



**TECHNICAL DESIGN DOCUMENT**  
LAMA | ONLINE GAME DESIGN 2018 - 2019



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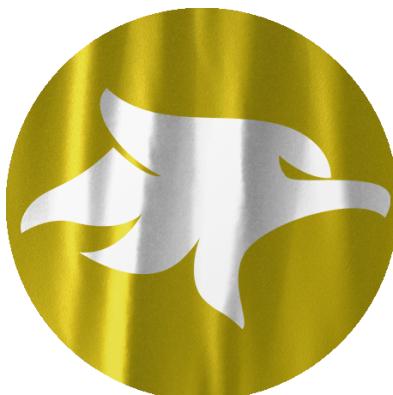
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## 1 Changelog

Team member	Date	Description
Maione	22/03/2019	Document creation
Carrarini	09/04/2019	Added sections: <ul style="list-style-type: none"><li>- Project goals</li><li>- Provided services</li><li>- Client side</li></ul>
Maione	10/04/2019	Added sections: <ul style="list-style-type: none"><li>- Back-end</li></ul>
Maione	11/04/2019	Added sections: <ul style="list-style-type: none"><li>- Development</li><li>- Cost estimation</li></ul>
Carrarini	12/04/2019	Added sections: <ul style="list-style-type: none"><li>- Hardware requirements</li><li>- Workload estimation</li></ul>
Carrarini	13/04/2019	Added sections: <ul style="list-style-type: none"><li>- Front-end</li><li>- External services</li><li>- Communication</li></ul>
Maione	03/05/2019	Applied small changes to: <ul style="list-style-type: none"><li>- Front-end</li><li>- Back-end</li></ul>
De Cosmo	13/05/2019	Corrections to several sections; Updated section Development; Subdivided section "External services" in: <ul style="list-style-type: none"><li>- Customer care</li><li>- Payments</li></ul> Added section: Staff
De Cosmo	20/05/2019	Changed Gantt chart; Modified section Staff; Added section Costs; Done costs estimation; Applied small corrections
De Cosmo	31/05/2019	Applied corrections; Updated sections: <ul style="list-style-type: none"><li>- Project goals</li><li>- Provided services</li><li>- External services</li></ul>

De Cosmo	01/06/2019	Small corrections Updated section Client-side
De Cosmo	02/06/2019	Updated section Workload estimation
De Cosmo	03/06/2019	Updated section Front-end
De Cosmo	05/06/2019	Updated section Back-end
De Cosmo	07/06/2019	Updated sections: - Back-end - Communication
De Cosmo	08/06/2019	Updated sections: - Front-end - Back-end - Team - Development
De Cosmo	09/06/2019	Updated sections: - Delivery - Development - Costs

## 2 Project goals

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Hypogaeum is developed to be played by Microsoft Windows, MacOS and Linux users through the **Steam** client. It has been designed with a **client-server** architecture, players so the start their clients and connect to a central server over the Internet.

The game requires to its users an **Internet connection** and is a **collaborative** and **competitive multiplayer online** game (this means that it does **not** have an **offline** game mode).

## 3 Provided services

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In addition to the game itself, the services provided by Hypogaeum are:

- **availability 24/7;**
- **low latency**, to support real-time engaging battles;
- **maintenance;**
- **periodic updates**, to improve the game experience and add new contents and features;
- an **online website** where players can get the latest news about the game and information about their **personal** in-game statistics, the ranking **position** of each faction and a leaderboard of the **best players** for each species;
- an **in-game store** where players can buy **season passes** and in-game elements to **customize** their characters (skins, weapons and cars);
- **social-network integration** (at least Facebook) to give to the players the chance to share their achievements and statistics with their friends, showing them how good they are at the game.

## 4 External services

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In addition to the ones already described, the game requires other services that have been delegated to **external companies**: **customer care**, **personal data management**, **payment system**, **matchmaking** and **lobby** and **in-game chat**.

### 4.1 Customer care

Since Hypogaeum is both a **collaborative multiplayer** and a **competitive player-versus-player** game, designed principally for **killer** players, we expect to receive **complaints** and **help requests** about the game itself and/or about possible connection issues. For these reasons, we need to provide to our players a **customer support** service that lets them feel that their opinions and problems are heard and helps them to face the issues they could encounter. To do this, we decided to delegate this service to a **third-party external company: 5CA**. As described on the company's website, 5CA offers video game support through different **channels** (phone, social media, email, communities, chat, ecc.) and about different **topics** (game experience, hardware issues, billings and payments, etc.). This is a huge advantage since it allows our users to get help in different ways and on different problems. At the moment, the company collaborates with Epic Games, 2K games, Razer, Psyonix, and many others.

Since 5CA's pricing philosophy is based on “**pay what you use**”, we can not foresee in advantage the cost of this service, even because it strictly depends on our player base dimensions and on the possible issues they could encounter. More information can be found on the company's [official website](#).

#### **4.2 Personal data management**

Since players' **personal data** (password, username, sensitive informations, etc.) could represent a huge problem for us, due to the security issues they implied, we delegate their management to **Steam**, through the use of its **OpenID library** that allows to **authenticate** the users, without requiring them to enter their username and password. In this way, we avoid to get access to (and then to manage) any kind of sensitive information. For more details, see the [official documentation](#).

#### **4.3 Payment system**

Hypogeum provides an **in-game store** that allows the users to buy **season passes** and **customize** their characters with skins, weapons and cars. To do so, we decided to use the **Steamworks Steam Microtransactions APIs** that let the players make **purchases** through their **Steam Wallet** and also gives us useful **tools** to try to **anticipate frauds**. In this way we avoid assuming the responsibility of managing credit cards data, that could represent a huge security issue, even though this requires the sharing of our revenues with **Steam**. For more information, see the [official documentation](#).

