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Application As A Service(AAAS)

By

Farzan ul haq siddiqui	19b-125-SE
Muhammad Sufyan	19b-076-SE
Syed Muhammad Ghazi	19b-087-SE
Muhammad Murtaza	19b-105-SE
Muhammad Shakir	19b-096-SE

Supervised by

Muhammad Usman Arif

Declaration

I hereby declare that this project report is based on my original work except for citations and quotations which have been duly acknowledged. I also declare that it has not been previously and concurrently submitted for any other degree or award at USMAN INSTITUTE OF TECHNOLOGY or other institutions.

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Student Name (Student ID):

Signature: _____

Student Name (Student ID):

Signature: _____

Student Name (Student ID):

Signature: _____

Student Name (Student ID):

Signature: _____

Date: _____

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1. Introduction

1.1 Motivation

In today's world where everything is transforming into digital form due to use of computers everywhere, products which are digital in nature performing a vital role in every day aspect of human life. Use of digital products as services is increasing at a great rate. Digital product can be anything digital like video, music, e-book, software, API, game etc. which are consumed by users through the internet [1]. Digital products in context of this reports are log, templates, downloadable software and APIs (API is the acronym for Application Programming Interface, which is a software intermediary that allows two applications to talk to each other). To earn good passive income or to make your business, selling digital products is the best way due to ease-of-distribution, low investments, unlimited stock, good profit margins and much more.

1.2 Current System

On the internet digital products can be sell by making your own website/store or by using the existing market place to sell by uploading the product. It is a great way to start earning from things you created as well as provide value to customers.

Before discussing how developers earn from their API, lets discuss the roles and architecture of API value chain (The term **value chain** refers to the various business activities and processes involved in creating a product or performing a service [2]):

- API provider: the developer/company that creates and offers an API [3]
- API consumer: developer who implements API [3]
- End user: user that uses web/app that contain the API [3]

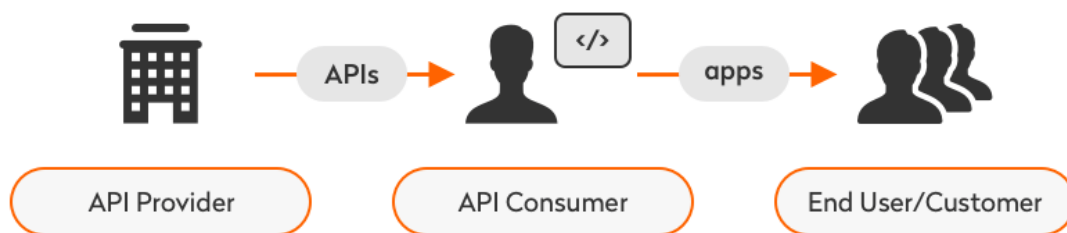


Figure 1.1 API value chain [3]

Developers host their APIs on their own server and manage themselves as well in order to generate income from it.

On the other hand, they can use API as a Service platform to sell their APIs to the targeted consumers and the platform keep their commission for the service.

1.3 Problems with current system

To make money from their Products (APIs, Templates, logos, Downloadable Software), Developers link their API or Product owners upload their Products on a web server. But

they will also need to take care of things like targeting and selling their products to related customers, payment gateway, customer support, and client management. This could be a hassle for developers and creators as it requires marketing and management skills and would be very time-consuming. Rather on spending time on these things, they can spend their time by making their products more enhance and better. Also, clients who need any Products/APIs, so they have to search many sources to get authentic Products/API for their applications.

As Market places to solve above problems are also available but they are not truly for all kinds of digital products. Like there are different platforms for selling and marketing APIs and different platforms available for other digital products but not a platform which is truly digital in nature to sell and market everything digital like APIs, software, templates, logos, etc.

1.4 About the project

The problems mentioned in the above section-1.3 can be solved by this project AAAS (Application As A Service). It is the platform which have the functionality sell and market APIs as well as any other product which can be sell digitally.

For the API, Developers can define endpoints of their API hosted on a different web server and for the other products, they can upload their executable file and create package based on the statistical analysis suggested by platform. Then get approved on the AAAS platform for free of cost and the platform is responsible for brochure creation (if necessary) and marketing it on different platforms chosen by the seller. And whenever a Buyer buys a package, the seller will get paid, and the platform will charge a small portion of that transaction.

For the FYP scope of AAAS, functionality of certain digital products are implemented for the time being which include API, templates, logos and downloadable software. Other type of products functionality will be implemented in future work.

