LET ME R.I.P.

TECHNICAL DESIGN DOCUMENT
ONLINE GAME DESIGN 2021/2022

THE ACIDS

Table of Contents

THE ACIDS TEAM

ANDREA BORGHESI

952944

Game Design

Game Programming

Team Leader

andrea.borghesi1@studenti.unimi.it

ANDREI DANIEL BALANICA

941778

Game Design

Game Programming

andreidaniel.balanica@studenti.unimi.it

ANDREA PASSINI

991178

Game Design

Game Programming

andrea.passini@studenti.unimi.it

1. PROJECT GOAL

Let me RIP is an Action Role Playing Game playable on Steam.

The game requires an Internet connection to be played, as the players need to be able to communicate and cooperate with their friends and be matched with other players. Consequently, there won't be an offline mode.

2. SERVICES

In this section are listed all the services that will be offered in addition to the game itself.

2.1. In-House Services

The following services are all developed and maintained by us.

2.1.1. Game Updates

Once the game will be published on the Steam platform, we will provide regular updates to improve it and rebalance it, if necessary.

During the entirety of the open beta, we will publish updates to fix bugs and address other problems that may arise.

2.1.2. Game Availability

The game should run 24/7 and downtimes should be limited as much as possible. However, some longer downtimes are to be expected during the first few months of the open beta.

2.1.3. Online Presence

The game will have a website that will be composed of the following parts:

- A landing page made to attract the players.
  It will display the game trailer, some general information about the story and the gameplay, and the link to the game's Steam page.
- A roadmap of the expected updates
- The changelog of each patch

2.2. External Services

The following services are external and outsourced to third parties, hence we are not directly responsible for them.

2.2.1. Domain & Web Hosting

The domain and web hosting will be taken care of by Aruba, an Italian cloud company. Considering the current use of our website, the cheapest of their Linux hosting services is plenty enough.

2.2.2. Payments

Steam will take care of managing all the payments; thus, no credit card information will be collected directly by us. The included transactions are both the game purchases and the in-game microtransactions.

However, we'll be able to consult all the statistics about all transactions through the Steam Publisher account.

2.2.3. Customer Experience & Support

The CX aspect will be outsourced to 5CA, a leader in the sector, with plenty of experience in the game industry and trusted by many game providers.

Our customers will be able to report issues directly related to the game and provide feedback if they wish to do so.

For other issues (e.g., Payment-related), the customer, will be supported by Steam support.

2.2.4. Steam

We'll be using Steam's services for the following purposes:

- Player Authentication
- DRM
- Matchmaking (integrated with the Photon one)
- Game Publishing
- Achievements Management
- Further integration with Steam: Steam overlay, instant screenshots, leaderboards

All these services are available through a Steam Publisher account and the Steamworks APIs.

2.2.5. Photon Engine

We will be using the Photon Fusion networking engine for Unity to handle all the multiplayer components of the game. The engine allows us to develop a multiplayer game by offering different solutions and configurations.

Apart from the basic aspect of matchmaking, Fusion also has built-in components to deal with many critical aspects that are typical of online games (e.g., lag compensation, client-side prediction), greatly helping the development process.

We'll also be using the Photon Chat service to implement the in-game chat and friending system.

All the services are hosted on Photon Cloud, meaning no custom game server will be necessary.

2.2.6. Data Persistency Solution

For managing the in-game character's information we'll rely on AWS, specifically on DynamoDB. To properly handle security the DB will only be accessed by AWS Lambdas that will be invoked via REST APIs exposed through the AWS API Gateway.

2.2.7. Anti-Cheating

We will be running Photon Fusion in "Shared" mode, meaning the server won't have full authority over all the game objects, it will just have state authority.

For this reason, an anti-cheating system will be implemented before the release of the game. The extent of the anti-cheating measures implemented will be determined based on the performance of the open beta. Extensive measures are not currently necessary since there aren't any PvP aspects in the game.