#### **4.4 Matchmaking and lobby**

The **matchmaking** and **lobby** systems are necessary to let users play online, set up the teams and create balanced matches, based on players' skill level and game settings, so that they can have the best possible game experience. To make this possible, we use **Steamworks matchmaking and lobby APIs** that represent the backbone for getting players playing together. To get more information, see the [official documentation](#).

#### **4.5 In-game chat**

Since Hypogeum has a rather important cooperation factor, it is necessary to have a **team chat system** that helps the players to create a **strategy** and then **coordinate** their actions. We aim to provide two ways of communication inside the game: **text** and **voice chat**. The **text chat** service is obtained using again the **Steamworks matchmaking and lobby APIs**, that give us the possibility to create a chat inside the lobby. To add the **voice chat**, we use **Steamworks Steam Voice APIs** that allows us to register audio from user's microphone and send it to other players, that can then listen to it. For more details see the official documentation ([text](#) - [voice](#)).

## 6 Client-side

The players can download and install the game directly from their **Steam** client. In the following, we describe the **client-side requirements**, both **hardware** (minimum and recommended) and **software**.

### 6.1 Minimum hardware requirements

Processor	Dual-core @ 2.4 GHz
Memory	2 GB RAM
Graphics	ATI Radeon HD 4850 or NVIDIA GTX 260
Storage	150 MB available space
Sound Card	DirectX-compatible sound card
Connection	Broadband Internet connection
Network	ADSL 10 Mbps
Input Devices	Mouse and keyboard are required

### 6.2 Recommended hardware requirements

Processor	Quad-core @ 2.5+ GHz
Memory	4 GB RAM
Graphics	ATI Radeon HD 7950 or NVIDIA GTX 660
Storage	150 MB available space
Sound Card	DirectX-compatible sound card
Connection	Broadband Internet connection
Network	ADSL 20 Mbps
Input Devices	Mouse and keyboard are required

### 6.3 Software requirements

OS	Windows 7 64-bit or newer Ubuntu 14.04 LTS x64 or newer MacOS X 10.10 or newer
DirectX	Version 9.0c
Other	Steam client

## 7 Workload estimation

Based on the **top performers** and **competitors** (see the **Game Design Document** for more information), we foresee to have **on average 130,000 players per month**, that means **4,000 players per day on average**, with **daily peaks of 7,000 players**, whereas the **peaks during the day** are estimated around **2,000 simultaneous players**.

Since we have estimated peaks of 2,000 players in the day and the matches are designed for up to 8 players, we need to handle about **250 simultaneous matches**.

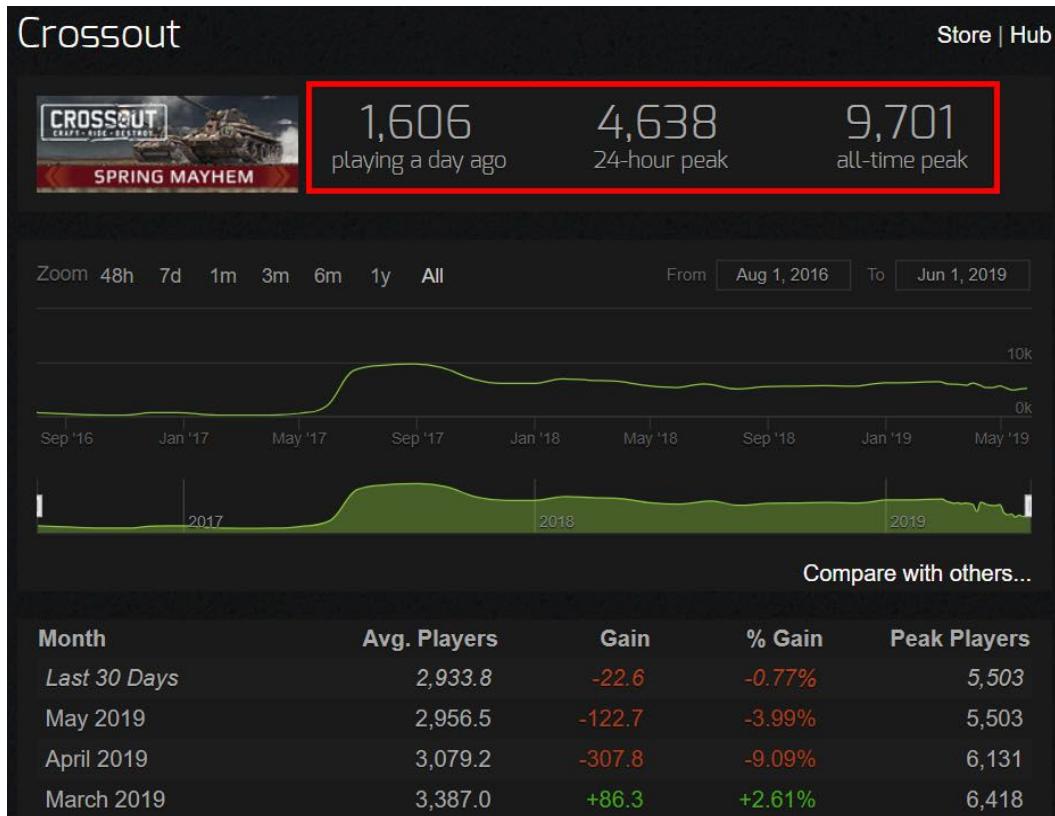
Since Hypogeum has **season-based mechanics**, we do not expect to have a drastic drop of users in the first months, so the **curve** representing the graph has a **slower decrease** than the average one. In addition to this, thanks to the release of **several updates** that will add more **in-game elements**, new **features** and **personalization items**, we can **raise up** again our player base dimensions, keeping the **current users** and involving **new ones** or those that **have left** the game.