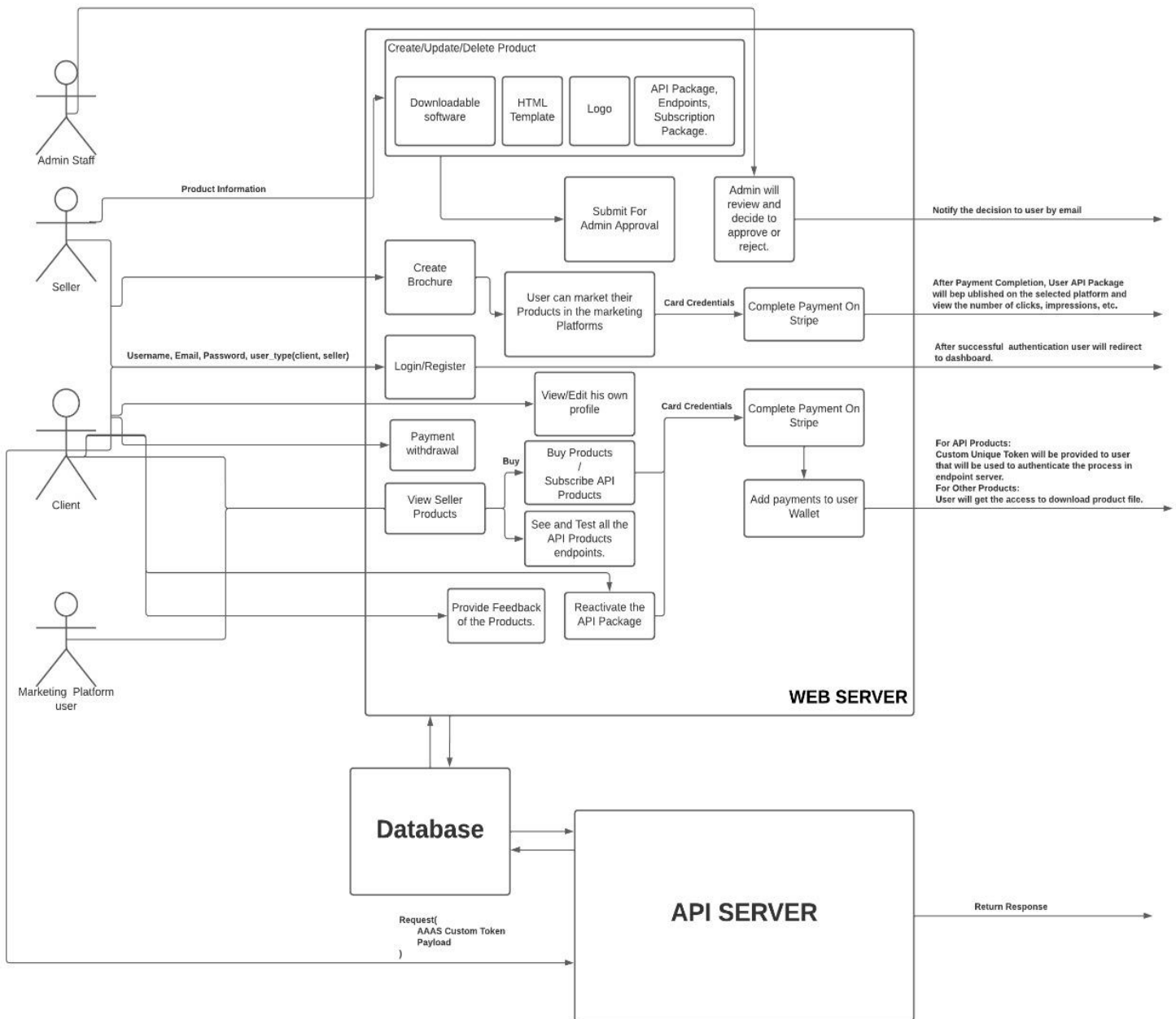


Figure 1.2 System diagram of AAAS

1.5 Objectives

The AAAS project will meet the following objectives:

- Developers will be able to earn by selling their Products.
- AAAS will be responsible to authenticate and market the seller's Products.
- Buyer will be able to buy and use Products available on the platform.
- Buyers will be able to search for related Products on the platform.
- Developers also get an opportunity to market their products on different platforms and increase their revenue.

- Developers also get an opportunity to use Platform's built-in brochure templates for marketing.
- Developers can view the Similar Product Statistical Analysis for better pricing and package creation.

1.6 Limitations

Any kind of Product issues after it has been validated/authenticated by the customer will not be catered in the project.

1.7 Expected Final Product

The final product will be a web application that requires an internet connection and a desktop or laptop to show the demonstration. It enables Software engineers/developers as a seller to earn passively by publishing and market their Products on the platform while buyer get their required Products at same place.

1.8 About this report

- Chapter 2 includes the background and literature review of related projects along with their issues, development and performance.
- Chapter 3 covers aim and statement of problem and how it is tackled under the scope of the project.
- Chapter 4 will evaluate software analysis and requirements of this project and the comparison of different available choices.
- Chapter 5 will cover design and implementation, discussing the reasons for the design and implementation problems.
- Chapter 6 describes the algorithms being used in this project and provide the comparison of similar algorithms in terms of complexity.
- Chapter 7 explains the implementation of functionality with the help of code, technical interfaces and diagrams.
- Chapter 8 covers the testing and evaluation.
- Chapter 10, 11 provide the conclusion and potential future work respectively.
- Chapter 12 evaluates the overall achievements of this project

2. Background and Literature Review

Buying and selling through the use of internet like online shopping and use of online services is increasing day by day. Everyone is selling online now a days. All kinds of businesses are making their presence online and digital to gain more customers and make their business grow more. In fact selling digital products is a great way to start earning good income or can build whole business from it.

Digital Product is a software enabled product or service that offers some form of utility to a human being [4] or They are the products which are not touchable, available only online and could sell only through digitally and only for digital use [5]. It can be in the form of downloadable file or the service that can be used over the internet. Examples of digital product is movies, songs, e-books, logos, templates, software, APIs, etc. Anybody with skills and creativity can make and sell digital products of their interests.

2.1 Selling digital products vs physical products

Analyze the table below which shows why selling digital products is more fruitful for a business-individual.

