent information about the seller
6.

Figure 18

The main results are summarized in this table:



Topic	Description	Mapping
Goals		
G001	Create a e-marketplace platform to exchange digital product and services in the music field and implement it during P2 & Bachelor Thesis	A001, A002
Actors		
A001	Sellers	I001, I002, I003
A002	Buyers	I004, I005, I006
Impacts		
I001	Can start sell their product and services online	D001, D002, D007
I002	don't need to create their own website	D003, D004
I003	reach out more potential clients	D005
I004	Buy digital product and online services	D006, D007
I005	More trust to buy something online	D007
I006	Better knowing the provider of the product/serices	D008
Deliverables		
D001	sellers can manage their products/services	
D002	get paid after each sell	
D003	file up their profiles with relevant information they would put on website	
D004	Non-technical & non-hosting fees	
D005	Bring more buyers on their profil	
D006	Most popular payment methods available	
D007	Has to be secure	
D008	Show relevant information about the seller	

Figure 19

As a result of this analysis, we can see that security has 3 impacts that are highly relevant for both buyers and sellers. This supports our choice for «Secure-by-Design», discussed separately in this report.

4.2 Secure-By-Design (SbD) for security requirements

Secure-By-Design (SbD) is a relatively new approach in software engineering [10]. The basic idea is that security aspects are not looked at later in the development process, as was often the case, but that security is part of the design itself. This means that while the software engineers are designing and creating the application, they are considering that malicious actors will be trying to attack the system in every conceivable way.

Our approach to Secure-By-Design incorporates design recommendations but also tools specially engineered for SdD :

a) JHipster recommendation to secure the app with JWT [11]

b) Heroku recommendation how to prepare for production [12]

c) JHipster recommendation dependency vulnerabilities check for the backend (is done manually) [13]

d) Snyk API for the front-end analysis integrated in the CI/CD pipeline [14]

e) Frontend and Backend test integrated the CI/CD pipeline

f) Once deployed in the CI/CD pipeline, we run a product from Zap company [15] in our pipeline called Zap Baseline Scan [16] on the URL of the application

g) ZAP baseline scan of the build application used in the production [16]

4.3 User stories

Because we are taking an agile approach to software development, we will list the requirements phrased in terms of “extended user stories.” This format presents the requirement from the perspective of the user, but also provides any additional details which are essential for the implementation.

We group the user stories written in 3 pieces «AS A (role) I WANT TO (do stuff) SO THAT (goal)” by related functionality for each user category. We are also using a new approach that tries to capture some additional key details.

We first detail epics related to the **Seller Story map** and afterwards epics related to **the Buyer Story map.**

4.3.1 Seller

User: SELLER	
Authentication	As a SELLER, I want to ensure I’m able to login if I have an account or ask the admin to create one so that I access and can start selling products and services. Additional details: – I can login using my username & password – I cannot create an account, only the admin provides me a username password – I can change my password
Profile management	As a SELLER. I want to create and edit my personal profile so that buyers are well informed about me. Additional details: – I can share a direct link to my profile

Product management	As a SELLER, I want to create, edit, and remove products so that buyers can buy them. Additional details: – I can receive money on my bank account after a buyer buy it

Table 4

4.3.2 Seller Epic: Administering products

User: Buyer	
Browsing	As a BUYER, I want to look at sellers’ profiles that interests me, so that I know them better. Additional details: – I can see product on the profile of the seller
Buy product	As a BUYER, I want to buy a product from a seller so that I can use it for my personal use. Additional details: – I can use different payment methods

Table 5

4.4 Non-functional

In addition to the functional requirements, which we have phrased as extended user stories above, there are some key non-functional requirements that this application must fulfil.

The non-functional requirements are as follows:

1. Reliability
   - Possibility for data or the code source of the application to be restored to an older version if needed (using a Version Control System [17])
   - Integrate a CI/CD pipeline that runs tests, analyzes security issues and deploys it on the server so that early adopters can run the last version [18]
2. User-friendly
   - The solution can be used without any technical knowledge for the user
   - Intuitive, the user is informed of the result of his/her operation, this means for error or success
   - Modern look, the app is responsive and uses modern components such as buttons, pop-ups, etc.
   - Mobile first, focus on the layout on the phone first as it will be the first support to access the solution
3. Performance & efficiency
   - Navigation within the application is smooth for the user
4. Maintainability & flexibility
   - The system modulable and can be modified according to new business needs
5. Scalability

- Infrastructure should be evolutive and support a user growth phase

5 Implementation Strategies

This Chapter describes the following topics: the evaluation and explanation of the technologies to use for the implementation; the technical details of Security-by-Design (SbD) as well as the SbD tools used; the domain model and the generation of entities.

5.1 Selecting the development and hosting stacks

There are several different technology stacks used for full stack web development, and initially it was not clear which one was appropriate for this project. Therefore, to make the correct choice, we carried out a weighted make-buy analysis. This is like a standard make-buy analysis, but in which each category is assigned a weight, according to the importance it has to the overall project.