The server has to store data about **players' personal statistics, information** and **in-game progress, state** and **result** of the **matches** and the **factions' ranks**, with a weight of around **200 KB for each user**.

In the following we present the **SteamCharts** of **Rocket League**, **CrossOut** and **Borderlands 2**, that are **three** of our **main competitors**, evidencing the **number of users** that played the game **the day before** the data were collected, the **24-hour peak** and the **all-time peak** for each of them.



Rocket League SteamChart.



CrossOut SteamChart.



Borderlands 2 SteamChart.

## 8 Front-end

We provide an **online website** that allows the players to:

- **get the latest news about the game and the season;**
- **check their personal in-game statistics and score;**
- **know both their own rank and the top players' one in each faction's leaderboard;**
- **know the ranking position of each faction in the current season's leaderboard;**
- **get information about the game state;**
- **contact the game support.**

All these features are granted through a **front-end server**, able to fulfill the incoming requests.

### 8.1 Platforms

According to our estimation the **workload** of the front-end server is **lower** than the one of the back-end, due to the **smaller traffic volume** and since the **data** provided by the website to the players (for the **leaderboards**, the **rankings** and the **information** shown) have **small dimensions** and are **stored** in the **database** of the **back-end server** (from which they are obtained through **queries**).

For this reason we opt for an **Azure App Service** (provided by **Microsoft**). The **chosen configuration** has the following features:

Feature	Description
Region	West Europe
OS	Linux
Tier	Standard
Number of Instances	1
Instance "S2" features:	<ul style="list-style-type: none"> <li>- processor 2 cores Intel B-Series</li> <li>- memory 3.5 GB RAM</li> <li>- storage 50 GB</li> <li>- auto-scalability included</li> <li>- load balancer tier basic included</li> </ul>
Backup	Included
Cost per month	€116.97 + VAT

We foresee to use the App Service only in an **advanced phase** of the development, about **6 months before game release**, in order to reduce the expenses and have enough time to configure it and evaluate its performances and services.

### **Scalability and extensibility**

If the chosen configuration proves not to be able to sustain the incoming requests, it is possible to follow two possible scalability approaches: the **horizontal** one and the **vertical** one.

With the **horizontal scalability** we add **other instances** (up to **10** total instances) of the Azure App Service, that, thanks to the **load balancer**, can **split** the traffic and **distribute** it among themselves. In this way it is possible to **face** the increasing number of **concurrently connected** users and **respond** to their **requests**.

With the **vertical scalability** we can switch to an **improved tier** of the Azure App Service with the following technical features:

Feature	Description
Region	West Europe
OS	Linux
Tier	Standard
Number of Instances	1
Instance “S3” features:	<ul style="list-style-type: none"> <li>- processor</li> <li>- memory</li> <li>- storage</li> <li>- auto-scalability</li> <li>- load balancer</li> </ul> 4 cores Intel B-Series 7 GB RAM 50 GB included tier basic included
Backup	Included
Cost per month	€233.93 + VAT

If the incoming traffic shows up to be **heavier** and **more demanding** than our estimation has foreseen, the vertical scalability can be particularly **suitable** to provide **better performances** and add **more power**.

One important **advantage** of the **Microsoft Azure Platform** is that it allows not only to increase but also to **decrease** the amount of **reserved resources**, still through **horizontal** and **vertical scalability**. If, for example, the **traffic volume** gets **smaller** or the **server** requires **less resources**, thanks to the scalability, we can **decrease** the number of **active instances** or the **technical specifications** of the front-end server.

Since we **pay** only for **what we use** and **for the time** we use it, we can **reduce** our expenses and, most important, **adapt** the infrastructure to the possible **situations**.

### **Website domain**

The **domain name** of the website is purchased directly from the **Azure Platform** and managed by the **Azure Portal**:

Feature	Description
Available domains	.com, .net, .co.uk, .org, .nl, .in, .biz, .org.uk and .co.in
Support	Included

Privacy protection	Included
Cost per year	€10.112 + VAT

### Database

Since most of the data are not stored on the front-end server, but on the back-end one, we can attend **two** possible ways for the few data we need to manage directly in the website: **keep** them on the **storage** provided us by the **Azure App Service** or use an **Azure Database for MySQL**.

In a first phase we apply the **first strategy**, storing the data on the Azure App Service. In the case in which the amount of data **exceeds** the foreseen one, we will implement the **second approach**, adding an Azure Database for MySQL with the following **characteristics**:

Feature	Description
Region	West Europe
Tier	General purpose
Compute	5th generation, 4 vCore
Storage	30 GB
Backup	With LRS redundancy
Additional backup storage	50 GB
Cost per month	€265.07 + VAT

The technical specification of the additional database can both be **increased** or **decreased** depending on the **volume of data** we have to manage.

More **detailed information** about all the services described in this section are available on the **Azure Platform** official [site](#) and [documentation](#).

### 8.2 Front-end costs

According to what we said up to now, the front-end has an estimated total cost of:

Name	From	To	License for	Cost	Service total cost
Azure App Service S2	04/20	09/20	6 months	€116.97 + VAT per month	€701,82 + VAT
Website Domain	05/19	09/20	2 years	€10.11 + VAT per year	€20.22 + VAT
<b>Total</b>					<b>€722.04 + VAT</b>

## 9 Back-end

The **back-end server** is in charge of two main tasks: **store the data** and **run the game**.

