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Pharmageddon:

Technical Design Document

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1. Project Goal

1.1 Provided Services

The services we want to provide in Pharmageddon, since we heavily refer to Steam's services, we will provide the following::

- Availability of services **24/7**.
- Buy **DLC** in game market: new characters, maps and weapons. There will be also the possibility of purchase new skins for characters.
- **Stats and Achievements** of the players.
- **User Authentication and Ownership**.
- **Matchmaking** between players.
- Possibility to scan the user's system for **cheats** using **Valve Anti-Cheat**.
- Sharable content on social networks (leaderboard position, achievements,match results) via Facebook and Twitter and also with regular updates on the Steam page.
- Customer support will be managed via social media pages and through the dedicated website.
- Server maintenance (continuity and integrity).
- Online game site.
- Fast bug fixing .

2. Client side

2.1 Hardware Requirements

The game is optimized to run on most machines; however we suggest the minimum requirements needed to run the engine Unity 5 (as said in 3.3 GDD paragraph):

- Processor: Intel Core 2 Duo E6320 (2*1866) or equivalent
- Memory: 2 GB RAM
- Graphics: GeForce 7600 GS (512 MB) or equivalent
- Storage: 2 GB available space

2.2 Software Requirements

The game requires one of this operating systems:

- Windows 7 or later
- OS 10.6+
- Ubuntu 12.04 or later

The game also requires having this additional softwares:

- Steam Client

3. Workload Estimation

We realized a market understanding on similar games on the Steam service *Steamcharts*, therefore we expect not to exceed the **500 players (at peak)**, that means around **80 matches** at the most.

3.1 Competitors workload estimation

We deeply examined our competitors (as described in 3.4 GDD paragraph) steam stats as follow:



Fig 1: Steam charts stats for Enter the Gungeon

steamspy

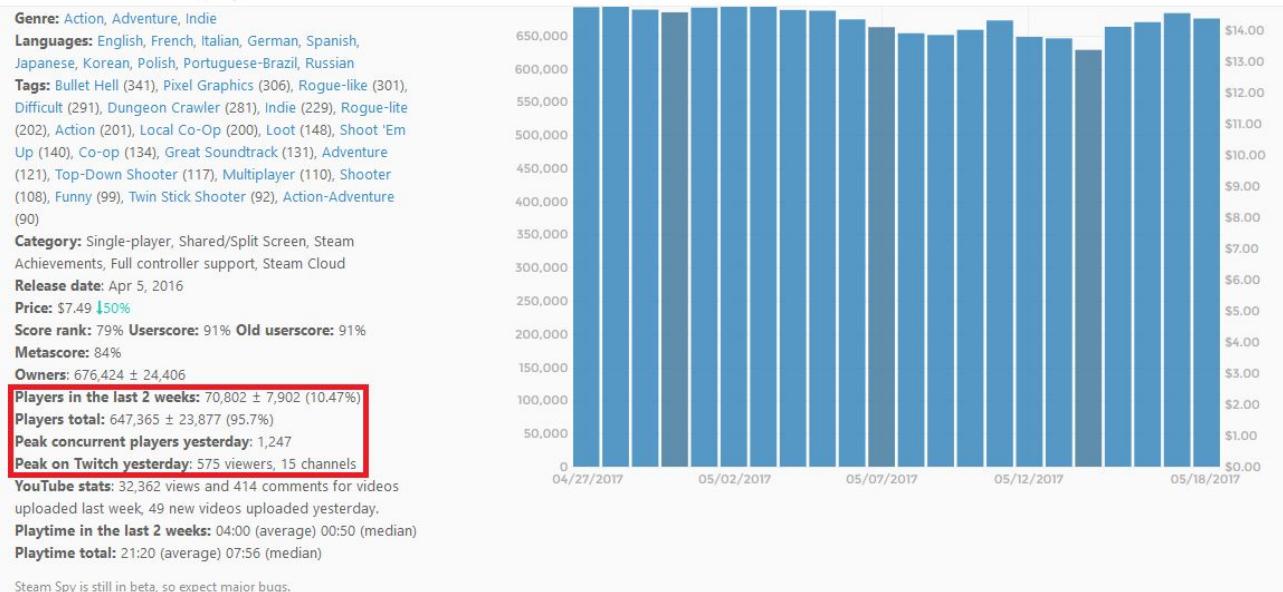


Fig 2: steamspy stats for Enter the gungeon



Fig 3: Steam charts stats for Nuclear Throne



Fig 4: Steamspy stats for Nuclear Throne

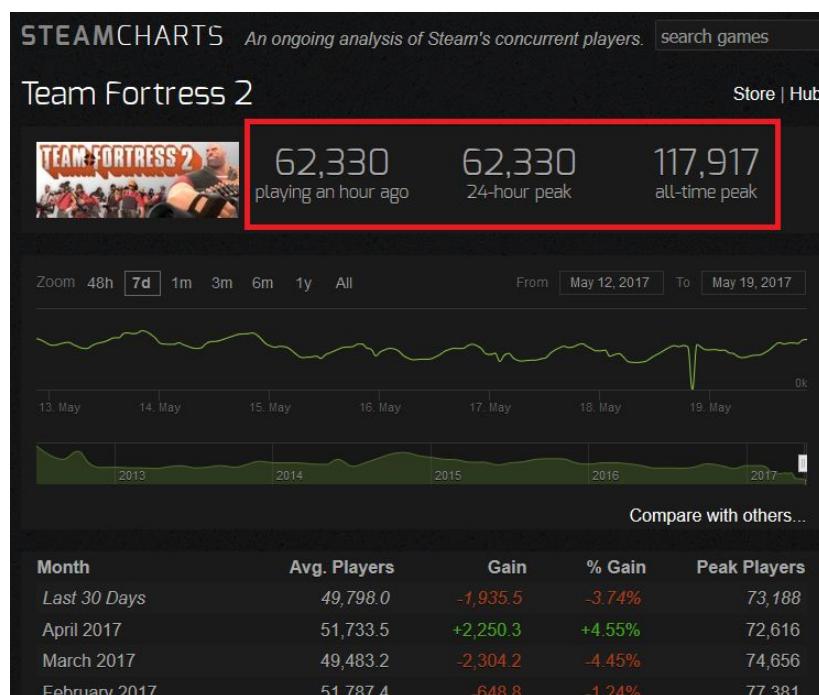


Fig 5: Steam charts stats for Team Fortress 2

steamspy



Fig 6: Steamspy stats for Team Fortress 2

Team Fortress 2 vaunts important players peak and total players numbers.

At the beginning we **don't expect** this player's amount to manage. We forecast stats aligned with *Nuclear Thrones* and *Enter the Dungeon* (note: the latter is only locally co-op, therefore we focus more on Nuclear Thrones stats which now is online multi player). We don't consider total player number but total subscribes.

So we expect **37500 (DAU)** players at **peak¹**, which means about **50.000 total subscribers, 500 CCU, 45000 MAU**.

According to the match division (as described in 5.3.4 GDD paragraph) we expect about **60 matches peak** (CCU match) at most (because every team must be at least composed by 4 players and the match start with 2 teams).

4. Frontend

4.1 Platforms

We decided to use the **Steamworks API** for managing our front-end, in order to have something easily scalable, based on a strong chain of distribution. Moreover, we would like to **delegate** the accounts player management the reason is that **we don't want to manage player's private data** (password, username ecc...).

¹ Exitimation based on <http://smartfoxserver.com/blog/decoding-dau-mau-and-ccu/> from our ccu count.

With Steamwork there is **no charge in pricing** for bandwidth and updating usage: the only requirement for accessing it is passing through the evaluation process of **Steam Greenlight** (further details are available in paragraph 9.2), as developers wishing to integrate the Steamworks SDK with their own games or applications still need to first be Greenlit and provided with an appID.

Steam will provide us: **matchmaking, leaderboard, log in, publishing.**

4.2 Hardware and Software

Delegating this phase to Steam, **we don't have additional expenses** in those departments.

4.3 Scalability and Extensibility

This part is completely delegated to Steam, which **can ensure** us a *scalable infrastructure*, coherent with the player's pool of the moment.

In terms of scalability of the network infrastructure we will rely on the UNet capability, not particularly powerful and probably not the best on the market for a MMO; on the other hand we do not forecast so many players, therefore we believe it to fit our needs.

4.4 Cost Estimation

This phase is completely delegate to Steam which works also as our publisher. See paragraph 9.4 for more costs information.

5. Backend

5.1 Platforms

We decided to use a third party solution, **PlayFab²**, a society specialized in back-end for gaming, due to with its high **compatibility with Steamworks**, and the possibility to use **dedicated servers**, located in physical machine of our choosing, for our games.

