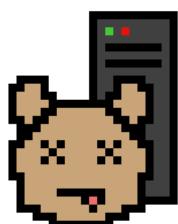


Technical Design Document



Team



Michael Marchesan - 945887
Luca Di Gennaro - 961208
Francesco Brischetto - 958022



Contents

1 Project Goal	4
2 Provided Services	4
3 Client	4
3.1 PC Requirements	4
3.1.1 Minimum System Requirements	4
3.1.2 Recommended System Requirements	4
3.2 HTML Requirements	5
3.2.1 Minimum System Requirements	5
3.2.2 Recommended System Requirements	5
3.3 Android Requirements	5
3.3.1 Minimum System Requirements	5
3.3.2 Recommended System Requirements	5
4 Workload Estimation	6
5 General Architecture	8
5.1 Frontend	8
5.1.1 Hardware	8
5.1.2 Software	9
5.1.3 Scalability and Extensibility	9
5.2 Backend	9
5.2.1 Hardware	9
5.2.2 Software	10
5.2.3 Scalability and Extensibility	10
5.3 Workload Capacity	11
6 Development	12
6.1 Hardware	12
6.2 Software	12
6.3 Major Software Development Tasks	13
6.4 Development Gantt	14
7 Connection	15
7.1 Global Infrastructure	15
7.2 Network Requirements	16
7.2.1 Outside	16
7.2.2 Inside	16
7.3 Network Hardware	16
7.4 Network Software	16
8 Delivery	17
8.1 Estimated Delivery Time	17
8.2 Delivery Platform	17
8.3 Delivery Methodology	17



9 Staff	19
9.1 Infrastructure	19
9.2 Ingame	19
9.3 Other	20
10 Location	21
10.1 Monthly expenses	21
10.2 Furniture	21
11 Cost Estimation	22
11.1 External Services	22
11.2 Game Servers	22
11.3 Development	22
11.4 Staff	23
11.5 Location	23
11.6 Totals	24



Changelog

Purpose

A Technical Design Document describes a solution to a given technical problem. It is a specification, or “design blueprint”, for a software program or feature. The primary function of a TDD is to communicate the technical details of the work to be done to members of the team. However, there is a second purpose which is just as important: the process of writing the TDD forces you to organize your thoughts and consider every aspect of the design, ensuring that you haven’t left anything out.

Creation Date

Since 10/05/2021.

Last modification

Last modification: 06/06/2021.

Who	What	When
Luca	Document created	10/05/2021
Francesco	Added Changelog section and basic document structure	11/05/2021
Luca	Added Project goals and Provided Services section	11/05/2021
Michael	Added Client requirements section	11/05/2021
Together	Added Gantt subsection	14/05/2021
Francesco	Added Front-end General architecture section	16/05/2021
Michael	Added Workload estimation section	16/05/2021
Luca	Added Location section	21/05/2021
Michael	Added Delivery section	25/05/2021
Francesco	Added Back-end General architecture section	26/05/2021
Francesco	Refined Client requirements section	27/05/2021
Michael	Added Network Requirements subsection	28/05/2021
Francesco	Added Global Infrastructure subsection	30/05/2021
Luca	Finished Development section	30/05/2021
Luca	Added Staff section	01/06/2021
Michael	Added Cost estimation section	01/06/2021
Luca	Finished Cost estimation section	03/06/2021
Francesco	Finished Connection section	03/06/2021
Together	Added Potential security issues section	04/06/2021
Together	Reviewed the final version of the document adjusting minor English errors	05/06/2021
Together	Fixed the structure of the document	05/06/2021
Together	Final draft of the document	06/06/2021



1 Project Goal

Our goal is to provide 24/7 game availability for players from both PC, Web Browser and Android through an internet connection with possibility of crossplay event and tournaments.

2 Provided Services

To enhance the player experience, we will provide additional services for our users:

- A website, in which we'll host the Web version of the game, alongside various information about it and a section for customer support and inquiries
- An official Discord server to host discussion between players, making announcements and basic customer support
- A Twitter page, as an alternative and public channel for announcements and upcoming content reveal
- Leaderboards, achievements and stats

3 Client

3.1 PC Requirements

3.1.1 Minimum System Requirements

- **Operating System:** Windows 7 / Windows 8.1 / Windows 10 32 or 64-Bit
- **Processor:** Intel Pentium E2180 @ 2.00GHz / AMD Turion 64 X2 Mobile TL-64
- **Video Card:** GeForce 7600 GT / Radeon HD 7310G
- **RAM Free:** 1 GB RAM
- **Disk Space:** 250 MB Free

3.1.2 Recommended System Requirements

- **Operating System:** Windows 10 32 or 64-Bit
- **Processor:** Intel Core2 Duo E6850 @ 3.00GHz / AMD Athlon II X2 250e
- **Video Card:** GeForce 8800 GTX / Radeon HD 6570
- **RAM Free:** 2 GB RAM
- **Disk Space:** 250 MB Free