In order to carry out the **first task**, a **database** containing all the following **information** is required:

- players;
- players' statistics and scores;
- leaderboards;
- match and season results;
- scripting code;
- character data;
- backups;
- etc.

The **second** task is accomplished through **game servers**, to which the players are **connected** and where the **game** is **run**.

### 9.1 Platforms

In order to perform all the required tasks, the back-end server has to face an overall **heavy workload**. First of all it has to **manage** all the **game data** in the **database** (it obtains them by the clients, updates stored information, responds to the front-end queries, etc.). Then it has to **run the game on the game servers**, **synchronizing** several **matches** through different clients (providing **multiplayer** functionalities), and **supervising** the battles as an **authoritative server**, trying to **prevent** and/or **avoid cheats**. Finally it has to **establish** the **communication** between the database and the game servers, so that they can **exchange** **necessary data**. All these tasks must be performed taking into account a **key aspect of multiplayer online games**: the **latency**, that plays an **important role** especially in **driving** and **shooting games**, where the **timing** is **crucial**.

For such reason we opt for **Azure PlayFab** (provided by **Microsoft**), that offers **specialized back-end services** and a **suite of useful tools** for game development. This brings an important advantage: since we choose the **same company** (Microsoft) both for the front-end and the back-end, **manage the infrastructure** should be **simplified**.

Since we pay for the services and tool suite, we do **not** have any **specific information** on the **hardware** used to power them.

#### *First phase*

In order to **test** both the **game** and the **infrastructure** from the very beginning, we decided to use the **Essentials plan** for the first phase of development:

Feature	Description
Plan	Essentials
LiveOps Features	Limited access
Professional Features	Excluded
Provided support	Web forums Documentation Tutorials

Maximum number of players	1,000
Cost per month	Free

### ***Second phase***

In the second phase, about **6 months before game release**, we expect to switch to the **Indie Studio plan**:

Feature	Description
Plan	Indie Studio
LiveOps Features	Complete access
Professional Features	Complete access
Provided support	Web forums Documentation Tutorials Slack
Maximum number of players	100,000 MAU (monthly active users)
Cost per month	€88.12 + VAT

We opted for this transition since this plan will also be the one that will be used at **game launch**, so it is necessary to **evaluate the actual service behaviour (performances, reliability, availability, etc.)** provided by the **back-end infrastructure** once the **game will run** on them.

### ***Evolution strategy***

When the number of players will **overcome** the **one hundred thousand MAU** (monthly active users), our evolution strategy expects to **switch** from the Indie Studio plan to the **Professional plan**:

Feature	Description
Plan	Professional
LiveOps Features	Complete access
Professional Features	Complete access
Provided support	Web forums Documentation Tutorials Slack Dedicated Support Service Level Agreement (SLA)
Maximum number of players	No limit
Minimum cost per month	€265.54

Cost per MAU	€0.008 (first 1,000 MAU are free)
Foreseen number of MAU	130,000
Foreseen MAU cost	€1,032
Total cost per month	€1,297.54 + VAT

As can be seen, the total cost per month depends on the number of MAU. Azure PlayFab **counts** the number of players who make an **API call to PlayFab** during the month, considering as a **single MAU** a person playing on **different devices** with a **linked account**.

The following **chart** represents our **estimation** about how the **number of MAU evolves over time**:



The expected **game life-cycle** is about **3 years**. The **four local minima points** of the graph correspond to the dates on which we plan to **release an update**: **February and October 2021** and **February and October 2022**.

### Back-end servers

From the **game release on**, we will need to **rent a set of Azure PlayFab Multiplayer Servers**, one for each of the **three geographical areas** we are interested in: **US West, West Europe and East Asia**. Each set will contain:

- **one main game server** to **run** game and matches;
- **one game server** that replaces the main one in case of **fault**;
- **one main data server**, containing all the **data** of the players of **its area**
- **one backup data server** that stores the **backups** and replaces the main one if a **fault** occurs.

Through this strategy, we will be able to **improve** the **game reliability** and **availability** and also **decrease** the **latency** (thanks to the servers delocalization), **providing** to the players a **better user experience** and a **more enjoyable game**.

### Scalability and extensibility

Azure PlayFab, such as the Azure App Service, provides us both **horizontal** and **vertical scalability**.

We can, in fact, **rent additional servers** temporarily or not and **decrease the traffic volume** on the main one (horizontal scalability), also thanks to a **load balancer** included in Azure PlayFab, in charge of **distribute the concurrent users' requests** among the machines.

It may happen that the **back-end incoming traffic** shows up to be **heavier** and have **bigger dimensions** than the ones we foresee. In that case, we can **improve our servers' performances** and **computational power** simply switching to a **more powerful server configuration** (vertical scalability), for that specific situation or not, that is able to **provide a better service**.

As already described, **Microsoft Azure Platform** also allows us, if the **usage** of the **reserved resources** is **lower** than a **certain threshold**, to **decrease both the number of servers** and their **hardware specifications**, reducing the **costs** and **adapting the back-end infrastructure** to the possible cases.

For more **detailed information**, see the official [site](#) and [documentation](#).