² Detailed PlayFab Technical document here
<https://playfab.com/assets/etc/PlayFab%20technical%20whitepaper%202016.06.18.pdf>

Address	Region	Status	Games	Max games	Build	Uptime	Pinged
52.193.253.177	Japan	Running	0	20	Server	00:00:33:43	00:09

Fig 7: The above image refers to a test server, which explains the low number of games at the same time.

This way, the **workload** will be *balanced* between our servers; therefore our infrastructure can be **easily scaled** adding new machines. Furthermore, **we save the cost of a full time service administrator**, since all those services are covered by PlayFab team.

We chose to proceed with this company since it is one of the few to offer the opportunity to **rent physical machines** and know their local region coordinates: this way, we can try to mitigate possible **latency** issues, ensuring machines with acceptable distance to our players.

Latency is very important for our bullet hell game. We need it as low as possible for that reason **we do not adopt cloud computing**.

We opted for this solution mainly for two reasons: the former is the **low initial investment**, the latter is the fact that this solution increases our chances to **receive a bank loan** to cover startup expenses.

The rationale is that a bank should be more prone to lend to a company which proportionately spend more on interruptible services than on hard-to-resell assets.

5.2 Hardware and Software

During the initial phase of our development, we were thinking of leaving hardware and software management in the hands of PlayFab by *renting* the machines they own in determined regions, with the software included. To be sure that PlayFab gives us servers in the correct region we need to buy the *Enterprise Edition PlayFab*. We only need to implement a server build for our game, send it to PlayFab and run it on the various machines.

The service price depends on the *Monthly Active User (MAU)*, and the number of modules (i.e services) we intend to purchase. Additional add-ons can only be discussed personally

with a telephone conversation with the company, and our team found it impossible to find more accurate information.

We suppose PlayFab will rent us **4 servers**: 1x server for the running game and players match, 1x server to replace the game server in case of breakdown in order to have the game service **always** available, 1x server for players data (not log in or credit card data but additional personal information about dlc, skin ecc), 1x server for players data backup in case of breakdown.

Playfab in its technical document guarantees the provision of **backup servers** for data and game so we have accounted them in the cost.

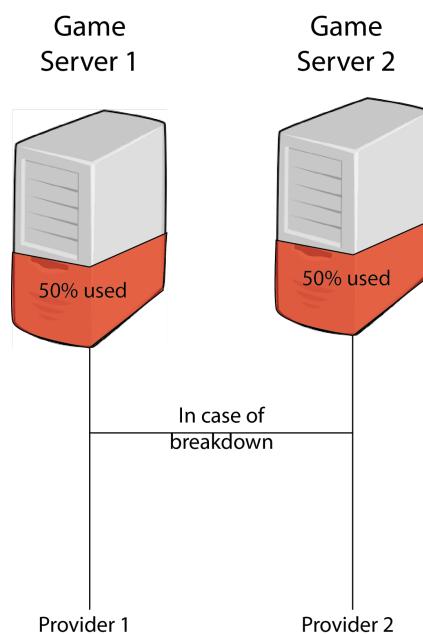


Fig 8: The above image refers to PlayFab backup servers configuration.

5.3 Data storage

We don't need much storage space to manage players data. We need to save information about only purchased virtual goods. PlayFab offers us an **unlimited number of players** and **10,000KB of storage per player** (because we need the Enterprise Edition). We delegate sensible players data, such as log in or payment data, respectively to Steam and to PlayFab³.

³ More information about PlayFab storage: <https://playfab.com/pricing/details/#pro-full>.

5.4 Scalability and Extensibility

In the face of a possible *expansion* of the infrastructure of our game, PlayFab offers the option of setting up *private servers*, mounted by their team, and adding them to the list of available servers managed by **their load balancers**. This can be seen as a fast solution to eliminate potential latency areas, particularly relevant due to the kind of game developed. Despite the servers are private we delegate the management to PlayFab.

5.5 Cost Estimation

PlayFab says to use **Amazon Servers** so we base our cost estimation on Amazon prices⁴. Based on m4 host dedicated in Europe (Ireland) (server general use, 2 socket, 24 physical core) server we pay 568€ monthly if we choose to rent it for a year and pay in advance. So we add +30% for PlayFab intermediary. Total for one month server: €738. We use that server typology for running our game server (x2).

Based on i3 host dedicated in Europe (Ireland) (optimized storage) server we pay €1.286 monthly if we choose to rent it for a year and pay in advance. Total for one month server (adding +30% PlayFab) €1.672. We use that server type for data players storing (x2).

Note: in the +30% estimation we assume that PlayFab will cover its service that we need (see 7 paragraph for more information).