Type of Product	Manufacturing Cost	Store Cost	Delivery Cost	Profit Margin	Stock
Physical	Cost incurred every time product is manufactures	Necessary as they are tangible and occupy space	Have delivery cost as well	Low profit for seller due to many expenses	Have possibility of out of stock
Digital	Just one time cost when product is made	Intangible and store on online platform	Not have delivery cost	High profit margin due to less expenses	Always in stock due to digital in nature

Table 2.1 Significance of selling digital product over physical product.

2.2 How to Sell Digital Products

There are many ways and process from which anybody can start their journey to sell amazing digital products which they find interesting and learn and analyze the market trends to enhance their business more. Here are five basic steps which is essential for everybody who is starting their business or wanted to sell their services on the internet.

1. Analyze and research market trends.
2. Make your digital product.
3. Use services of available platforms to sell or make your own site.
4. Market your product to the right audience.

5. Now start selling and improve your business from customer feedbacks, reviews and ratings.

2.3 Digital Products under the scope of this FYP

There are vast types and categories of digital products available over the internet but certain types of digital products are taken under the scope of this project and the remaining will be integrated in the future work.

Digital products which are under the scope of this project include:

2.3.1 API

Application Programming Interface (API) is mechanisms that enable two software components to communicate with each other using a set of definitions and protocols [6].

Client and server are commonly used to describe API architecture. The application that sends the request is known as the client, and the application that sends the response is known as the server.

Example of API is that the different weather application get weather data from the weather software system and show it to the users.

2.3.2 Template

Templates are a way to display information on the user's browser. It aims to describe what we want to show [7].

2.3.3 Logo

A logo is a word and image-based symbol that identifies an individual or a company. An excellent logo conveys what the brand does and its values [8].

2.3.4 Software (Downloadable)

Downloadable Software means any computer software programs, SDKs, codes, and/or files made available to consumers through internet which you may be required to download and install/store locally on your computer to use the functionality of it.

2.4 Similar Platforms (API)

2.4.1 Rapid API

2.4.1.1 Introduction

RapidAPI, the world's largest API hub, is used by over three million developers to find, test, and connect to thousands of APIs — all with a single API key and dashboard [9]. Find the API as per your requirements and use it in your app and manage all your api through single dash board. You can sell your API to millions of users using RapidAPI Hub.

2.4.1.2 Costing

It charges 20% on every transaction.

Checkout the table below of three kinds of API on RapidAPI:

API Type	Description
1. Free APIs	APIs that do not require a credit card or subscription plan to consume
2. Freemium APIs	Paid APIs that include a limited free tier and require a credit card
3. Paid APIs	APIs that require a paid subscription plan and credit card to consume

Table 2.2 Types of API in RapidAPI [10]

2.4.1.3 Main Features

- More than 10.000 public APIs
- Easy listing, manage and monetizing API
- Effective API marketing
- Collaboration with teams on building APIs
- Support of different API types
- Easy to integrate and manage
- High security
- API performance tracker
- Single Dashboard of Analytics for all API Usage.

2.4.1.4 Limitations

- Some public APIs listed in RapidAPI doesn't give expected results
- Only can buy and sell API

2.4.2 Celigo

2.4.2.1 Introduction

Celigo is a fully integrated Platform as a Service (iPaaS) and is one of the most effective API marketplaces for publishing and selling APIs. Celigo employs best practices must be followed and provides a variety of features to its users. It also allows for real-time integrations. They also offer a wide range of solutions of different categories such as supply chain & logistics ERP, CRM and much more [11].

2.4.2.2 Costing

Not sure about developers who wants to sell their APIs but for consumers, check the packages below:

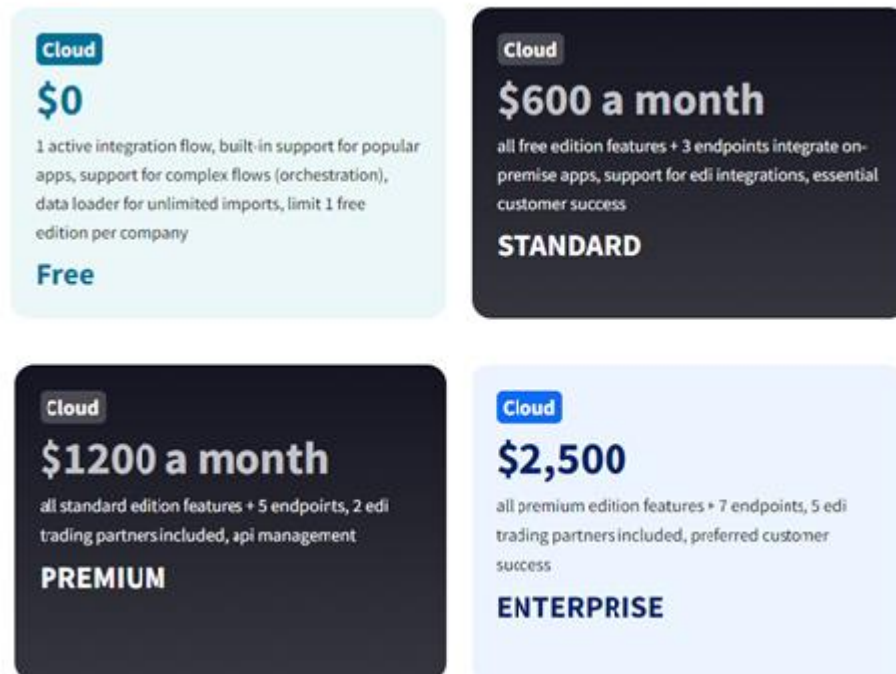


Fig 2.1 Celigo subscription packages [12]

2.4.2.3 Main Features

- Real time integration
- Connectors
- API designer
- Application management
- Data encryption
- Monitoring
- Maintain security standards
- Manage file transfers

2.4.2.4 Limitations

- Platform is expensive

2.4.3 APILAYER

2.4.3.1 Introduction

APILayer, a cloud-based SAAS and API provider, launched its API marketplace in February 2022. This was coupled with its acquisition of Prompt API, a platform for the developers to monetize their APIs. This is the platform for developers to list and monetize their API [13].