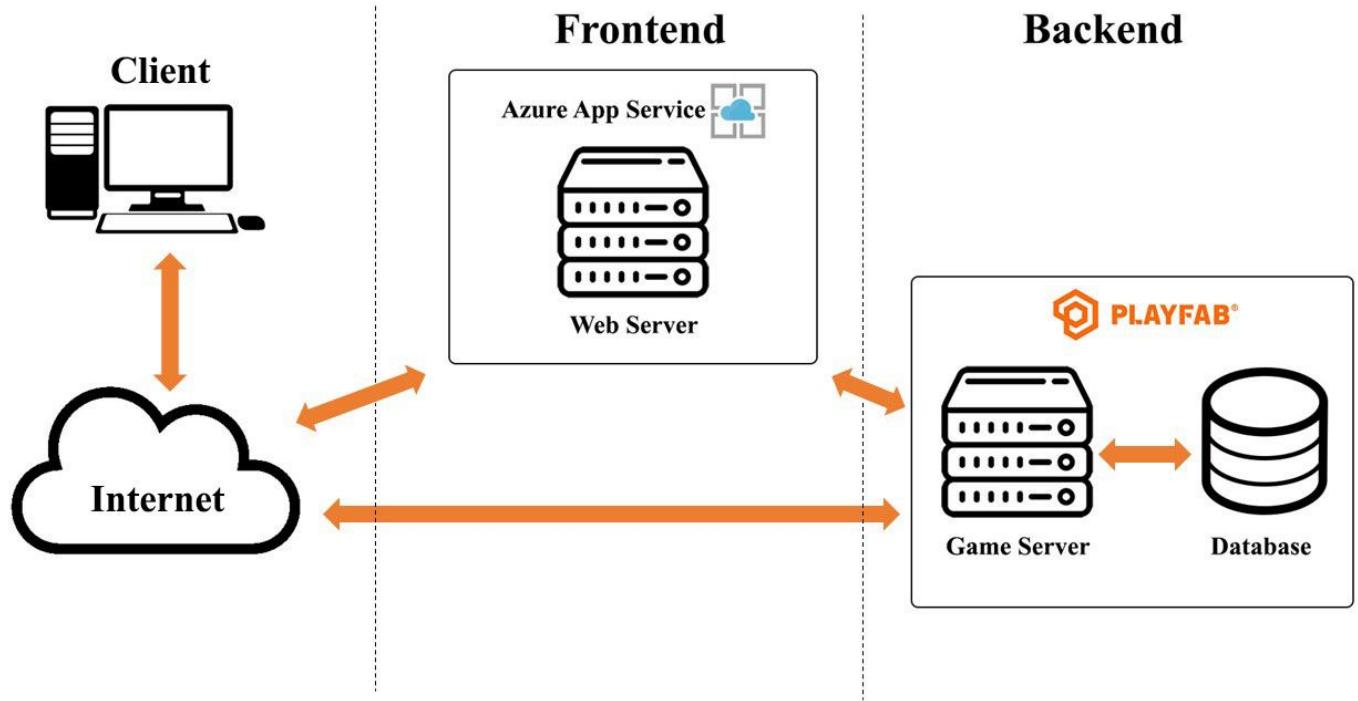
## 9.2 Back-end costs

According to what we said up to now, the back-end has an estimated total cost of:

Name	From	To	License for	Cost	Service total cost
PlayFab Essentials Plan	05/19	03/20	11 months	Free	Free
PlayFab Indie Studio Plan	04/20	09/20	6 months	€88.12 + VAT per month	€528.72 + VAT
<b>Total</b>					<b>€528.72 + VAT</b>

## 10 Communication

### 10.1 Global infrastructure outline



Network infrastructure.

### 10.2 Network requirements

On the **server-side**, Microsoft Azure offers us **horizontal** and **vertical scalability** both on the **front-end**, where we use **Azure App Service**, and on the **back-end**, where we use **Azure PlayFab**, so we can **adapt** the infrastructure to our **needs**. The **firewalls** are guaranteed by **Steam**, **Azure** and **Azure PlayFab**.

On the **client-side**, since Hypogaeum is a **real-time driving-shooting game** with a **collaborative** and **competitive online multiplayer**, have high values of **latency** represents an important **issue**. According to our estimation, a **10 MBps ADSL** Internet connection should be **enough** to play, but we **recommend** to have **at least a 20 MBps ADSL** Internet connection.

### 10.3 Network hardware

Since we rely on **Azure Platforms** (**App Service** and **PlayFab**), we do **not** have to **manage** the **hardware** **directly**.

### 10.4 Costs

Due to our front-end and back-end **choices**, we do **not** have **additional costs**.

## 11 Team

In order to develop the game our team needs a set of **professional figures** that belong to **different areas** and **have different skills**.

### 11.1 Infrastructure setup and management

The **infrastructure setup** and the **management** are **guaranteed** by **Microsoft Azure** both for the **front-end** (App Service) and for the **back-end** (PlayFab), so we **do not need** additional **specialized personnel**.

### 11.2 Development

For the **game development** we need to **hire**:

- a 2D and 3D artist;
- a junior programmer;
- a tester;
- a web developer.

In this way our **team** will be made up of **eight people**: the original **four members of Team Lama** and the **four new professionals**.

### 11.3 Salaries

Except for **Team Lama** members that work **for free** up to the **game release** (fixed for **16th October 2020**), the **team** has an **estimated overall cost** of:

Team member	# Members	From	To	# Months	Salary per month	Total salary
Team Lama	4	05/19	09/20	17	€0.00	€0.00
2D and 3D Artist	1	04/20	09/20	6	€3,000.00	€18,000.00
Junior Programmer	1	09/19	09/20	13	€3,500.00	€45,500.00
Tester	1	05/20	09/20	5	€1,500.00	€7,500.00
Web Developer	1	05/20	09/20	5	€4,000.00	€20,000.00
<b>Total</b>						<b>€91,000.00</b>

### 11.4 Offices

We decided to rent **8 coworking rooms** at **Centro Leoni** in **Milan** (via Spadolini) from **Regus** (see the official [website](#) for more information), with a **daily cost of €11.00 per person**. The contract **includes**:

- fast Internet connection;
- telecommunication services;
- maintenance;
- office cleanings;
- receptionist;
- meeting room;
- dining room.