Total cost estimation for 4 servers + services platform: **€4.820 monthly**.

We expect to have 37500 DAU so we will have 45000 MAU.

We make an evaluation that PlayFab Enterprise costs (for this MAU) €358/month (€7,15/1.000 MAU)

6. Development

6.1 Platforms

For the development of our game, we have budgeted the following expense for each necessary program:

- *OS: Windows 10 pro licence .*
- *Development platform: Unity 5 Professional Edition because we estimate game profit more than \$200k .*

⁴ Amazon servers price: <https://aws.amazon.com/it/ec2/dedicated-hosts/pricing/>

- **3D Modelling:** *Blender (free)*.
- **Graphic Editor:** *Krita (free)*, *Gimp (Free)*, *Inkscape (Free)*.
- **3D Painting:** *Substance Painter and Substance Designer* .
- **GitLab Enterprise Edition Starter :** offer *private code repositories (max 10gb per repository), additional security and workflow controls, continuous integration and delivery* (Gitlab now integrates Docker for free).
- **WordPress Business edition:** for our game website and communication, give custom host and domain, Google Analytics (an analytic tool important for future expansion pianification).
- **IDE: Visual Studio Community Edition 2017:** Since we our team is made by 7 people at the most, we do not reach the minimum to be considered an organization by Microsoft (as described in the *Visual Studio Community Edition 2017 licenses terms*) so we can use it for free.
- **Doxxygen:** tool for html code documentation (GNU GPLv2).

6.2 Hardware

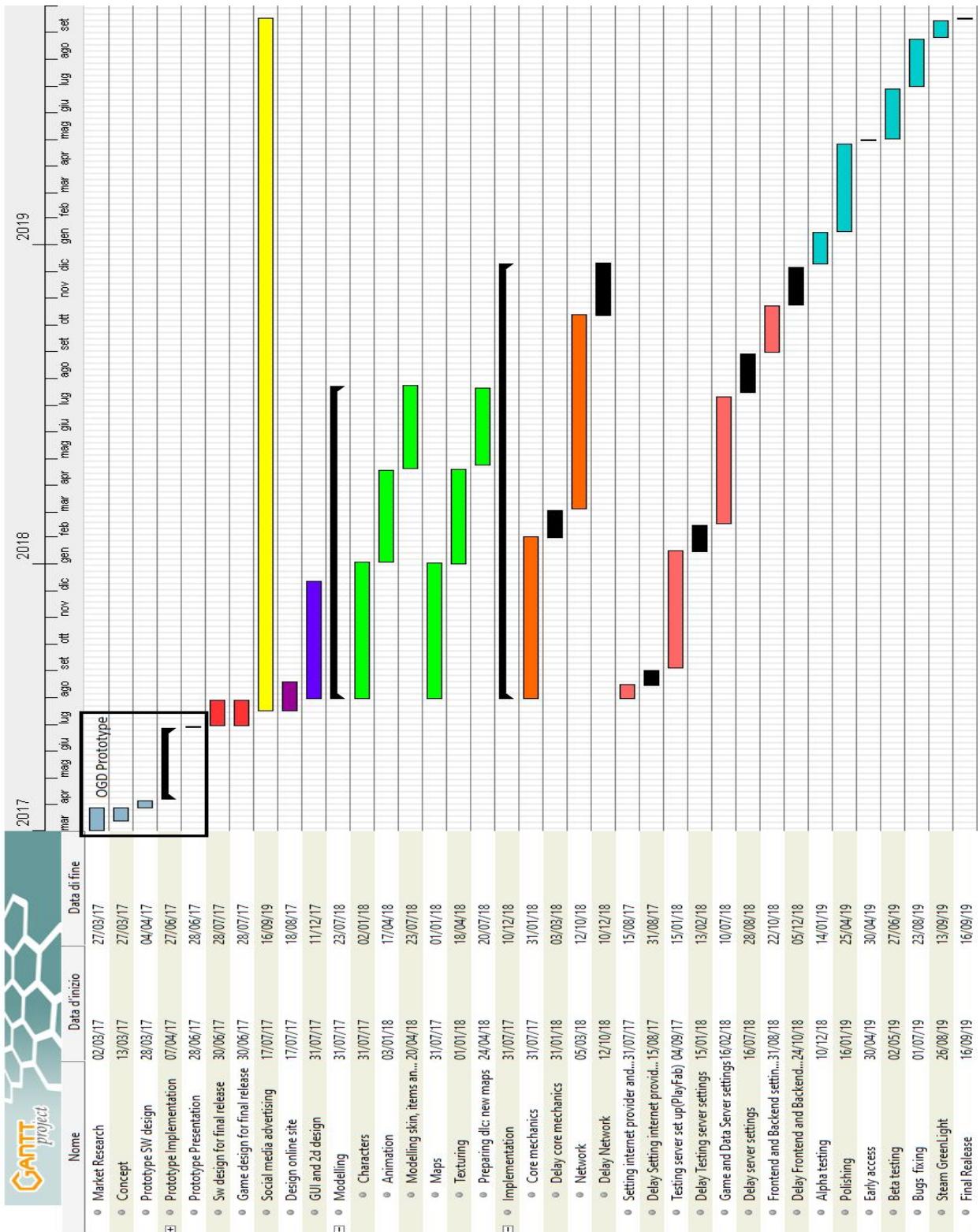
The team consists of 3 programmers, a 2D artist and 2 3D artists. The necessary equipment is therefore:

- 3 x Asus K550VX + 256GB SSD Samsung MZ-75E250B (mainly for developing the software and testing it)
- 3 x Monitor ACER MONLCD G236HLBB 23P
- 3 x Assembled PCs with :
 - Nvidia GeForce GTX 1080ti,Seagate Barracuda 2TB 7200RPM SATA3 Samsung MZ-75E250B, 256GB SSD, Intel Core i7 3770K Unlocked Quad Core (for rendering,scene building and producing all the graphics)
- 1x Wacom DTK-1300-3
- 1x Asus X540SA-XX311T Notebook, Display 15.6" HD, Intel N3060, RAM 4 GB, HDD 500 GB (for the social manager)

6.3 Major Software Development Tasks

- Design maps
- Design the GUI
- Design and balance Gameplay
- 2D graphic asset
- 3D graphic asset
- Polishing
- Beta testing

6.4 Development GANTT



6.5 Cost Estimation

Hardware	Pricing (euro)
3 x Asus K550VX	3 x 999
3 x 256GB SSD Samsung MZ-75E250B	3 x 123
3 x Monitor ACER MONLCD G236HLBB 23P	3 x 119
3 x Assembled PCs (as described above)	3 x 1960
1x Wacom DTK-1300-3	1 x 770
1x Asus X540SA-XX311T Notebook	1 x 300

Total hardware cost : approximately **11.000 euro**

Software	Pricing (euro)
Windows 10 pro licence	7 x 130
Unity 5 Professional Edition	3 x 125 (monthly)
Substance Painter and Substance Designer	2 x 19 (monthly)
GitLab Enterprise Edition Starter	1 x 39 (annually)
WordPress Business edition	1 x 24.92 (monthly)

Total software cost : **910 + 435 (monthly) euro**

7. External Services

7.1 PlayFab Services

We will use some important PlayFab feature such as:

1. **server maintenance and security:** PlayFab ensures that its servers breakdown seldom.
2. **sell virtual goods** (such as dlc, skin, maps and weapons).
3. **player analytics monitoring.**

These services are included in backend cost estimation⁵ (see 5.5 paragraph).

7.2 PlayFab Add-On Services

PlayFab offers the possibility to add customization services.

We add Customer Support (offered by its partner Zendesk). Prices are variable but we need multilingual support: one agent costs 49 euro monthly. We think to use 6 persons.

7.3 Sound and music

We will buy sounds and music from Unity asset store and from *Audio Network* only when necessary⁶.

7.4 Office space for rent

We want to set up our team in **Poland** to benefit of the **Special economic zones (SEZ) in Poland**⁷ characterized by a low taxation level (from 20% to 40%).

We will establish our office in one of these zones, in **Krakow Technology Park**. Co-working spaces are between 20-120 euro per person⁸. Our team is made up 7 people so we need about **70 mq**, so we will pay around **600 euro** for office rent.

More services are offered by office rent company, including: furnished offices, lounge area, IT support, **reception services**, videoconferencing, conference facilities, **meeting rooms**, bike racks, kitchen, **cleaning/janitor**, copying facilities, close to mainline train station, 24-hour access, lift, central heating, WC (unisex), hot desking, flexible terms, **24-hour security**, Wi-Fi, virtual office options, car parking, fitness centre, training rooms.