2.4.3.2 Costing

- Charges 15% on revenue.

2.4.3.3 Main Features

- Listing API.
- Monetize API
- Monitoring API
- Test API

2.4.3.4 Limitation

- Marketing services is not present in APILayer Platform.

2.4.4 Rakuten

2.4.4.1 Introduction

Rakuten is a popular API marketplace with 1 million+ developers across the globe. They help you manage, market, and sell your API without any difficulties [13].

2.4.4.2 Costing:

- 20% on revenue.

2.4.4.3 Main Features:

- Listing API.
- Monetize API
- Monitoring API
- Market API from Affiliate Marketing.
- Fast Integration
- Test API
- Manage Invoicing & Billing

2.5 Similar Platforms(Digital Products)

2.5.1 Sellfy

2.5.1.1 Introduction

It is one of the simplest and powerful platforms to sell digital products effectively. It has the functionality to buy/sell both physical and digital products. According to Sellfy, creating a digital store only takes five minutes. All landing pages can be altered. You can arrange the layout, add your logo, and experiment with colour schemes. If you wish to strengthen your branding, you may even connect your domain name. Every product page is optimized for mobiles as well [14].

2.5.1.2 Costing

- Starter (\$19/month)
- Business (\$39/month)
- Premium (\$89/month)

2.5.1.3 Main Features

- Print on demand products
- Built-in email marketing
- Unlimited products and bandwidth
- High level security
- Large file support
- Mobile Optimized store
- Connect custom domain to your store

2.5.1.4 Limitations

- Limited customization options available
- Cannot allow to sell API and other services

2.5.1.5 Implementation

For digital goods, Sellfy hosts product files on their secure server, provides access to the checkout process, and handles delivering orders to clients immediately following a successful transaction. It will give you access to the checkout capability for physical products, but Seller will be responsible for shipping and order fulfilment. Customers can pay you using Stripe or PayPal if you integrate those services [15].

2.5.2 Podia

2.5.2.1 Introduction

Podia is a platform for the sale of downloads, memberships, online courses, and webinars. It can be considered an all-inclusive e-commerce platform. You can make a website to sell digital products on. Email and affiliate marketing are supported. In addition, you may include a live chat widget to interact with potential clients [14].

Podia is considered among the greatest e-commerce platforms to sell online courses.

2.5.2.2 Costing

- Mover (\$390/year)
- Shaker (\$790/year)
- Earthquaker (\$1,790/year)
- Free plan available with transaction fees.

2.5.2.3 Main Features

- Easy to use platform
- Instant payouts
- Descent pricing
- Good customer support
- Email marketing integration
- Tracking and management
- Unlimited bandwidth
- Built-in online chat feature

2.5.2.4 Limitations

- Not appropriate for all kinds of digital products and services.

2.5.3 SendOwl

2.5.3.1 Introduction

SendOwl is an all-in-one solution designed to help creators successfully sell and deliver audiobooks, e-books, photography, software, memberships, event tickets, online courses, and much more [16]. It supports buy/sell of both physical and digital products in nature.

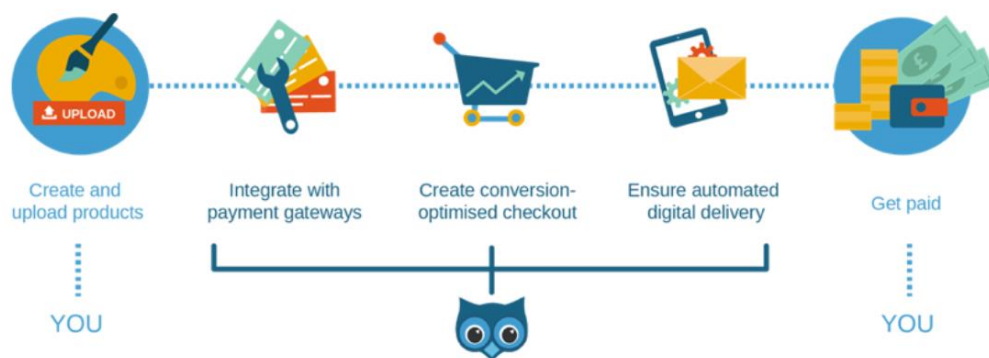


Fig 2.2 Working of SendOwl [17]

Above Fig 3.1 shows the simplicity of how SendOwl works. The seller just needs to create or upload the product and the platform will be responsible to sell it effectively. Marketing can also be implied to target more related buyers.

2.5.3.2 Costing

- Basic (\$9/month)
- Standard (\$15/month)
- Premium (\$24/month)
- Business (\$39/month)

2.5.3.3 Main Features

- affiliate marketing
- Multi-language and multi-currency
- API access
- Manage taxes
- Email marketing
- Cart abandonments
- 1-click upsells
- Good security
- Built-in analytics

2.5.3.4 Limitations

- Emergency support, such as live chat or phone support not available
- No Facebook community group.