2.3. User Data Management

We DO NOT intend to collect any of the data of our players. The regulations and challenges associated would be too costly.

The third parties we rely on for the external services will collect some data to provide their services, however, we won't be responsible for it.

3. CLIENT REQUIREMENTS

The following are the software and hardware requirements for our game client to work properly. They are not to be considered definitive, as they are subject to change.

These are estimations based on the requirements of similar games and the general performance observed in the prototypes.

3.1. Software Requirements

- Windows 10 64-bit version 20H2, Windows 11 or newer
- MacOS 10.10.13 High Sierra or newer.
- Linux Ubuntu 10.14 or newer

3.2. Hardware Requirements

An internet connection is required to play the game.

	Minimum Requirements	Recommended Requirements
Windows 10-11	Processor: Intel i5 Quad-Core, 2.7 GHz RAM: 8 GB Graphics: GTX 660 / RX 460 Storage: 2 GB available space Input devices: Controller or Mouse and Keyboard	Processor: Intel i5 Quad-Core, 3 GHz RAM: 8 GB Graphics: GTX 1080 Ti / RX Vega 64 Storage: 2 GB available space Input devices: Controller or Mouse and Keyboard
macOS	Processor: Intel i5 Quad-Core, 2.7 GHz RAM: 8 GB Graphics: GTX 660 / RX 460 Storage: 2 GB available space Input devices: Controller or Mouse and Keyboard	Processor: M1 RAM: 8 GB Graphics: M1 Storage: 2 GB available space Input devices: Controller or Mouse and Keyboard
Linux	Processor: Intel i5 Quad-Core, 2.7 GHz RAM: 8 GB Graphics: GTX 660 / RX 460 Storage: 2 GB available space Input devices: Controller or Mouse and Keyboard	Processor: Intel i5 Quad-Core, 3 GHz RAM: 8 GB Graphics: GTX 1080 Ti / RX Vega 64 Storage: 2 GB available space Input devices: Controller or Mouse and Keyboard

4. WORKLOAD ESTIMATION

Based on the estimations of our competitors' player base, we expect, for the released game, between 900k and 1.2 million monthly active users. Meaning we'll have between 45k and 60k daily active users. However, a larger number of players is to be expected in the first few months after the release.

For the open beta, we estimate to have around one-third of the player base compared to the released game, meaning we expect between 300k and 400k monthly active users. This translates to a total of daily active users between 15k and 20k, thus we should be able to withstand a number of concurrent users in the range of 800-1000.