For each team member, the **offices** have an **estimated total cost** of:

Team member	# Members	From	To	# Days	Office total cost
Team Lama members	4	05/19	09/20	519	€22,836.00
2D and 3D Artist	1	04/20	09/20	183	€2,013.00
Junior Programmer	1	09/19	09/20	396	€4,356.00
Tester	1	05/20	09/20	153	€1,683.00
Web Developer	1	05/20	09/20	153	€1,683.00
<b>Total</b>					<b>€32,571.00</b>

## 11.5 External professional figures

To carry on Hypogea, we need **four external professional figures**:

- the **legal support**;
- a **music artist**;
- a **professional social media manager**;
- an **accountant**.

## 11.6 External costs

The **external professional figures** have an **estimated overall cost** of:

Professional figure	From	To	# Months	Salary	Total salary
Legal Support	05/19	10/20	-	€5,000.00 per project	€5,000.00
Music Artist	05/19	10/20	-	€7,500.00 per project	€7,500.00
Professional Social Media Manager	09/20	10/20	1	€3,000.00 per month	€3,000.00
Accountant	05/19	10/20	-	€5,500.00 per year	€11,000.00
<b>Total</b>					<b>€26,500.00</b>

# 12 Development

As already said, the **development** is carried on by an **eight-people team** with the collaboration of **external professional figures**.

## 12.1 Platforms

The **developers** will be working on **Windows 10 Professional**, whereas the **artists** will be doing so on **macOS Mojave**.

## 12.2 Hardware

The price of the **development hardware** is the one indicated on the **website** of the corresponding **manufacturing company**:

Tag	Price	Name	Technical Specifications
PC Developer	€1,369.00	Dell XPS Tower 8930	<b>OS:</b> Windows 10 Professional <b>Processor:</b> 8th Generation Intel Core i7-8700 6-Core Processor 12MB Cache, up to 4.6GHz <b>Memory:</b> 16GB, DDR4, 2666MHz <b>Storage:</b> 256GB M.2 PCIe x4 SSD + 2TB 7200rpm Hard Drive <b>Graphic Card:</b> NVIDIA GeForce GTX 1070 8GB GDDR5
	€0.00	Dell Multimedia Keyboard	<b>Keyboard:</b> Keyboard - KB216 (included with the XPS Tower 8930)
	€0.00	Dell Optical Mouse	<b>Mouse:</b> Optical Mouse - MS116 (included with XPS Tower 8930)
	€253.75	Dell 27 InfinityEdge Monitor	<b>Monitor:</b> 27 InfinityEdge Monitor - S2719H 27"
<b>Total cost</b>			<b>€1,622.75 + VAT</b>
PC Artist	€1,531.97	13-inch MacBook Air	<b>OS:</b> macOS Mojave <b>Processor:</b> 1.6GHz dual-core Intel Core i5, Turbo Boost up to 3.6GHz, with 4MB L3 cache <b>Memory:</b> 16GB of 2133MHz LPDDR3 <b>Storage:</b> 256GB PCIe-based SSD <b>Graphic Card:</b> Intel UHD Graphics 617
	€69.67	Apple Optical Mouse	<b>Mouse:</b> Magic Mouse 2
<b>Total cost</b>			<b>€1,601.64 + VAT</b>
Graphic Tablet	€504.12	Wacom Intuos Pro Paper	<b>Graphic tablet:</b> Wacom Intuos Pro Large Paper edition with digital workflow
	€0.00	Wacom Pro Pen	<b>Pen:</b> Wacom Pro Pen 2 (included with the graphic tablet)
<b>Total cost</b>			<b>€504.12 + VAT</b>

### **Development hardware total cost**

The **total cost** for the **required hardware** is:

Hardware	#	Total cost
PC Developer	6	€9,736.50 + VAT
PC Artist	2	€3,203.28 + VAT
Graphic Tablet	2	€1,008.24 + VAT
<b>Total cost</b>		<b>€13,948.02 + VAT</b>

### **12.3 Software**

Inside the team, we can identify **four major roles**: **Artist (A)**, **Designer (D)**, **Musician (M)** and **Programmer (P)**. Each team member will need **various software** in order to carry out his job.

Software class	Member	Used for	Software	Cost per user
Development environment	A, D, M, P	Operative System	Windows 10 Professional macOS Mojave	€0.00 €0.00
Project Management	A, D, M, P	Document	Acrobat Reader DC 2019	€0.00
		Flowchart	Draw.io Desktop 8.8.0	€0.00
		Issue tracking	Pivotal Tracker online	€0.00
		Office suite	G Suite	€0.00
		Version control	Git 2.19 GitHub Team	€0.00 €7.94 + VAT per month
Asset editing	A, D, M, P	3D model	Blender 2.79	€0.00
		General text files	Notepad++ 7.5.9	€0.00
		Soundtracks Special effects	FL Studio 20	€0.00
		Raster graphics	GIMP 2.10	€0.00
		Vector graphics	Inkscape 0.91	€0.00
Prototyping	A, D	Prototype	Tiled 1.2.0 Stencyl Starter	€0.00 €0.00
Development	D, P	C# development	Visual Studio Professional	€1,057.18 + VAT per year €704.49 + VAT renewal

		Unity project	Unity Pro	€115.00 + VAT per month
		Web development	PhpStorm	€199.00 + VAT first year €159.00 + VAT second year €119.00 + VAT third year on
Graphics	A	Project graphics	Adobe Creative Cloud	€69.99 + VAT per month

#### ***Development software total cost***

The **total cost** for the **required software** is obtained considering both **how many months** (or **years**) each **additional team member** will spend with us, based on the table provided in section [10.3 Salaries](#), and the **initial composition of Team Lama**. The software that are **free** and do **not require** a **paid license** are **excluded** from the following table.