In this analysis, we choose to put more weight to the cost (which should be highly predictable) and to a “loose coupling” between platform and provider (so that if a platform solution disappears or changes their policy, the application can be migrated to another platform).

Finally, the selection of this PaaS and SaaS also includes factors based on personal preference from the research carried out.

Technology stack evaluation						
Criteria of technology assessment	Cost	Simplicity and ease of use	Stability of technology	Technical reliability	Dependency Coupling	Total
Weight	2	1	1	1	2	
Jhipster + Heroku (PaaS) Cost : Free - $7 per month (free to $9 per month DB) Coupling Open-Source soft. And Heroku	4	3	4	4	4	27
React + Firebase (PaaS) Cost : Free - PayAsYouGo Coupling (Firebase Google)	5	4	3	4	2	25
React + Sharetribe (SaaS) Cost : 79$/month - 299$/month Coupling (Sharetribe software)	1	4	3	4	2	17

Table 6

After carrying out this analysis, together with other research, we feel that JHipster (which combines a ready-production ecosystem made with open sources tools) is a big advantage: we can easily access the frontend and backend source code and modify it based on evolving customer needs as the project goes on. This increases the complexity but also increases the flexibility of the application. It also provides tools to generate CRUD entities in frontend and backend.

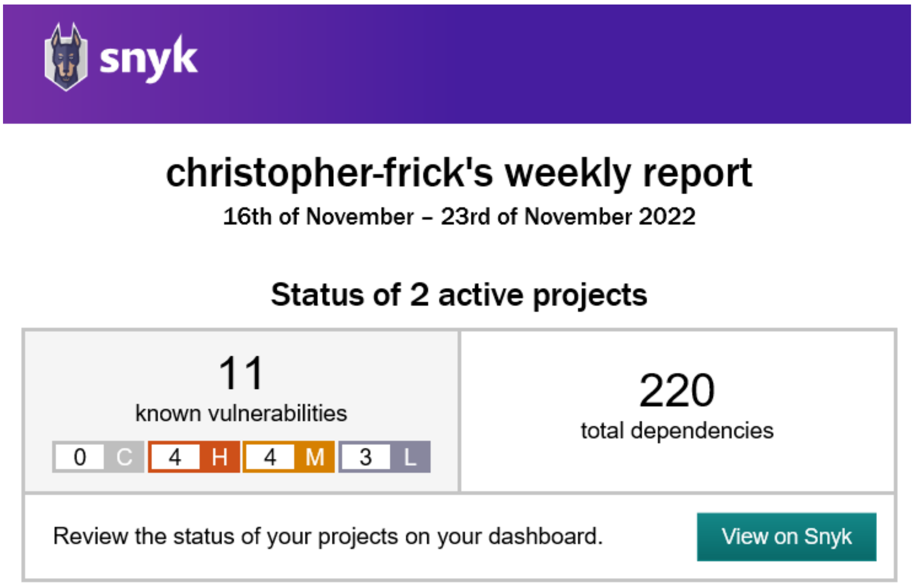
Finally, it is “loosely coupled” to the hosting infrastructure; that is, if we decide to change the hosting infrastructure later, there will be no need to re-write the application.

5.2 Security-by-Design tools

To be more efficient we use automated configuration integration and configuration deployment (CI/CD) of GitHub known as GitHub Actions. We have designed these to improve security from the start and during the development of the application.

Here are the following points we cover in the CI/CD:

1. GitHub Actions secret and Heroku Config Vars to keep sensitive information secret but needed for the application to be functional
2. Running generic unit tests and integration tests. In the future we would also add end-to-end tests but for Project 2 they are not required.
3. Dependency Vulnerabilities Check using Dependabot and Snyk, this is for monitoring as fixing them is not in project scope. This software generates automated reports after a detection of a vulnerability as well as suggestions for a fix, as shown in the following diagram.



snyk

christopher-frick's weekly report

16th of November – 23rd of November 2022

Status of 2 active projects

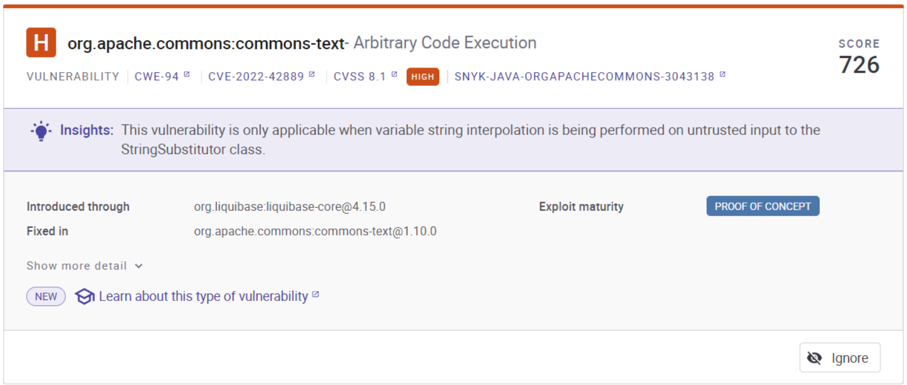
11
known vulnerabilities

0	C	4	H	4	M	3	L

220
total dependencies

Review the status of your projects on your dashboard.