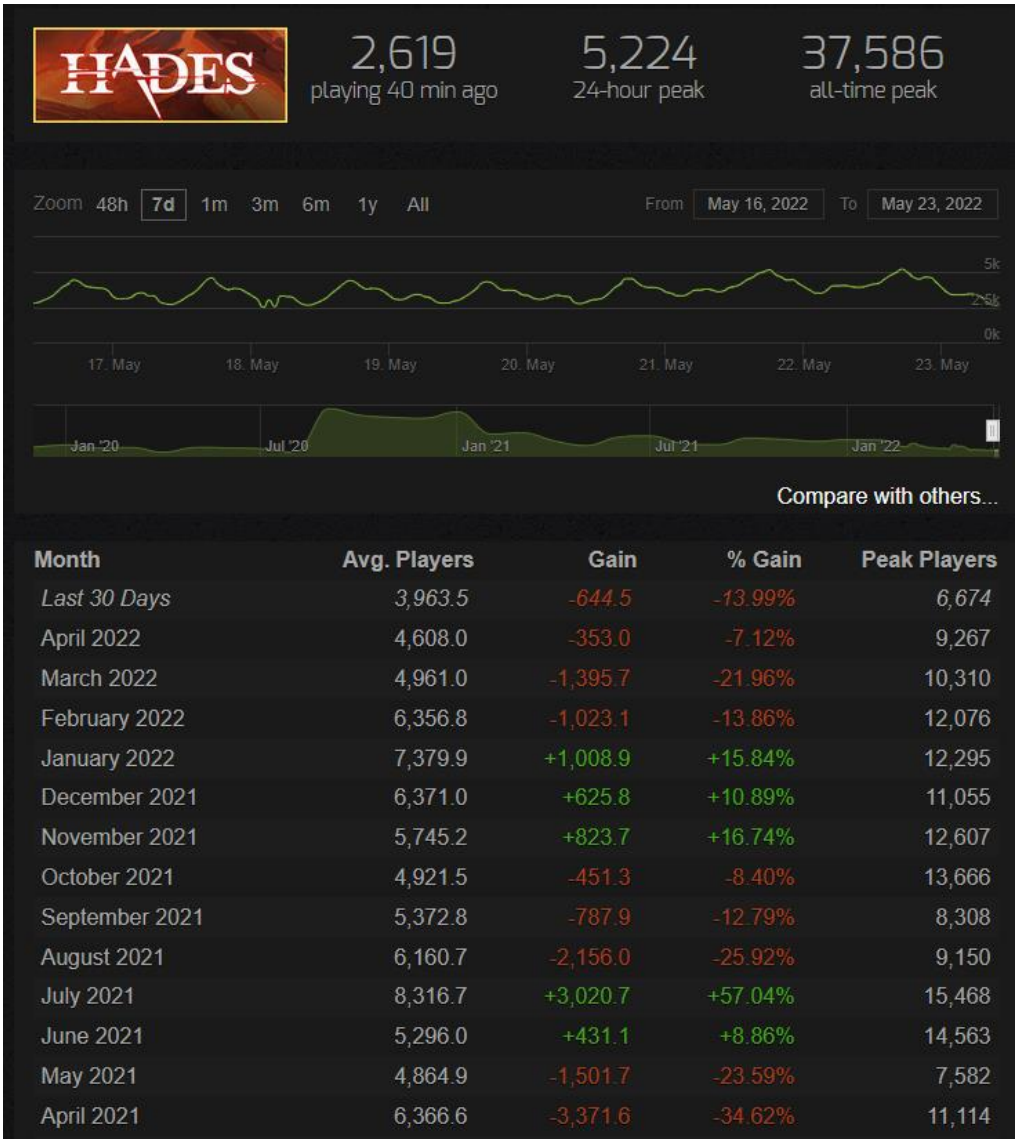
As regards the storage, we estimate a maximum of 3MB of storage per player, hence, we expect a maximum usage of 1.2TB in total per month during the open beta.

Workload Estimation		
Metric	Open Beta	Release
Monthly Active Users	300k – 400k	900k – 1,2 million
Daily Active Users	15k – 20k	45k – 60k
Concurrent Users	800 – 1k 1,5k – 2k peak	2,4k – 3k 4,5k – 6k peak
Storage per Month	1,2TB max	3,6TB max

To estimate these numbers we took as a reference the statistics of mainly Hades and Dead Cell, since we expect our game to reach the same numbers after release.

The charts below show an estimation of the average daily concurrent players for these two games.

4.1. Hades Players Chart



Month	Avg. Players	Gain	% Gain	Peak Players
Last 30 Days	*3,963.5*	*-644.5*	*-13.99%*	*6,674*
April 2022	4,608.0	-353.0	-7.12%	9,267
March 2022	4,961.0	-1,395.7	-21.96%	10,310
February 2022	6,356.8	-1,023.1	-13.86%	12,076
January 2022	7,379.9	+1,008.9	+15.84%	12,295
December 2021	6,371.0	+625.8	+10.89%	11,055
November 2021	5,745.2	+823.7	+16.74%	12,607
October 2021	4,921.5	-451.3	-8.40%	13,666
September 2021	5,372.8	-787.9	-12.79%	8,308
August 2021	6,160.7	-2,156.0	-25.92%	9,150
July 2021	8,316.7	+3,020.7	+57.04%	15,468
June 2021	5,296.0	+431.1	+8.86%	14,563
May 2021	4,864.9	-1,501.7	-23.59%	7,582
April 2021	6,366.6	-3,371.6	-34.62%	11,114