Software	# Total licenses	Total cost
GitHub Team	97 monthly	€770.18 + VAT
Visual Studio Professional	4 yearly 4 renewals	€4,228.72 + VAT €2,817.96 + VAT
Unity Pro	64 months	€7,360.00 + VAT
PhpStorm	2 yearly	€398.00 + VAT
Adobe Creative Cloud	27 monthly	€1,609.77 + VAT
<b>Total cost</b>		<b>€17,184.63 + VAT</b>

#### ***12.4 Cloud storage***

In order to keep a **complete backup** of our project, we decided to subscribe to **Mega**, a **cloud storage** and **file hosting service** known for its **security feature** based on **local end-to-end encryption** before the upload (for more information see the official [website](#)). The **Mega Business subscription** (detailed information [here](#)) offers us the following **features**:

Main features
<b>Unlimited storage:</b> there is no upper-bound on the amount of data we can store
<b>Unlimited transfer speed:</b> there is no upper-bound, the speed only depends on our Internet connection
<b>User management tools:</b> only selected users can access to the data video and voice conferencing access and transfer user's data to other user's account

**Analytics and data usage:** we can evaluate how Mega is used

**End-to-end encryption:** all the data are encrypted (included messages and videos)

**Apps:** through the apps we can access to our data wherever we are

**Total cost:** €10.00 per user per month

### ***Cloud storage total cost***

The **total cost** for the **cloud storage** is:

Cloud storage	# Total months	Total cost
Mega Business	97	€970.00 + VAT
<b>Total cost</b>		<b>€970.00 + VAT</b>

### ***12.5 Project development main tasks***

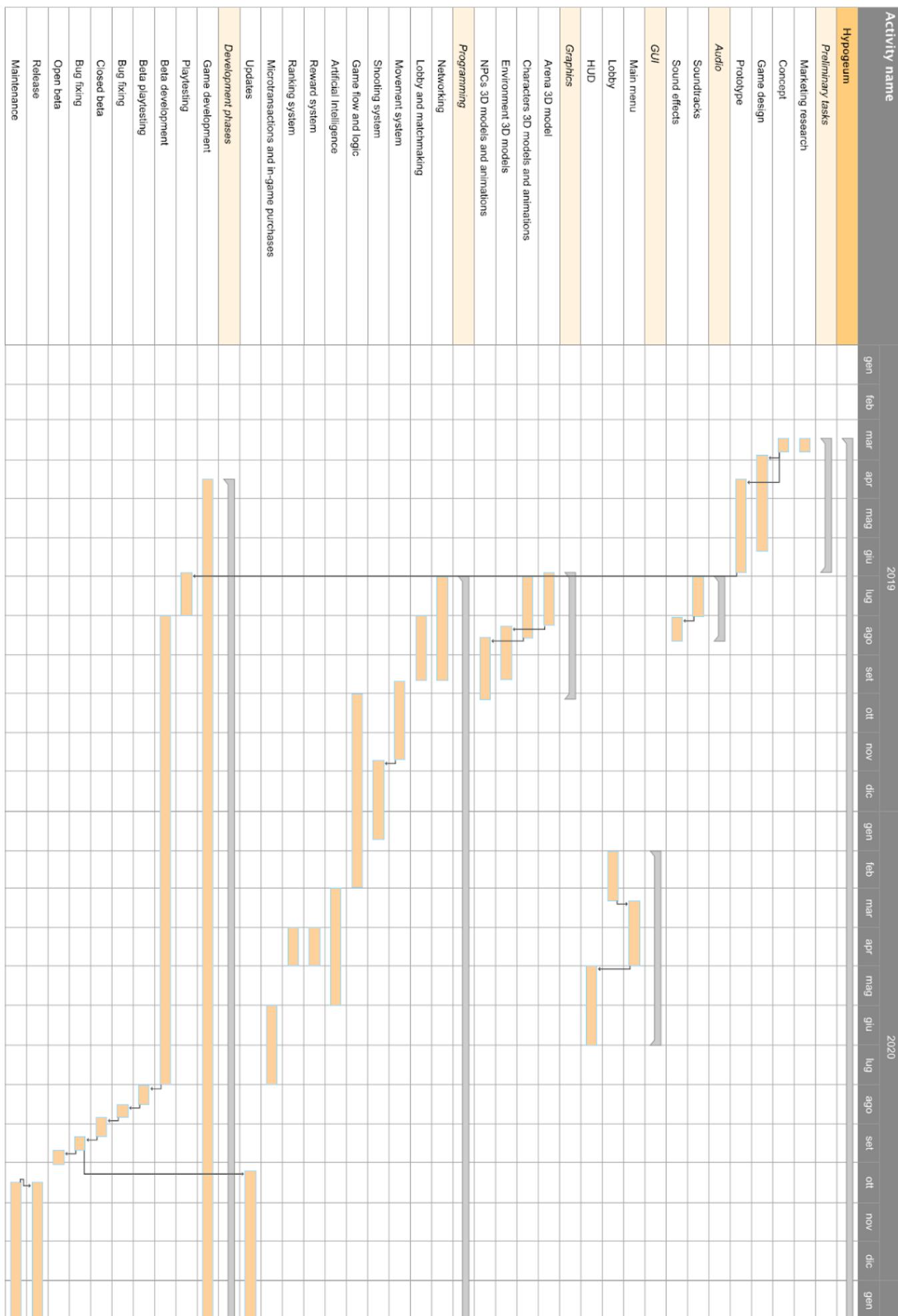
We can identify **five main tasks** in the development of the project:

- Preliminary tasks;
- Audio;
- GUI;
- Graphics;
- Programming.