Figure 20 Weekly report of Synk



H org.apache.commons:commons-text- Arbitrary Code Execution

VULNERABILITY | CWE-94 | CVE-2022-42889 | CVSS 8.1 HIGH | SNYK-JAVA-ORGAPACHECOMMONS-3043138

SCORE
726

Insights: This vulnerability is only applicable when variable string interpolation is being performed on untrusted input to the StringSubstitutor class.

Introduced through org.liquibase:liquibase-core@4.15.0

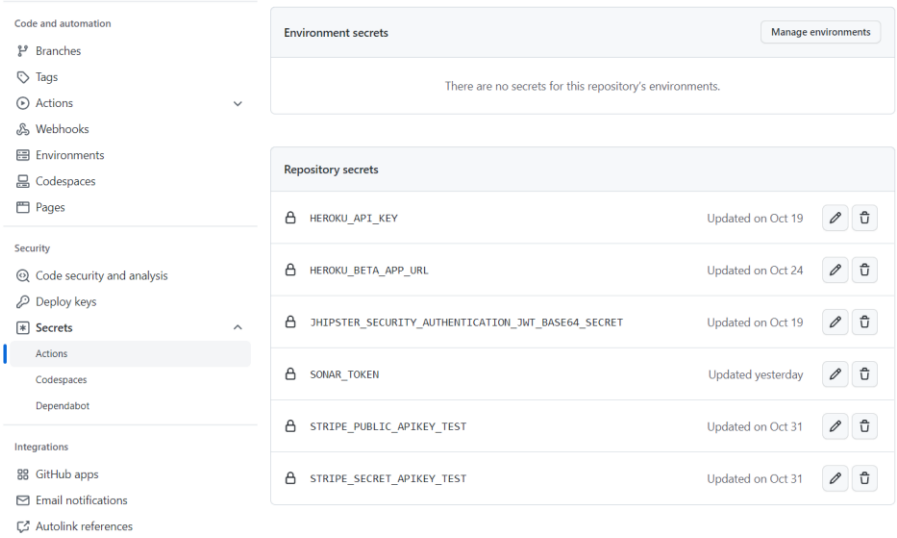
Exploit maturity PROOF OF CONCEPT

Fixed in org.apache.commons:commons-text@1.10.0

Figure 21 Specific vulnerability

4. Automatically deploy artifact on Heroku.

Some of the tools listed above need API keys to communicate with the service. To keep them secret, we store them with GitHub secret actions. The web administration interface looks like this :



Environment secrets

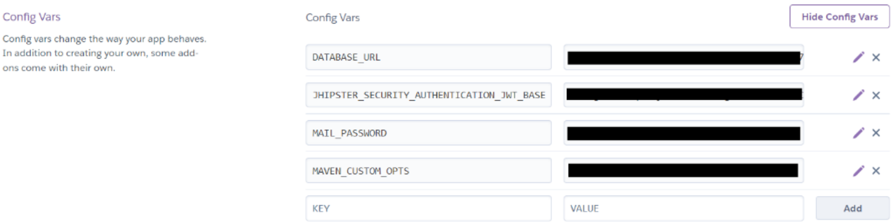
There are no secrets for this repository's environments.

Repository secrets

HEROKU_API_KEY	Updated on Oct 19
HEROKU_BETA_APP_URL	Updated on Oct 24
JHIPSTER_SECURITY_AUTHENTICATION_JWT_BASE64_SECRET	Updated on Oct 19
SONAR_TOKEN	Updated yesterday
STRIPE_PUBLIC_APIKEY_TEST	Updated on Oct 31
STRIPE_SECRET_APIKEY_TEST	Updated on Oct 31

Figure 22

The running application on Heroku also requires sensitive information to be functional, such as the email password, private key for JWT encryption, etc. These are configured on Heroku dashboard as config vars. Here is how the actual config vars looks on Heroku web interface:



Config Vars

Config vars change the way your app behaves. In addition to creating your own, some add-ons come with their own.

Config Vars

DATABASE_URL	[redacted]
JHIPSTER_SECURITY_AUTHENTICATION_JWT_BASE	[redacted]
MAIL_PASSWORD	[redacted]
MAVEN_CUSTOM_OPTS	[redacted]
KEY	VALUE

Figure 23

5.3 JHipster

As JHipster is the core technology for the implementation of this Project 2 we give here an overview of this technology, some tools provided that we used, and the most important advantages and disadvantages

Today many technologies exist to develop a modern web site. From the backend to the frontend making the right choice between all technologies is important. Some of these technologies are new and have a small community maintaining them. Therefore, some of them may be deprecated in the future or have a poor documentation to use them properly.