4.2. Dead Cells Players Chart

Month	Avg. Players	Gain	% Gain	Peak Players
Last 30 Days	*2,990.3*	*+87.5*	*+3.01%*	*6,609*
April 2022	2,902.8	+294.1	+11.28%	6,441
March 2022	2,608.6	-1,404.1	-34.99%	5,492
February 2022	4,012.7	-3,008.2	-42.85%	7,525
January 2022	7,020.9	+3,426.2	+95.31%	13,556
December 2021	3,594.8	+1,076.3	+42.74%	7,553
November 2021	2,518.5	+646.9	+34.56%	8,530
October 2021	1,871.6	-295.0	-13.61%	4,579
September 2021	2,166.6	-125.5	-5.48%	5,483
August 2021	2,292.1	-711.2	-23.68%	3,680
July 2021	3,003.3	+645.5	+27.38%	6,287
June 2021	2,357.8	+389.9	+19.81%	5,852
May 2021	1,967.9	-742.5	-27.39%	4,588
April 2021	2,710.4	-229.1	-7.80%	6,771

5. DEVELOPMENT REQUIREMENTS

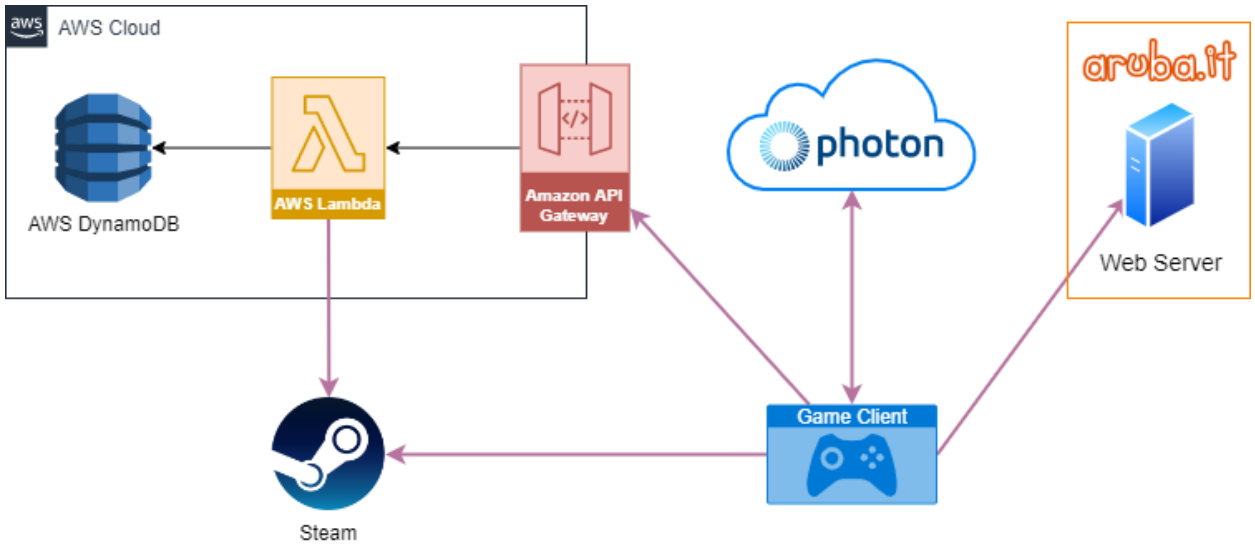
5.1. Software

Application	Used for	Qty	Cost
Unity Pro	Game Development	3	1.800$/year per person
Visual Studio Professional	Code Editing (IDE)	3	45$/month per person
Bitbucket	Version Control	3	3$/month per person
Jira	Task Management	3	Free
Blender	3D Modelling	3	Free
Microsoft 365 Business Std	Documents Management	3	12.5$/month per person
Draw.io	Schemas – Graphs	3	Free
Affinity Photo	Imagery	1	$54.99
Affinity Designer	Vector Graphics	1	$54.99
Figma Professional	Prototyping	3	$144/year per person
FigJam	Whiteboarding	3	$36/year per person
Steam Publisher Account	Publishing & Steamworks API access	1	$100