2.5.4 BigCommerce

2.5.4.1 Introduction

BigCommerce is a NASDAQ-listed ecommerce platform that provides software as a service to retailers. The company's platform includes online store creation, search engine optimization, hosting, and marketing and security from small to Enterprise sized businesses [18]. It has built-in mobile optimization as well.

2.5.4.2 Costing

- Standard (\$29.95/month)
- Plus (\$71.95/month)
- Pro (\$269.96/month)
- Enterprise (Custom Pricing)

2.5.4.3 Main Features

- SEO features
- Free templates (approx. 12)
- Page builder
- CMS
- Support selling of physical, digital and service based products
- Email Marketing integration of different services
- Management, tracking and reporting
- Can sell unlimited amount of products

2.5.4.4 Limitations

- Not recommended for beginners with limited tech experience in ecommerce platforms.
- Need to learn functionality to effectively use the platform

3. Aim and Statement of Problem

3.1 Aim

The main aim of the project is to have a platform where there can be a marketplace for digital products/API for developers to sell or buy the product/API as there are limited platforms where either marketing of digital products or API is done.

3.2 Objectives

The AAAS (Application As A Service) project will meet the following objectives:

- **Earning:** The first and foremost objective of the AAAS is to provide the developers and other sellers the platform where they will be able to earn by selling their Products.
- **Market and Authentication:** The marketing and authentication of the seller's product will be the responsibility of AAAS.
- **Marketplace:** Buyer will be able to buy and use Products available on the platform. They will be able to find their required product from wide range of products uploaded on the platform.
- **Attract customer from marketing platform:** Sellers will also get a solution to market their products on different platforms (of their choice) and increase their revenue.
- **Brochure Templates:** Sellers will also get an opportunity to use Platform's built-in brochure templates for marketing.
- **Statistical Analysis of related products:** Seller can view the Similar Product Statistical Analysis for better pricing and package creation.

3.3 Project Summary

The project is mainly for the digital product sellers and developers. Specifically the project is designed for sellers to make money from their Products (APIs, Templates, logos, Downloadable Software). The process of the project is that developers can link their API or upload their products on a web server. Creation of products for API, developers create endpoints and create their subscription packages whereas for the creation of product other than API, the seller add product executable file in case of downloadable software or add PNG file for logo or can add template file as a product and create buy package. Once the product is created the product will be sent to the admin for review of the product created. According to product review given by the admin, the seller will be notified via email. Now platform can provide the market product on different platform with a predefined template of brochure. The seller will select the platform where to market the product. Then the seller completes the payment procedure of the platform and the product will be published. The buyer will view the product, For API the buyer will test the endpoints subscribe to package After

subscription the product will appear on buyers dashboard. For other product the buyer will check the reviews and after the payment confirmation, the product and its status will appear in the buyer's dashboard.

3.4 Risk

Project risks are characteristics, circumstances, or features of the project environment that may have an adverse effect on the project or the quality of its deliverables. Known risks identified with this project have been included below. A plan will be put into place to minimize or eliminate the impact of each risk to the project.

Project risks are described below

3.4.1. Project Risks

The Risk that might get associated with AAAS are:

Risk Area	Level (H/M/L)	Risk Plan
1. External Hazard Risk	M	Risk plan activity: Any external malware/virus can hit the platform. To counter this we will secure our web by HTTPS, automatic backup, up-to date Website.
2. Performance Risk	L	Risk plan activity: Design a risk response to reduce the downside and take advantage of the upside potential.
3. Small Delay In Response. There can be a delay in response because the API server is located in a specific region. Users far from any region will experience delays in API response.	L	Risk plan activity: In order to reduce the risk, we have to start the platform on a single region for best performance and expand the business by adding servers of different regions.
4. There can be bugs in user API	M	Risk plan activity: The API bug in user API affects the user profile in terms of ratings.

Table 3.1 AAAS project risks, their level (severity) along with risk plan

3.4.2 Project approach

1. User (Seller/Buyer) registration and login system is to be made then user profile functionality is to be created which enable registered users to view and update their profiles.

2. For API Product, the different subscription packages will be made for every API (in our case packages are basic, standard and premium) which will require an already registered user as a Seller and endpoints of an API.
3. For Products the either then API, the single pricing package will be made for every product which will require an already registered user as Seller and downloadable executable file of product.
4. After the Buyer functionality, we have to create another server to allow buyers to use API Products endpoints by requesting the endpoints and receiving the response from the endpoint. After that, the admin functionality will be made to authenticate and approve the Seller's Product. Now related Buyers will be able to view the products.
5. the Buyer will be able to view the Products posted by Seller.
6. For APIs Product: The Buyer will test the endpoints and if interested, then subscribe to the specific package and proceed to payment.
7. For Other Product: The buyer will see the product review and if interested, then the buyer will proceed to payment.
8. The buyer will make the payment transaction with a payment system implemented in stripe. After a successful transaction, the Seller will receive the money in their wallet.
9. There will also be the marketing functionality that enables Seller to post their packages on pre-selected marketing platforms and also ask for the expert marketing guide. Then complete project testing and transition of project to production will be done.

3.5 Project Scope

3.5.1 In scope:

- In this project, our main aim is to provide a platform to developers and other digital product sellers where they can publish their Products.
- Marketing functionality on specified platforms after the authentication of product from admin side.
- Payment system integration (stripe)
- For the scope of this FYP, feature to buy/sell different kinds of digital products include:
 - APIs
 - Templates
 - Logo
 - Downloadable Software

- Other categories will be included in the future work.
- **Customer/Buyer:** The user/customer will subscribe/buy then use the products.
- **Publisher/Developer:** By the subscription of the product the developer or seller can easily earn. The developer can select the better package options based on the statistical analysis provided by the platform at the time of package creation.