This is where the free and open-source project JHipster comes in. It is an example of a Rapid Application Development (RAD) framework, designed to simplify and speed the development of complex software applications. It helps us generate a full stack application by combining popular Open-Source projects and make them all work together. It does even more by providing functionality working out of the box like user login, monitoring, DB schema migration, etc. They also provide different profile for development, production, containerization, and other features.

5.3.1 Key JHipster components

(A) **JHipster Online** [19]: Once an account created on it, we used this application to choose the technology stack we wanted. Afterwards we connected it to your GitHub repository and

JHipster both directly pushed the generated code source into the repository. It also helps us set up continuous integration for our application.

(B) JHipster Studio: Is also a tool available on JHipster online. We used it to model our entities and relationships between them. It is a very powerful tool cause for the entities we can directly choose the different fields and their type. It allows us to specify which field is required and give a pattern that values must respect. For example, an e-mail has a specific format to be valid. By typing information, we have in real-time a picture of the domain model display which helps us during redaction. From there we could export a picture of our domain model and a jdl file that we put in our project repository.

(C) JHipster Domain Language (JDL): This is the language used inside JHipster Studio to write the domain model. Once the file is in the project repository by typing one command, we can generate code specified inside this means front-end in our case in React code and Spring Boot with best practice for each technology. For Spring Boot, we had a Security implementation with available endpoints to Create, Read, Update, Delete (CRUD) our entities from domain model with formular validation in frontend to backend validation.

5.3.2 Advantages and disadvantage of JHipster

In the above table we've put a non-exhaustive list of advantages and disadvantages we faced with JHipster during Project 2.

Advantages	Disadvantages
JHipster creates a complete working application, with all those technologies	Understand the basics of generated code to run it locally and start working on it
Everything just "works out-of-the-box" this means we can start quickly on deliver value to end user	Many dependencies are outdated but should be fixed at next JHipster release
Web based tools like JHipster Online and JHipster Studio to generate the app and design entities	Upgrade of an actual application may not be down automatically without causing errors
Use good practice of each technology and a "standard" application structure for the front and back	Many languages, frameworks, technologies in one project (Java, Spring Boot, JavaScript, React, etc.) may be too much for small project
Generate test based on Domain Model for each entity, Unit, Integration, performance and end-to-end (E2E) tests	A "simple" business rule must be implemented at many places with tools we didn't work with before. This slowed our velocity.
Multiple Cloud providers support for continuous integration and continuous deployment (Google, Heroku, GitHub, …)	

Table 7

5.3.3 The specific tools in the technology stack

JHipster supports several different technologies. The following table shows an overview of our chosen technology stack. For more details about each technology and what are their purpose please look at JHipster website [20].

Part	Technologies
Front-end	React [21] - Redux [22] - Bootstrap [23] - Bootswatch [24] - Webpack (compiles, minifies, optimizes) [25] - NPM (dependency package manager) [26] - Yeoman front-end generator [27] - JWT authentication
Backend	- Maven - Spring Boot [28] - Spring Security - Spring Data JPA - Liquibase [29] - Hibernate 2nd level cache [30] - JWT authentication
Database	PostgreSQL [31]
Hosting	Heroku [32]
Version Control System (VCS)	GitHub

Table 8

5.3.4 Domain model and entities generation

To create our Domain model, we used a tool provided by JHipster called JDL-Studio. There we use JDL (JHipster Domain Language) to write our entities with their fields and add relationship between them.

Below is the resulting domain model available for download from JDL-Studio:

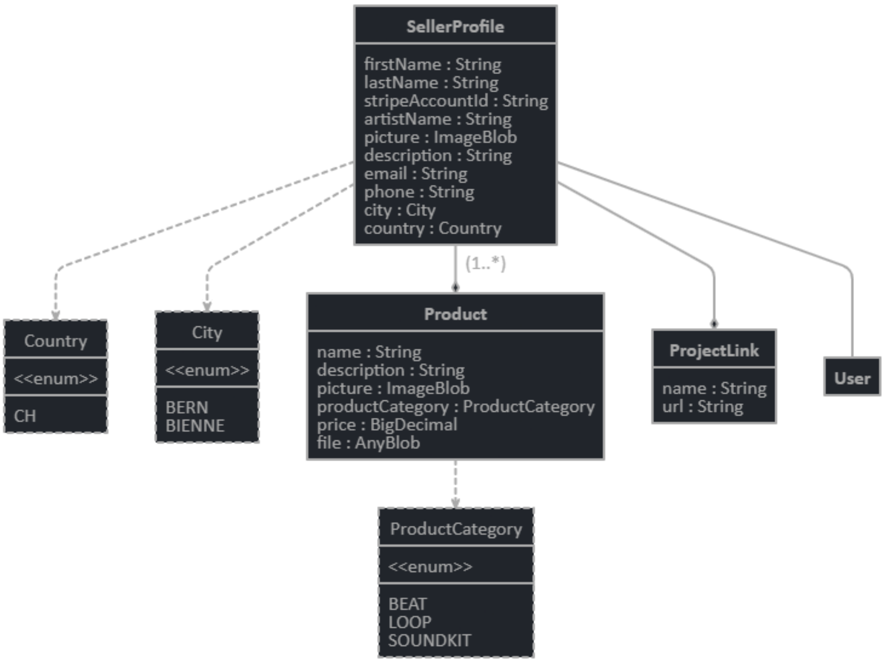


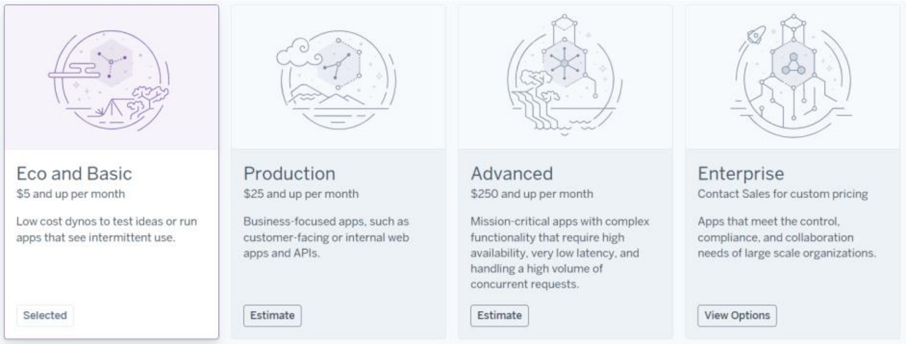
Figure 24

This is the minimal domain model to successfully implement defined user stories for Project 2. In further version, domain model may change according to business needs.

5.4 Heroku

5.4.1 Pricing

Heroku changed its pricing policies during the project development. They don't have free plans anymore here is what they propose:



Eco and Basic
$5 and up per month
Low cost dynos to test ideas or run apps that see intermittent use.
Selected

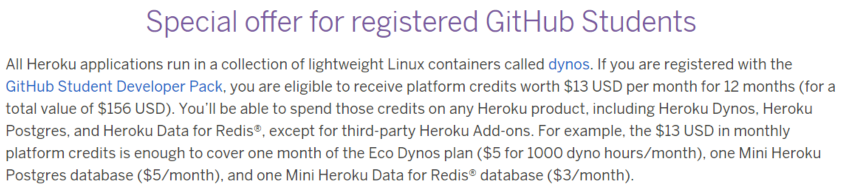
Production
$25 and up per month
Business-focused apps, such as customer-facing or internal web apps and APIs.
Estimate

Advanced
$250 and up per month
Mission-critical apps with complex functionality that require high availability, very low latency, and handling a high volume of concurrent requests.
Estimate

Enterprise
Contact Sales for custom pricing
Apps that meet the control, compliance, and collaboration needs of large scale organizations.
View Options

Figure 25

The migration was very eazy to do and guided from the web interface. I could continue use Heroku plan freely for one year using their GitHub Student + Heroku special offer it is more detailed here : https://www.heroku.com/github-students



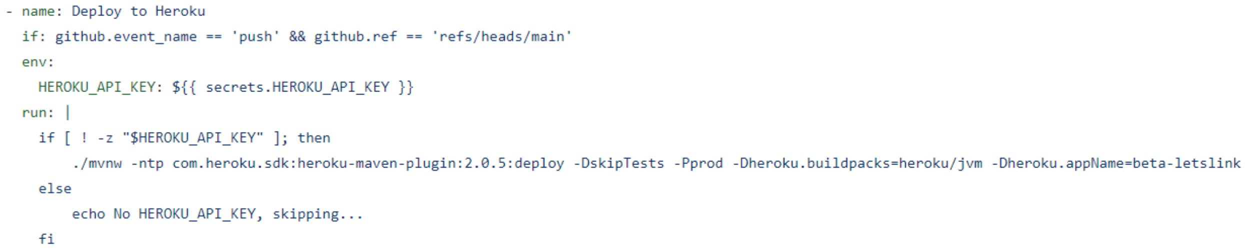
Special offer for registered GitHub Students

All Heroku applications run in a collection of lightweight Linux containers called dynos. If you are registered with the GitHub Student Developer Pack, you are eligible to receive platform credits worth $13 USD per month for 12 months (for a total value of $156 USD). You'll be able to spend those credits on any Heroku product, including Heroku Dynos, Heroku Postgres, and Heroku Data for Redis®, except for third-party Heroku Add-ons. For example, the $13 USD in monthly platform credits is enough to cover one month of the Eco Dynos plan ($5 for 1000 dyno hours/month), one Mini Heroku Postgres database ($5/month), and one Mini Heroku Data for Redis® database ($3/month).