5.2. Hardware

Device	Configuration	Qty	Unit Cost
Windows – Linux Machine	Asus prime z390-A Intel Core i9 9900K Windows 11 Pro Master liquid lite 240 Corsair CX750M Arctic F12 – x3 32GB DDR4 RAM 1 TB SSD NVMe M.2 3TB HDD Gigabyte GeForce RTX 2060 Nvidia Quadro P400 Mouse and Keyboard Monitor 4K Dell 32"	2	$2900
Mac Studio (For game dev)	M1 Ultra 20 CPU cores 64 GPU cores 64GB RAM 1TB Storage Mouse and Keyboard Monitor 4K Dell 32"	1	$6000
MacBook Pro	M1 Pro 10 CPU cores 16 GPU cores 32GB RAM 1TB Storage	2	$3,200

6. GENERAL ARCHITECTURE



6.1. Frontend

For the frontend, we must deal with the following aspects.

6.1.1. Website & Online Presence

As stated in section 2.2.1. we'll be using Aruba's services for web hosting and game domain. The relative costs are low, and we'll be billed annually.

The considered solution does not impose any limitations on the available space; therefore, we'll be able to upload any number of pictures and videos to promote the game. The available bandwidth is also plenty for our purposes.

With the hosting also come the domain, unlimited emails with 1GB of upgradable storage, and 5GB of a MySQL DB, all for free. We currently have no use planned for the database, whereas the custom-domain emails can be used as the official address used to reach the support service.

Aruba Costs	
Linux Hosting Basic **(Domain & other services included)**	16$ for 1st year 60$ from 2nd year onwards

6.1.2. Game Client

To implement all the mechanics described in detail in the Game Design Document, we need the frontend part to use the Photon Cloud services. These are the related costs:

Photon Costs	
Photon Account	Free
Photon Fusion Plan	$500/month for up to 2000 simultaneous players
Photon Fusion Traffic	Free up to 6TB of traffic/month $0.05/GB over the free 6TB
Photon Chat Plan	$170/month for up to 2000 simultaneous players
Photon Chat Traffic	Free up to 1TB of traffic/month $0.05/GB over the free 1TB
Monthly Traffic	580 TB/month of total expected traffic
Monthly Costs breakdown	$670/month for the plans $27,000/month for traffic
Monthly Costs	$27,670

Both Photon Fusion and Fusion Chat have a limit on the messages that can be sent over 1 second, however, they are plenty for the current version of the game.

Also, both services include a CCU Burst, meaning that in case we get more than 2000 simultaneous players, they will still be able to flawlessly access the game. We'll then be able to adjust our Photon plans to handle a bigger player base over the following 48 hours.
The extra CCU will be billed the following month for $0.29 each.

Moreover, since the plans can be upgraded and downgraded at any time, we can change them according to the observed playing users.

For developing the frontend, we also need access to the Steamworks APIs. All the costs related to Steam are detailed in Section 9.2.

6.2. Backend

With regards to the backend, we only need to develop an AWS backend to handle game data like a character's level, items, etc.

We will be using DynamoDB to get data persistence and different serverless functions to access set database. These serverless functions will be deployed to AWS lambda and will be reached by the associated API endpoint (set via AWS API Gateway).

To protect the endpoints and the access to the database, we'll be using the Session Tickets provided by Steam, after the player successfully authenticates on the game platform.