3.5.2 Out of scope:

- In this project, we will not cater to any kind of Product issues after it has been validated/authenticated by the customer.

4. Hardware, Software analysis and requirements

4.1 Required Software Analysis and requirements:

This section expands on different software platforms required, comparison with alternatives and their role in the project.

Following are the main technologies used in this project:

- Django Framework (backend development)
- PostgreSQL (database)
- HTML, CSS and JS (frontend development)
- VS Code (for coding, debugging, and testing)

4.1.1 Django

Django is used in this project for the backend development. Django is free and open-source framework and maintained by the Django Software Foundation. It is a Python Web Framework that enables fast, secure development and easily maintainable and scalable built by experienced developers.

4.1.1.1 Django vs Other Technologies

Django provides all the necessary things to develop a fully functioning web application. These things make development easy and fast. Django also allows up-to-date security features to prevent attacks like XSS, CSRF and SQL Injection. It takes care of both of the principles DRY (Don't Repeat Yourself) and KISS (Keep it simple and short). Django also provide easy integration to different databases including PostgreSQL.

4.1.2 PostgreSQL

PostgreSQL is a free and open-source relational database management system developed at the University of California, Berkeley.

PostgreSQL provides rich features and extensions including nested transactions, asynchronous replication, and full-text search.

4.1.2.1 PostgreSQL vs MySQL

PostgreSQL performs better than MySQL because it supports concurrent writing operations.

4.1.3 Frontend Technologies

HTML provides the basic structure of sites and beautified by CSS. JavaScript(JS) is used to make the site dynamic by altering the behavior.

4.1.3.1 JS vs JS Frameworks

There is also an option to go with JavaScript frameworks so It's increase the efficiency but more costly. The JavaScript itself works perfect in our scenario and less costly but more development is required. We decided to go with JavaScript.

4.1.4 VS Code

Visual Studio Code is a lightweight yet capable source code editor for Windows, macOS, and Linux that runs on your desktop. It includes built-in support for JavaScript, TypeScript, and Node.js, as well as a robust ecosystem of extensions for other languages and runtimes (including C++, C#, Java, Python, PHP, Go, and .NET) [19].

4.1.4.1 VS Code vs other Code Editors

- a lightning fast source code editor
- perfect for day-to-day use. With
- support for hundreds of languages, VS Code helps you be
- instantly productive with syntax highlighting, bracket-matching, auto-indentation, box-selection, snippets, etc.

4.2 Required Hardware Requirements:

The two different sides of hardware requirements are:

4.2.1 Client-side requirements

- Laptop/Desktop
- Internet connection

4.2.2 Server-side requirements

For the time being, server-side requirement of this project is none as services of Web server and API server will be used over the internet for this project.

4.2.2.1 Web Server:

Web server is required to serve web pages to all the users.

4.2.2.2 API Server:

API server is required to serve REST API and allow buyers to use API products.

4.3 Algorithms:

4.3.1 Customize Indexing Algorithm:

Customized Indexing Algorithm is created to rank products according to their sales and reviews.

4.3.3 How buyer can use seller's API.?

First, the buyer will subscribe the package. The buyer will get the AAAS Token(to validate and authenticate requests). The buyer make a request to our server along with AAAS Token and seller defined payload. Server authenticates the user request and make request to seller's server and return the response that comes from seller's server.

4.4 Diagrams

The overall structure and functionalities of AAAS is show with the help of system diagram, actor use case diagram and activity diagram