The **Development phases** section **summarizes** the whole development process.

For more a **more detailed description** of each task (**starting and ending date or duration**) see the following **table** and the **Gantt chart**.

Activity name	Starts on	Ends on	Duration
<b>Hypogea</b>			
Preliminary tasks	15/03/19	27/06/19	105g
Marketing research	15/03/19	25/03/19	11g
Concept	15/03/19	25/03/19	11g
Game design	28/03/19	10/06/19	75g
Prototype	16/04/19	27/06/19	73g
<b>Audio</b>	01/07/19	20/08/19	51g
Soundtracks	01/07/19	01/08/19	32g
Sound effects	02/08/19	20/08/19	19g
<b>GUI</b>	01/02/20	30/06/20	151g
Main menu	11/03/20	30/04/20	51g
Lobby	01/02/20	10/03/20	39g
HUD	01/05/20	30/06/20	61g
<b>Graphics</b>	28/06/19	04/10/19	99g
Arena 3D model	28/06/19	08/08/19	42g
Characters 3D models and animations	01/07/19	17/08/19	48g
Environment 3D models	09/08/19	19/09/19	42g
NPCs 3D models and animations	18/08/19	04/10/19	48g
<b>Programming</b>	01/07/19	06/10/22	1194g
Networking	01/07/19	20/09/19	82g
Lobby and matchmaking	01/08/19	20/09/19	51g
Movement system	21/09/19	21/11/19	62g
Shooting system	22/11/19	22/01/20	62g
Game flow and logic	01/10/19	29/02/20	152g
Artificial Intelligence	01/03/20	31/05/20	92g
Reward system	01/04/20	30/04/20	30g
Ranking system	01/04/20	30/04/20	30g
Microtransactions and in-game purchases	01/06/20	31/07/20	61g
Updates	07/10/20	06/10/22	730g
<b>Development phases</b>	16/04/19	16/10/23	1645g
Game development	16/04/19	16/10/23	1645g
Playtesting	28/06/19	31/07/19	34g
Beta development	01/08/19	31/07/20	366g
Beta playtesting	01/08/20	15/08/20	15g
Bug fixing	16/08/20	25/08/20	10g
Closed beta	26/08/20	09/09/20	15g
Bug fixing	10/09/20	20/09/20	11g
Open beta	21/09/20	01/10/20	11g
Release	16/10/20	16/10/23	1096g
Maintenance	16/10/20	16/10/23	1096g





## 13 Delivery

### 13.1 Estimated delivery time

Hypogeum will be released as a **free-to-play game** on **Steam** on **16 October 2020**. We suppose to follow a **freemium business model**, so we also plan to deliver **four major updates** during the game's lifecycle to add more game contents (characters, skills, weapons, skins, objectives, NPCs and game modes).

### 13.2 Delivery platform

Since Hypogeum will be **available on Steam**, players can both **download** and **install** it on their PCs and also **update** the game through the **Steam Client**.

### 13.3 Delivery methodology

We decided to **promote** our game on **several social media**, such as Facebook, Instagram, Twitter and YouTube, in order to create from the very beginning a **community** of players and improve our **catchment area**. This **advertising campaign** is planned to start in **early September**, a couple of weeks **before** the **open beta**, thanks to a **professional social media manager**.

We will have a **closed beta** to get the **first feedbacks** and **suggestions** about the game and an **open beta** to understand **players' general opinions** and also **test** how the game responds to a **real usage**.

The game **release** is planned for **16 October 2020**, about **18 months** after the beginning of the project.

As already said, since we opted for a **freemium business model**, we will release **four major updates** to improve players' **game experience** and **involvement**. Up to now we **plan** these release dates for **February** and **October 2021 and 2022**.

The game is designed to be **supported at least** for **2** years, but according to our estimation we do **not foresee** a duration of **more than 3 years**.

### 13.4 Delivery cost

According to **Steam Direct**, that is the official **Steamworks Distribution Program** (for more information see the official [website](#)), in order to deliver our game on Steam we have to pay a **\$100.00 USD fee** (approximately **€88.17**). Starting from October 1, 2018, **Steam** modified its **policy** about **revenue splitting**, that now **depends** on **game earnings**: the less the game earns, the higher the percentage is. In fact, for game **revenues**:

- between **\$0** and **\$10 million**, Steam withholds the **30 percent**;
- between **\$10 million** and **\$50 million**, Steam withholds the **25 percent**;
- over **\$50 million**, Steam withholds the **20 percent**.

## 14 Costs

We received an **initial budget of €200,000** to cover all the **development** up to **October 1, 2020**, the date the **open beta will end**.

To sum up, the **overall development costs** are:

Area	Cost + VAT	Total cost
Front-end	€722.04 + VAT	€880.89
Back-end	€528.72 + VAT	€645.04
Salaries		€91,000.00
Offices		€32,571.00
External professionals		€26,500.00
Development hardware	€13,948.02 + VAT	€17,016.58
Development software	€17,184.63 + VAT	€20,965.25
Cloud storage	€970.00 + VAT	€1183.40
<b>Hypogeum total cost</b>		<b>€190,762.16</b>