6.2.1. AWS Lambda

The code that will run on the serverless functions will mostly interact with the Steam APIs to authenticate the caller and with the DB, thus the minimum amount of resources configurable for an AWS lambda will be enough.
The functions will be deployed on at least the Europe and North America regions to reduce latency and allow for a smoother experience.

AWS Lambda	
Requests Cost	$0.20 for every 1 million requests
Execution Time Cost	$0.00000084 for 400 ms (expected avg) $0.0000000021/ms
Expected Invocations per Minute	20 per player 20k calls/minute
Monthly Cost	740$

6.2.2. AWS DynamoDB

AWS DynamoDB	
Storage per User	3MB
Peak Usage	1.2TB
Number of operations	20k/minute 92% of operations are writes 8% of operations are reads
Writing Cost	$1.4846 for every 1 million writes
Reading Cost	$0.297 for every 1 million reads
Storage Cost	Free for the first 25GB $0.29715/GB over the free 25GB
Monthly Costs breakdown	$1,210k for writes $21 for reads $350 for the storage
Monthly Cost	$1580

6.2.3. AWS API Gateway

AWS API Gateway	
Requests Cost	$1.16/request for the first 300 million requests per month $1.04/request after this threshold 600$
Expected Invocations	20k/minute 876 million/month
Monthly Cost breakdown	$350 for the first 300 million $600 for the others
Monthly Cost	$950

6.3. Workload Capacity

Given we entirely rely on cloud services, we can handle any number of players. All the used services provide an automatic or hassle-free way to scale in different dimensions based on the current needs.

As regards AWS, depending on the resources used, we'll receive the bill at the end of the month. In the case of Photon Cloud, the bill will be at least equal to the current plan.

Considering none of the Photon services we plan to use have a per-user or per-call cost, but only a cost in terms of concurrent player and data used, we will be monitoring closely the number of concurrent connections and changing the plan accordingly.

7. CONNECTION

For the infrastructure refer to section 5. Based on this architecture we expect a usage of 40MB per hour on the Internet, for each user.

The connection to the Game Server is completely managed by Photon. Low latency is to be expected for most locations around the world, given that Photon Cloud has many servers in different regions and automatically selects the closest server to the user.

As regards the database, fast responses are to be expected, however, being most of the calls writes, a higher latency does not impact the gameplay in any significant way.

8. WORKSPACE

We will be renting a flat in the suburbs of Milan to use as our office.

Workspace Costs	
Rent	$1,700/month
Electrical Bill	$350 every 2 months
Internet Bill	$40
Office Supplies	$75/month
Cleaning	$200/month
Forniture	$3000
Office Accessories (printers, cables, etc.)	$500

9. DELIVERY

9.1. Estimated Delivery Time

We estimate a total of three years to deliver the first open beta.

The beta will be available for purchase to anyone on Steam, however, it will be initially restricted to Windows users since they are the majority.

The versions for macOS and Linux will be delivered 3 months after the Windows version.

We believe a macOS version is going to be increasingly necessary, considering the rise of Apple Silicon-powered Mac devices. They deliver enough performance to allow for flawless gameplay.

Gaming on Linux is also gaining momentum thanks to the Steam Deck, so we believe a version of the game for the handheld console is also worth making.

9.2. Delivery Platform

As already mentioned, the game will be initially available only on Steam.

The business model we will be adopting is the paid-for game plus in-game Microtransactions. Thus, the game itself will not be free, but will come with a cost of $9.90 (the cost may vary by small amounts depending on the country of purchase).

Microtransactions are expected to debut with the Windows version of the beta. Purchasable items will come at a minimum cost of 3$, but no upper limit is defined, as of now.

Steam Costs	
Cut on transactions	30%
Game Cost	$9.90
Microtransactions estimations	15% of the MAU spend on microtransactions, meaning between 45k and 65k players. 1 microtransaction per player a month $7/user a month
Steam Developer Account	100$

10. STAFF

In this section are detailed the people and professionals that are going to be working on the project and are necessary for its completion.