3.2 HTML Requirements

3.2.1 Minimum System Requirements

- **Processor:** Intel Pentium E2180 @ 2.00GHz / AMD Turion 64 X2 Mobile TL-64 / Snapdragon 410 Quad Core 1.4 GHz or equivalent
- **Video Card:** GeForce 7600 GT / Radeon HD 7310G / Adreno 306 or equivalent
- **RAM Free:** 1 GB RAM
- **Software:** Any Browser with HTML5 support

3.2.2 Recommended System Requirements

- **Processor:** Intel Core2 Duo E6850 @ 3.00GHz / AMD Athlon II X2 250e / Snapdragon 430 Octa Core 1.4 GHz or equivalent
- **Video Card:** GeForce 8800 GTX / Radeon HD 6570 / Adreno 505 or equivalent
- **RAM Free:** 2 GB RAM
- **Software:** Any Browser with HTML5 support

3.3 Android Requirements

3.3.1 Minimum System Requirements

- **Operating System:** Android 7.0 or higher
- **Processor:** Snapdragon 410 Quad Core 1.4 GHz or equivalent
- **Video Card:** Adreno 306 or equivalent
- **RAM Free:** 1 GB RAM
- **Disk Space:** 250 MB Free

3.3.2 Recommended System Requirements

- **Operating System:** Android 9.x
- **Processor:** Snapdragon 430 Octa Core 1.4 GHz or equivalent
- **Video Card:** Adreno 505 or equivalent
- **RAM Free:** 2 GB RAM
- **Disk Space:** 250 MB Free

4 Workload Estimation

Being a tabletop-like game we can look at the stats for tabletop or similar games on PC and check their average and peak players stats. We can't take a game like AmongUs as reference, despite the similarities, since it's unrealistic to expect a similar explosion in popularity. But we can take still popular turn based multiplayer games and treat them as an upper bound.

RISK: Global Domination has an average of 1600-1700 players connected at the same time, with highly variable peaks, between 3000 and 10000+ players.