7.5 Cost estimation

Services	Pricing (euro)
Customer support	6 x 49 (monthly)
Music	10 x 140 (each song costs 140 with license)
Office space	600 (monthly)

Total to pay: 900 euro monthly + 1.400 euro

⁵ Additional features can be found here: <https://playfab.com/features/>

⁶ Soundtrack taken from :<https://www.audionetwork.com/>

⁷ More information here:

http://www.roedl.com/pl/en/hot_news/special_economic_zones_in_poland.html

⁸ Datas taken from <http://www.instantoffices.com/en/pl/office-space/krakow?for=13-24&size=5>

8. Communication

8.1 Global Infrastructure Outline

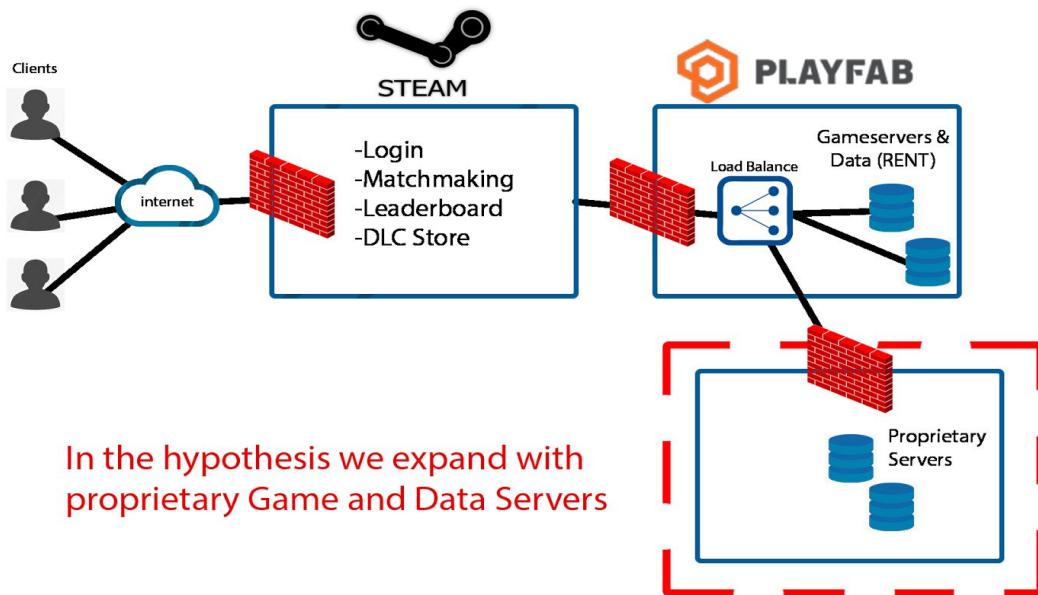


Fig 9: The above image refers to Pharmageddon global infrastructure summary scheme (backend plus frontend).

PlayFab Architecture

Architecture Overview

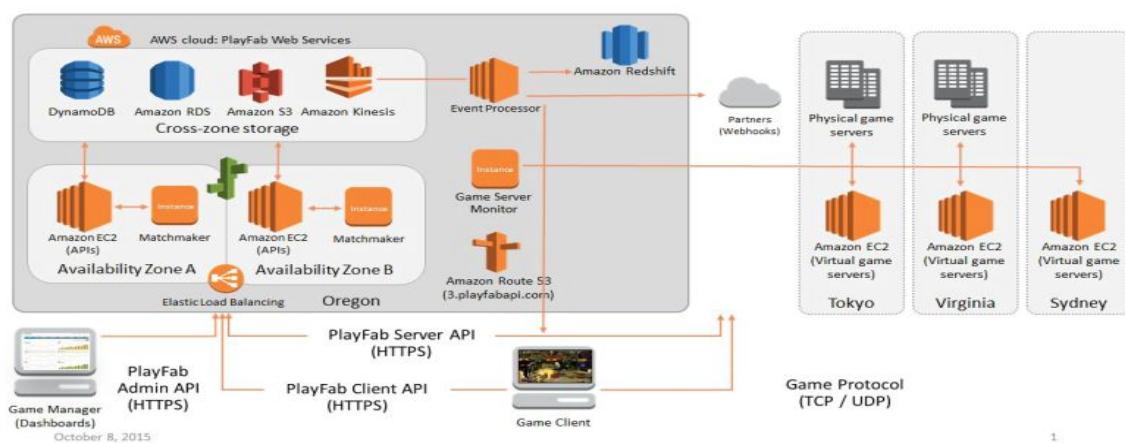


Fig 10: The above image refers to PlayFab configuration.