Staff		
Andrea Borghesi	• Game Design • Game Development • Internal Tester	$3,000/month prior to release
Andrea Passini	• Game Design • Game Development • Internal Tester	$3,000/month prior to release
Andrei Daniel Balanica	• Game Design • Game Development • Internal Tester • Linux & macOS adaptation • Infrastructure administrator • Website Development	$3,000/month prior to release
2D/3D Artist	• 2D / 3D Graphics • Game Animations	$2,200/month
Technical Artist	• VFX	$2,500/month
Sound Designer	• Game Music • Game Sounds	$15,000
Editor	• Video Editing • Photo Editing	$1,500
Marketing	• Game Marketing	$2,500/month
External Testers	• Playtesting of major milestones	$1,400/month After 1 year of development
Accountant	• Accounting	$5,000/year
Legal Support	• Copyrighting • Contracting • Other Legal Work	$25,000

11. COST ESTIMATION

In this section are reported all the costs related to the game.

11.1. Development Costs

Here we detail only the costs that are necessary for the development of the game.

11.1.1. Software

Recurring Costs		
Application	Cost	Yearly Cost
Unity Pro	$5,400/year	$5,400
Visual Studio Professional	$135/month	$1,620
Bitbucket	$9/month	$108
Microsoft 365 Business Std	$38/month	$456
Figma Professional	$432/year	$432
FigJam	$108/year	$108
	Total	$8,124

One-time Costs	
Steam Publisher Account	$100
Affinity Photo	$54.99
Affinity Designer	$54.99
Total	$210

11.1.2. Hardware

One-time Costs	
Windows – Linux	$2,900
Mac Studio	$6,000
MacBook Pro	$6,400
Total	$15,300

11.1.3. Staff

Recurring Costs		
Application	**Cost**	**Yearly Cost**
Andrea Borghesi	$3,000/month	$36,000
Andrea Passini	$3,000/month	$36,000
Andrei Daniel Balanica	$3,000/month	$36,000
2D/3D Artist	$2,200/month	$26,400
Technical Artist	$2,500/month	$30,000
Accountant	$5,000/year	$5,000
Marketing	$2,500/month	$30,000
External Testers	$1,400/month After 1 year of development	$16,800 After 1 year of development
	Total (1st year)	**$102,200**
	Total (afterwards)	**$119,000**

One-time Costs	
Legal Support	$25,000
Sound Designer	$15,000
Total	**$40,000**

11.1.4. Office

Recurring Costs		
Application	Cost	Yearly Cost
Rent	$1,700/month	$20,400
Electrical Bill	$350 every 2 months	$2,100
Internet Bill	$40/month	$480
Office Supplies	$75/month	$150
Cleaning	$200/month	$2,400
	Total	$25,530

One-time Costs	
Forniture	$3,000
Office Accessories (printers, cables, etc.)	$500
Total	$3,500

11.1.5. Totals

Item	One-time Costs	Yearly Costs
Software	$210	$8,124
Hardware	$15,300	-
Staff	$40,000	$102,200 (1st Year) $119,000 (afterwards)
Office	$3,500	$25,530
Web Hosting	-	$16 (1st Year) $60 (afterwards)
TOTAL	$59,010	$135,870 (1st Year) $152,714 (afterwards)

Time	Total
1st Year	$194,870
2nd Year	$152,714
3rd Year	$152,714
TOTAL	$500,298

11.2. Open Beta Costs

In this section we report the estimated cost for one year of the open beta.

11.2.1. AWS

Product	Cost	Yearly Cost
Lambda	$740/month	$8,880
DynamoDB	$1,580/month	$18,960
API Gateway	$950/month	$11,400
	TOTAL	$39,240

11.2.2. Total

Product	Cost	Yearly Cost
AWS	$39,240/year	$39,240
Photon	$27,670/month	$332,040
	TOTAL	$371,280