4.4.1 System Diagram

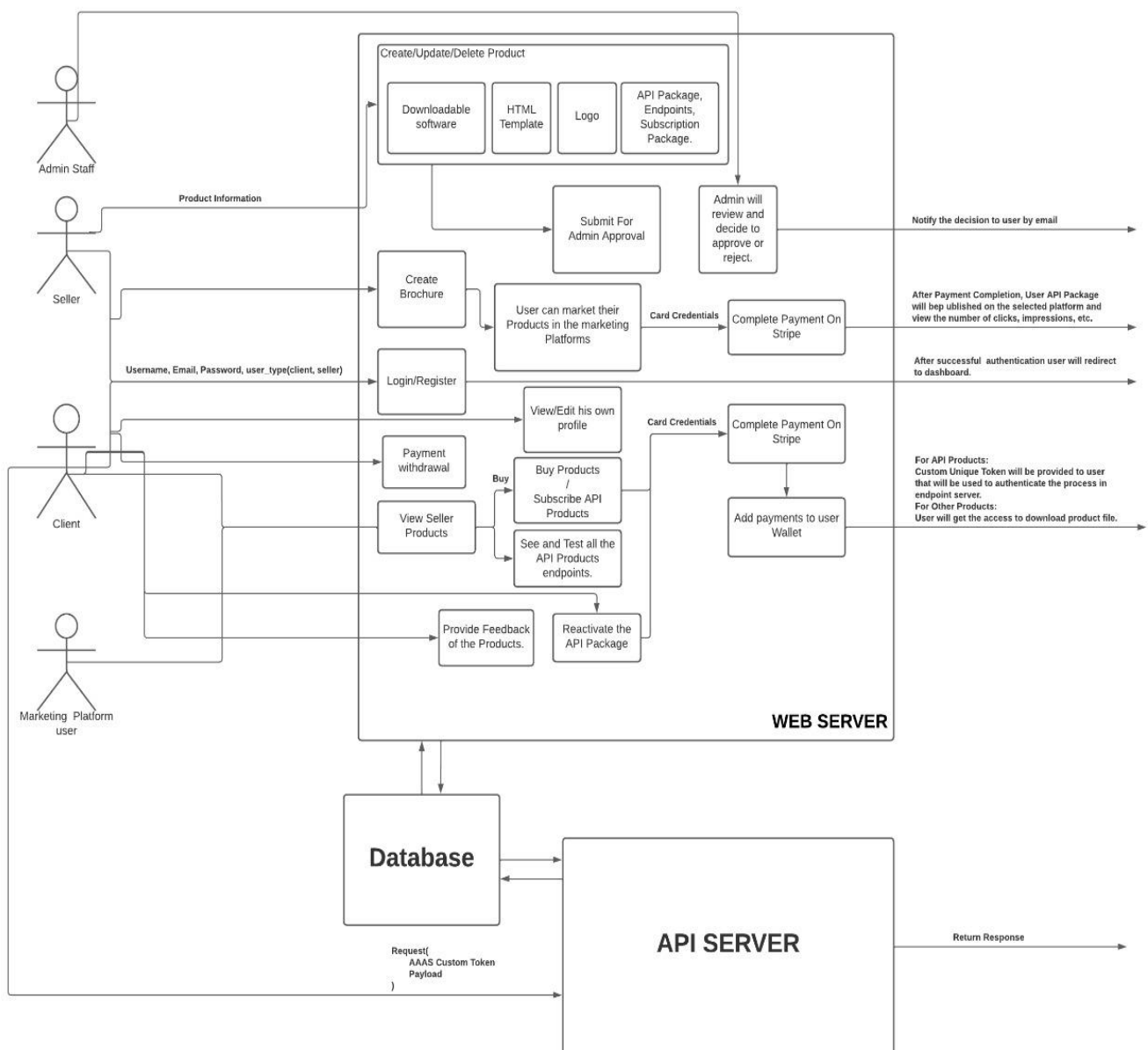


Fig 4.1 System diagram of AAAS

4.4.2 Actor Use Case Diagram

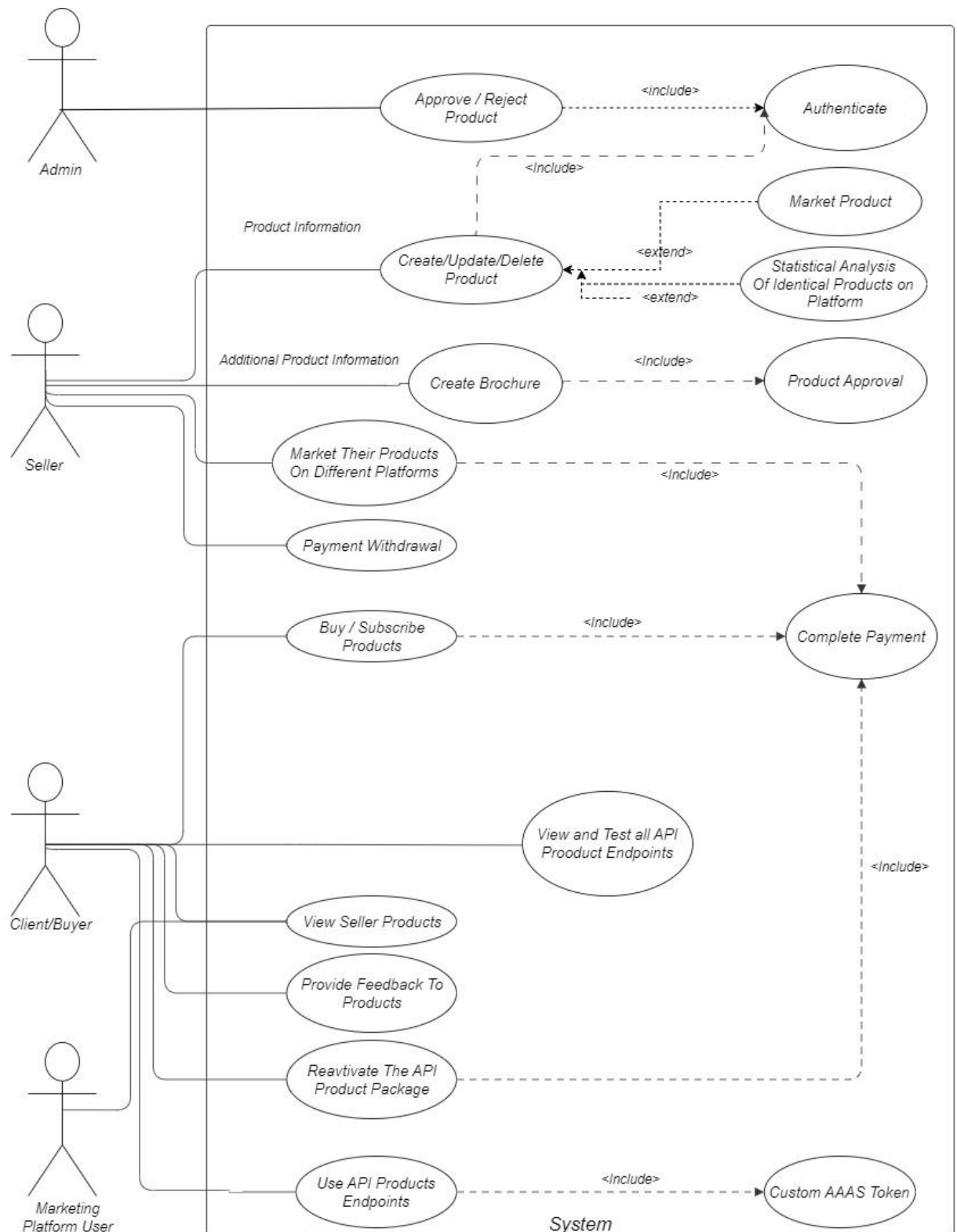


Fig 4.2 Actor Use case diagram of AAAS

4.4.3 Activity Diagram

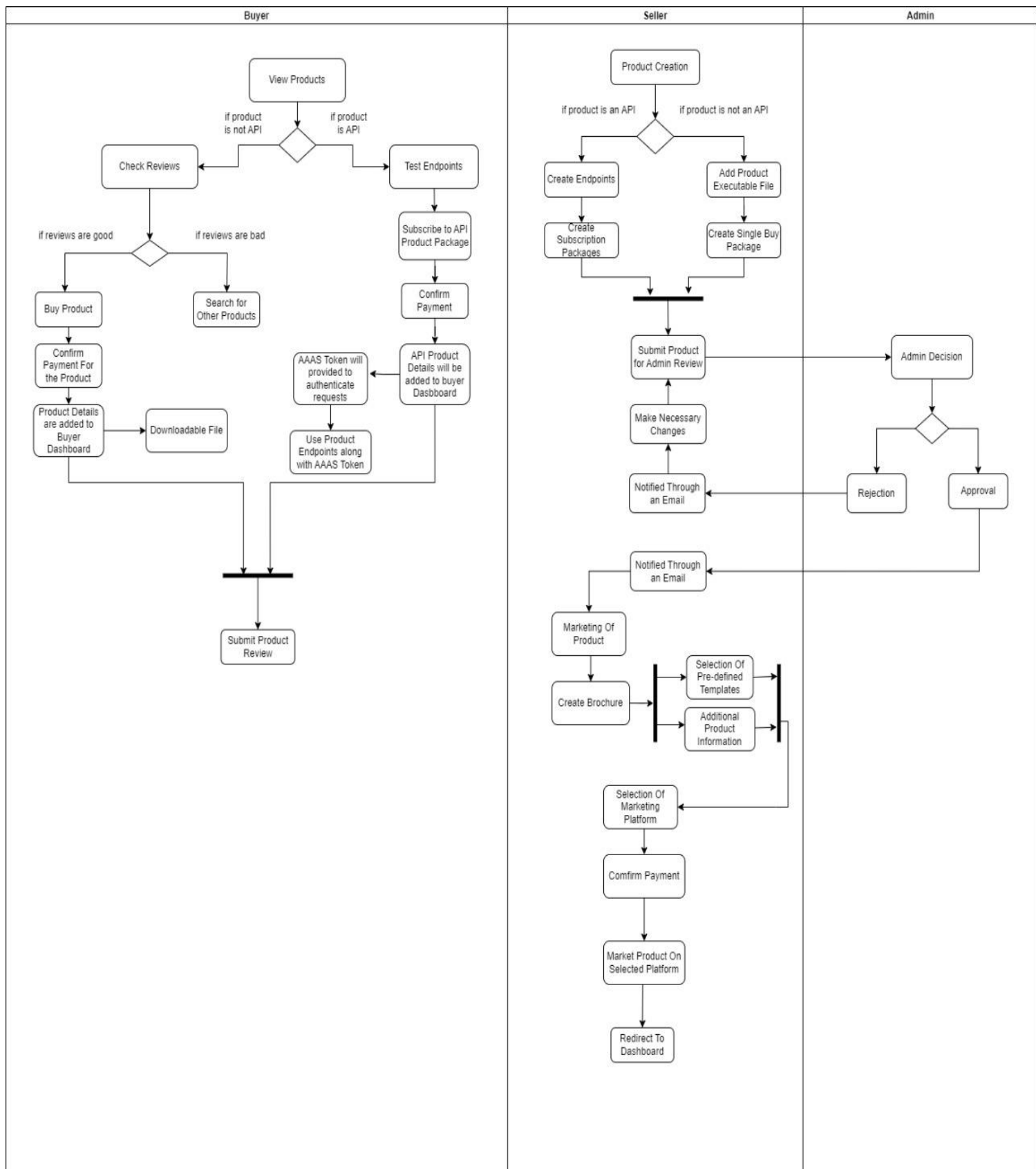


Fig 4.3 Activity diagram of AAAS

4.5 Requirements:

1. As a Developer, I want to sell my Products (Logo, html templates, API, downloadable software) so that I can earn passive income
2. As a Developer, I want to withdraw my money that I have earned.
3. As a Developer, I want to track all the progress of all my Products so that I can get aware of the utilization of my products.
4. As a buyer, I want to buy a Products, so that I can use.
5. As a seller, I want to create different API products packages including endpoints, so that buyers can buy the package and single package for other products.
6. As a seller, I want my Products to be marketed on different platforms, so that I can earn from various platforms.
7. As an admin, I want to review the Products created by the user, so that I can accept or reject it accordingly.
8. As a seller, I want an expert guide as a suggestion based on the stats of similar posted products on the platform.
9. As a seller, I want to design brochure of my product that will be used for marketing.

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