8.2 Network Requirements and Hardware

Analyzing similar games' Steam statistics (e.g. *Team Fortress 2* and *Enter the Gungeon*), we forecast peaks of **37500 (DAU)** players at the same time; therefore we need at least **45000 MAU** (as described in 3 paragraph), in order to be safe.

As we are entrusted to third parties for the management of our front-end back end, we do not have to worry that these requirements are not met: both Steamwork and PlayFab provide scalable service for our needs, and the only difference we face is an increase in the cost of the services offered by Playfab, calculated on the basis of MAU (as described in 5.5 paragraph).

8.3 Key Protocols

- Application layer protocol
 - UNet (offered by Unity)

8.3 Cost Estimation

Based on *Team Fortress 2* bandwidth usage, one player will use 50 KB/s⁹.

So, 500 (CCU) x 50 KB/s = 25000 KB/s = 200 Mb/s.

Because our servers will be located in Poland we make estimation about polish provider¹⁰.

We buy that bandwidth for **15 euro monthly** (we have taken *Hiper 250* provider) to link backend and frontend.

9. Delivery

9.1 Estimated Delivery Time

The estimated delivery time is 2 years since the game was designed to be quickly produced in order to lower upfront investments of time and money.

9.2 Delivery Platform

The game will be delivered on the Steam platform. We choosed Steam for the ease to use and the service integration. We want also to take advantage of Steam Greenlight to launch the game. We need to pass a selection phase in Steam Greenlight to be published in Steam. We want to use this phase as an advantage (see next 9.3 paragraph).

⁹ Data taken <http://forums.steampowered.com/forums/showthread.php?t=3181049>.

¹⁰ Some information and cost <http://www.satproviders.com/en/list-of-all-services/POLAND>

9.3 Delivery Methodology

Our delivery starts before the **effective** game delivery: as a small company we want to **publish ourselves** exploiting social media as Facebook, Twitter and YouTube to sponsor the new game by publishing weekly updates on game development (so we need a social media manager as described in paragraph 10.3). News will be posted also on our website.

There will be a launch date first in Europe, then if the game performs well, we will launch worldwide after 6 months. By adopting the PlayFab solution, we cannot avoid this time lapse since we need renting more servers in America and need time to set up them. Also PlayFab doesn't ensure having immediately available server location, moreover PlayFab Enterprise Edition ensures server location but not immediately.

In order to succeed in the first launch we will spread images, rumors and trailers through the various social networks since the early stages of the Beta development, firstly creating social network pages and uploading regular content about the process of producing the game. This strategy comes from the need to have a strong and loyal community even before the game launch, in order to have a relatively secure success at the launch date.

Shortly before the actual launch we will start our Greenlight campaign with the goal of passing it in about 3 weeks (judging by other indie companies experiences we know that the most important week is the first one).

Supposing we pass Greenlight we launch after a week for a early access preview in order to gather data from the users and fine tune/ polish the final state of the game.

The game is designed to be supported at least for **3 years**.

9.4 Cost Estimation

We will publish through Steam. Steam retains **30%** (around) of revenues.
Steam Greenlight first team registration costs **90€**.

10. Staff

10.1 For Infrastructure Setup and Management

PlayFab guarantees us **server management and their set up** in the hypothesis we will buy Enterprise Edition.

10.2 In game

Our team is designed to be a small team and so is made up:

- *3 software developers*
- *2 3D artists*: 1x for characters and item models, concepts and animation, 1x for new maps and their designer.
- *1 2D artist*: for the gui game, intro and selection game pages, and 2d content of the game site, textures, sprite animation.

10.3 Other

- *Social Media Manager and site designer*: this figure has to post news on our social pages, update game site contents, monitor online satisfaction players on online platform (observe what they write in online forums and so make satisfaction inferences), dialogues with the 2D artist to renew the official game page style.

10.4 Cost Estimation

Costs that follow are calculated in the Poland area so we have converted all from Poland currency (Zloty PLN) in euro.

Salary

Salary comes from *glassdoor site*¹¹.

The team will be created and start in **Poland**, due to financial start up facilitation and different taxation.

Salaries are monthly listed:

Figures	Net salary (in euro)
Programmer	1300
3D artist and 2D artist	1000
Social media manager	800

Total net salary to pay: 7700 euro monthly

Tax in Poland are **+20%** of the salary.