Figure 26

5.4.2 Deploy

Creating a GitHub workflow here https://github.com/christopher-frick/letslink/blob/main/.github/workflows/main.yml there is a part related for deploying app on Heroku platform here is the specific part of the file. This means every time we push on the main branch, the new source code his packaged and deployed on the Heroku app.



```
- name: Deploy to Heroku
  if: github.event_name == 'push' && github.ref == 'refs/heads/main'
  env:
    HEROKU_API_KEY: ${{ secrets.HEROKU_API_KEY }}
  run: |
    if [ ! -z "$HEROKU_API_KEY" ]; then
        ./mvnw -ntp com.heroku.sdk:heroku-maven-plugin:2.0.5:deploy -DskipTests -Pprod -Dheroku.buildpacks=heroku/jvm -Dheroku.appName=beta-letslink
    else
        echo No HEROKU_API_KEY, skipping...
    fi
```

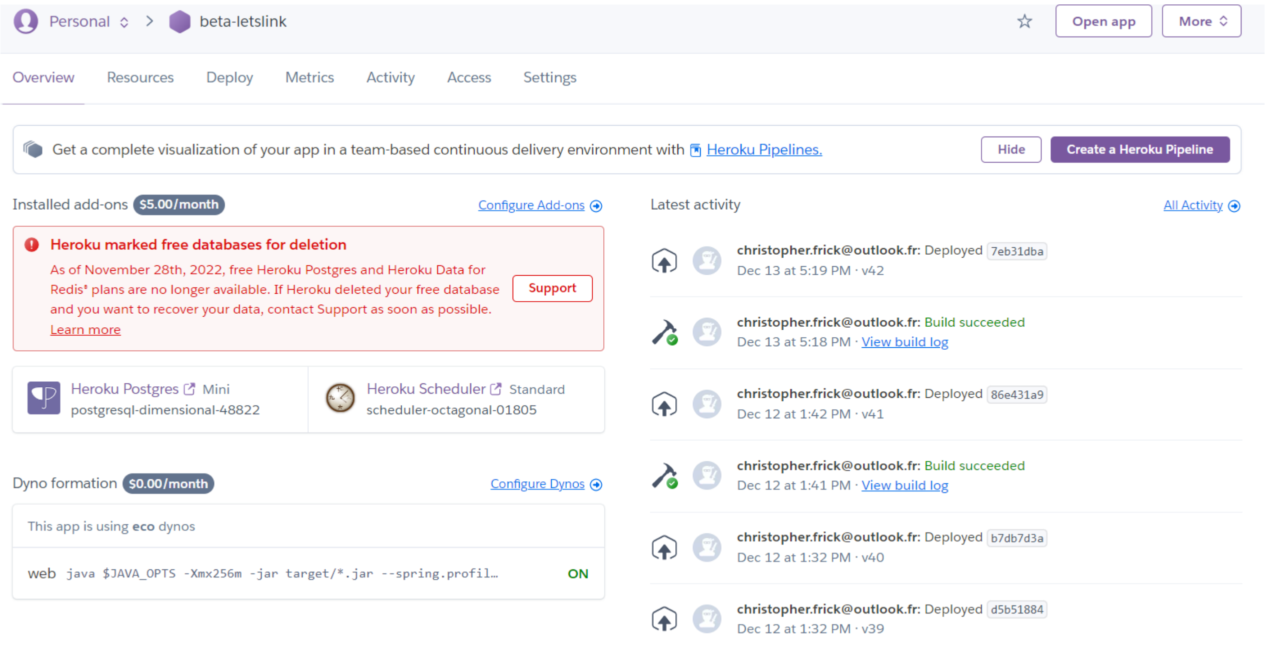
Figure 27

We must configure Heroku API key in the repository. This key can be found in profile settings on Heroku dashboard.

API Key: ....

Figure 28

We can display all information related to the application it looks like this.



Get a complete visualization of your app in a team-based continuous delivery environment with Heroku Pipelines.

Installed add-ons $5.00/month

Heroku marked free databases for deletion

As of November 28th, 2022, free Heroku Postgres and Heroku Data for Redis® plans are no longer available. If Heroku deleted your free database and you want to recover your data, contact Support as soon as possible. Learn more

Heroku Postgres Mini
postgresql-dimensional-48822

Heroku Scheduler Standard
scheduler-octagonal-01805

Dyno formation $0.00/month

This app is using **eco** dynos

```
web  java $JAVA_OPTS -Xmx256m -jar target/*.jar --spring.profil…   ON
```

Latest activity

christopher.frick@outlook.fr: Deployed `7eb31dba`
Dec 13 at 5:19 PM · v42

christopher.frick@outlook.fr: Build succeeded
Dec 13 at 5:18 PM · View build log

christopher.frick@outlook.fr: Deployed `86e431a9`
Dec 12 at 1:42 PM · v41

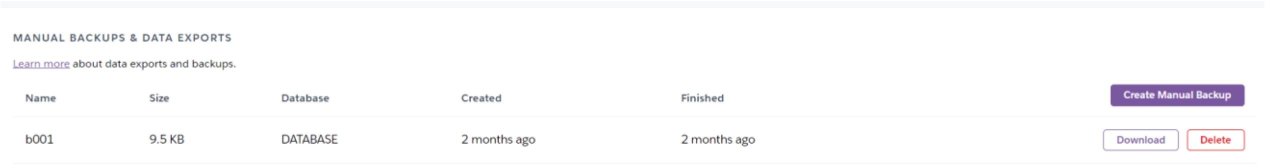
christopher.frick@outlook.fr: Build succeeded
Dec 12 at 1:41 PM · View build log

christopher.frick@outlook.fr: Deployed `b7db7d3a`
Dec 12 at 1:32 PM · v40

christopher.frick@outlook.fr: Deployed `d5b51884`
Dec 12 at 1:32 PM · v39

Figure 29

We can also easily access the database and manage it with the web interfaces like doing backup & restore and do SQL queries.