So: $20 \times (1300 \times 3 + 1000 \times 3 + 800) / 100 = 1.540$ salary **taxes**

¹¹ <https://www.glassdoor.com/Salaries/index.htm>

11. Potential Security Issues

Since we do not handle any sensible data neither player's accounts passwords or payment credential we don't expect any security issue besides players cheating (from a player perspective). Security is guaranteed in PlayFab feature. Anti cheating system is guaranteed by Valve in Steamworks.

Firewalls are also guaranteed by Steam and also PlayFab.

However we need a VPN to ensure security data and encrypt between backend and frontend.

11.1 Cost Estimation

We use an external service for VPN, offered by Golden Frog¹², established in Poland. Annually it costs \$299.00 (about 270€).

12. Other

We should succeed the GreenLight Steam step but we need to have an alternative in case of failure.

in this hypothesis we have to change our frontend and delivery strategy.

We will pass through the indie store **itch.io** and we will use **GameSpark** as frontend.

GameSpark is a PlayFab competitor, it offers all that PlayFab offers, except for the server personal hosting and maintenance. We want to separate the backend and frontend management because we don't want to be completely dependent on a single company. We will use **GameSpark** as we will use **Steamworks**.

12.1 Cost Estimation

Itch.io is an indie store, it doesn't require additional costs.

We need only some services from GameSpark (as described in 4.1 paragraph about frontend side). Costs are not personally available so we estimate GameSpark works as PlayFab list pricing (around 6.000\$/monthly, 5.320 euro) but we don't have Steam publishing percentage (+30%).

¹² <https://www.goldenfrog.com/vyprvpn/poland-vpn> and
<https://www.goldenfrog.com/vyprvpn/business>

13. Costs Summary

13.1 Total Project Cost

Note: our game is designed to live for 3 years. Analyzing competitors stats (as shown in paragraph 3.1) we can estimate our numbers of players for these years (50.000 total subscribers).

Type	Price (euro)
Servers and server services (PlayFab)	$(5.330 + 400) \times 12 \text{ (months)} = 68.000 \text{ (per year)}$
Staff	$9.240 \times 12 \text{ (months)} = 110.880 \text{ (per year)}$
Hardware	11.000 (fixed)
Software (and license)	$910 \text{ (fixed)} + 435 \times 12 \text{ (months)} = 5.220 \text{ (per year)} + 910$
Internet provider	$15 \times 12 \text{ (months)} = 180 \text{ (per year)}$
Other (office rent ecc)	$1.400 \text{ (fixed)} + 900 \times 12 \text{ (months)} = 10.800 \text{ (per year)} + 1400$

2 year production total costs: around 300.000€ (complete staff + hardware + software + internet provider + other for 2 years. Note: during the 1.5 years we will use PlayFab free servers tester).

3 year launch: around 330.000€ (half staff, only the 3 programmers for game maintanence + PlayFab server + other + internet provider).

+ 53.000€ for bank interests.

Total investment: around 683.000€.

Note: Hardware costs are active costs and we don't have variable costs.

13.2 How do we obtain the initial investment?

We need 350.000€ bank loan (with +15% interests annual).

280.000€ is social capital: 60.000€ from 3 programmers founders and 220.000€ is venture

capital (risk) from external lenders.

13.3 Estimated Cost per User

Analyzing games competitors, the game will be sell at **12,79 euro**. We use **psychological threshold**: we use thin numbers (such as 7 and 1) and not fat numbers (such as 8).

13.4 Revenue Estimation

We have an internal game store in which the player can buy dlc and items and characters skin.

Based on famous game store (as *League of Legends*) In our game store prices are from 0,99 euro to 4.99 euro, so we suppose **2 euro** spent on average every month for at least 50% of the players.

Our **revenue formula** is:

$$R(x) = 75\% \times 3 \text{ (years)} \times (12,79 \times x + 0,5 \times x \times 24) = 38x$$

x is the total players numbers that we need to break even. We suppose that half of them will buy at least one dlc (and so the 0,5 in the formula) during one year (and so 2 euro x 12 months), this is because if a player buys a game probably she will also buy dlc.

20-30% will be for Steam interests so we consider 75% of revenues.

So: $38x = 683.000$ (our total costs). $x = 18.000$ (around)

13.5 Break Even Estimation

We need 18.000 player to break even. We expect to have 50.000 total players during the all three years of the game life.

So $32.000 \text{ players} \times 38 = 1.216.000\text{€}$ is our gain.

Taxation in Poland is 40% (around) so the net profit is **487.000€**. So we have **162.000€** per year but $\frac{3}{4}$ go to the **external investors** (122.400€) and **39.600€** to the **3 founders**.