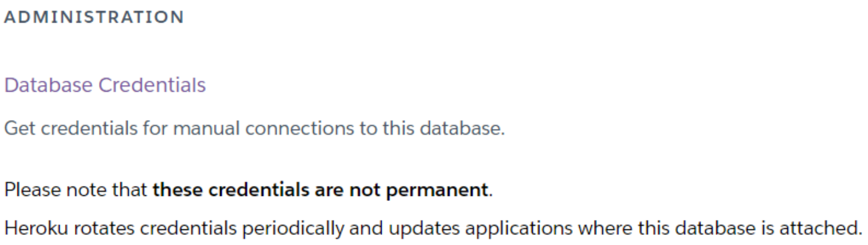


MANUAL BACKUPS & DATA EXPORTS

Learn more about data exports and backups.

Name	Size	Database	Created	Finished
b001	9.5 KB	DATABASE	2 months ago	2 months ago

Figure 30



ADMINISTRATION

Database Credentials

Get credentials for manual connections to this database.

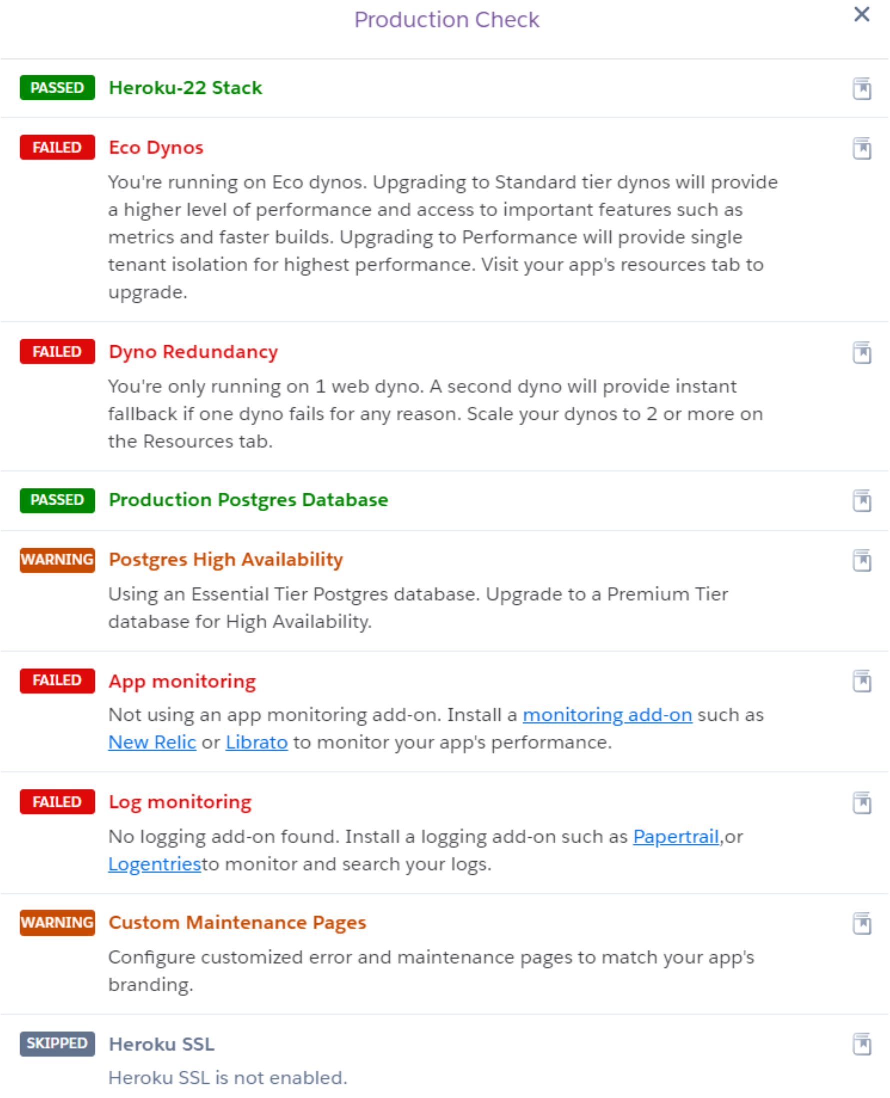
Please note that **these credentials are not permanent**.

Heroku rotates credentials periodically and updates applications where this database is attached.

Figure 31

5.4.3 For production

With production check Heroku provide the status of your app and improvement could be done, here is the result:



Production Check

PASSED Heroku-22 Stack

FAILED Eco Dynos

You're running on Eco dynos. Upgrading to Standard tier dynos will provide a higher level of performance and access to important features such as metrics and faster builds. Upgrading to Performance will provide single tenant isolation for highest performance. Visit your app's resources tab to upgrade.

FAILED Dyno Redundancy

You're only running on 1 web dyno. A second dyno will provide instant fallback if one dyno fails for any reason. Scale your dynos to 2 or more on the Resources tab.

PASSED Production Postgres Database

WARNING Postgres High Availability

Using an Essential Tier Postgres database. Upgrade to a Premium Tier database for High Availability.

FAILED App monitoring

Not using an app monitoring add-on. Install a monitoring add-on such as New Relic or Librato to monitor your app's performance.

FAILED Log monitoring

No logging add-on found. Install a logging add-on such as Papertrail,or Logentriesto monitor and search your logs.

WARNING Custom Maintenance Pages

Configure customized error and maintenance pages to match your app's branding.

SKIPPED Heroku SSL

Heroku SSL is not enabled.

Figure 32

6 Summary

Thanks to project module 2 we were able to realize the complexity of such a project. The constraints of time, cost and expected quality were an integral part of this project and it showed us that it is almost impossible to have all 3 at the same time. The best product, delivered in a short time for a small budget.

This project was carried out in 3 phases: the initial phase, the implementation phase, and the final phase. During the first phase hey we clarified the different objectives to be achieved during this module hey we also planned the different steps necessary to achieve the project. To identify the functional and non-functional requirements, we used an agile approach. This allowed us to put the user's needs at the center of our attention and thus deliver business value as soon as possible. We noticed that security was a crucial point for the success of our application. Thanks to different agile methods we were able to identify the features to implement to get as close as possible to the minimal viable product.

The implementation phase focused on the different technologies that were used during the project. In addition to choosing these technologies, we created the project and all the environment necessary for its future development by automating repetitive tasks as much as possible. In addition to the security aspect, we defined the minimum model domain that would allow us to develop our minimal viable product. In its current state the application allows users to log in to their account and edit their profile with their personal information. They also have the possibility to add digital products to their profile.

For the final phase we spent the rest of our time finishing the documentation, finishing the few implementation details, preparing the different materials for the presentation and the module report for project 2.

6.1 Next Steps

For the minimal viable product there are still several functions to implement before proposing this solution to early adopters. The Bachelor's thesis will consist in choosing one or more of the remaining features to be implemented and to realize it as a thesis work.

Based on all the work and analysis, the following suggestion are made:

- Fix some bugs
  - When switching from a profile to another
  - Add endpoints to get product of a specific profile
  - Better display card of the profile and product
- Make UI/UX prettier
- Integrate payment system so that seller can start earning money using this solution
- Seller can manage project they have worked on by providing some resource to it
- Seller can manage their Services

6.2 Lesson Learned

It is crucial to instantly evaluate how the work went, what went well, and what may be improved for the next time in the modern agile Way of Working (WoW). These findings were made from the viewpoint of the student:

Goal	Result
Learn the new technology	Success. Have learned the technology deep enough to

	implement all known or foreseen features
Understand my agile implementation velocity	Success. Have implemented enough features to know how fast I can develop. This is essential for planning the scope of the Bachelor thesis
Create an MVP for a possible start-up based on this project	In progress. For the moment we aren't able put it in production because we didn't reach the functionality to achieve our business plan

Table 9

- What worked well
  - Analyzing user to identify most important functional and non-functional requirements
  - Working with project supervisor
- What worked less well
  - Technologies stack is too big, must learn by doing specific case
  - Project Management to set realistic goals for project 2
  - The version is too light to be used by early adopters
  -
- Next time idea improvement
  - Maybe find a good partner to achieve more quickly some technical tasks

6.3 Personal conclusion

I am proud of the work that has been done during this project 2. Both in project management and technically speaking I learned a lot from this project. I am now much more capable of estimating the amount of work needed to complete a feature which will be very useful to better plan the Bachelor thesis.

Looking at the schedule, we can see that the time spent on the actual coding is less than half the time spent on the project. It will therefore be very important for the Bachelor thesis to plan the features to be implemented as well as possible so that they are achievable in the allocated time. The additional constraint to the selection of these features is that they bring a maximum of value to the future users of the solution.

After re-evaluating solution of competitors, it seems that Linktree [33] his solving a big issue that Let's Link is trying to solve in a better way, their users can sell digital product on their profile. This is a bit annoying but this is a reason why Let's link is trying to be agile; we will find a way to implement functionality that brings value to the user during bachelor thesis on next semester.

To conclude, I am happy with the results. In addition to the knowledge that I acquired, I am more aware of the complexity that some companies can have in developing software when there are several teams working at the same time on the same project and the importance of project management to coordinate the different teams.

7 List of illustrations

8 Contents of tables

9 Bibliography

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10 Appendix

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Put sources in the appendix like images, tables, ...

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