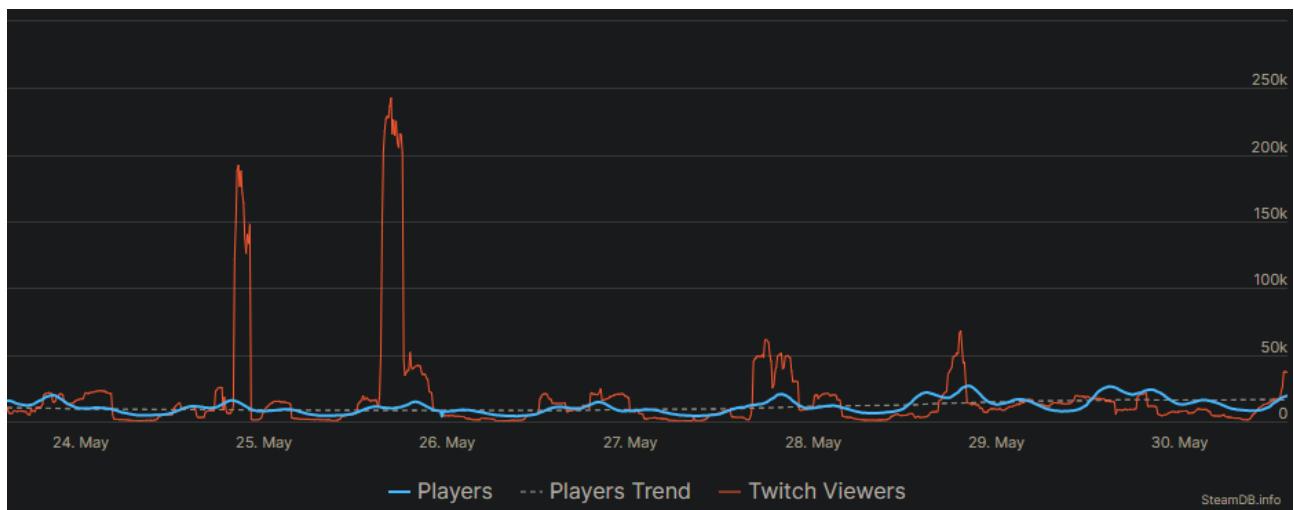


Figure 1: AmongUs recent daily players chart

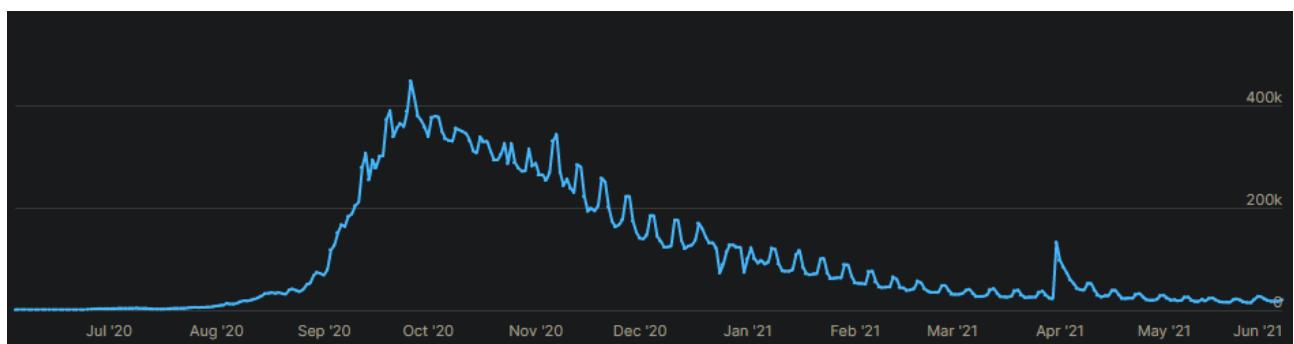


Figure 2: AmongUs yearly players chart

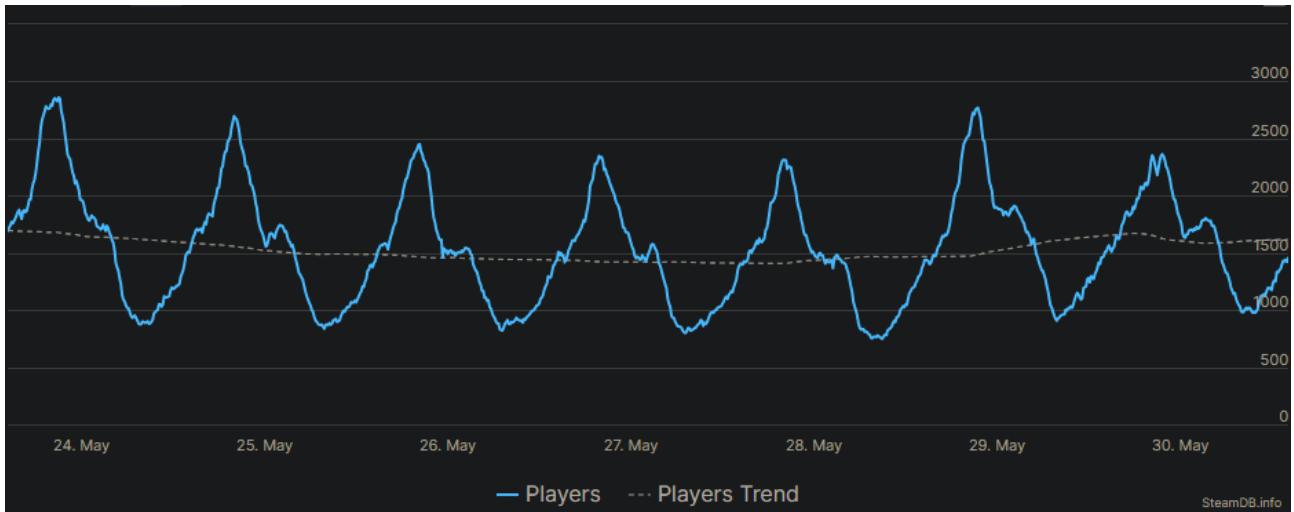


Figure 3: RISK: Global Domination recent daily players chart



Figure 4: RISK: Global Domination yearly players chart

The turn-based nature of the game makes it use very little resources; the network is only used intensively to prevent cheating in some minigames, which are treated as single-player experiences and need no further synchronization with other clients. Aside for minigames, networking operations and computation are minimal on both the client and the server side. The servers will have to keep track of currency, highscores and end-game statistics, and purchased cosmetics for each player. Ultimately it's again a negligible amount of data per each player. 50KB should suffice with enough overhead for future content.

After the game is released, besides bugfixing, there will be regular updates introducing new cosmetics, and potentially larger updates introducing new game modes and adding more rooms, minigames and statuses to the game. After the initial peak, we think the interest in the game will stabilize in few weeks, and remain relevant for 2 or at best 3 years.



5 General Architecture

5.1 Frontend

For the frontend we decided to use Steam with Steamworks API¹ for the PC version of the game. Moreover, we decided to use Google Play Service with Google APIs for the frontend of the mobile version of the game and have a custom website, which will also run the HTML5 version of the game, held using Amazon Web Services.

Since we distribute our game through Steam and Google Play Service we will use some of their features like:

- Authentication
- Achievements tracking
- Leaderboards
- Friends Invitation
- Patch downloads
- Payments for in-game purchase

For the Matchmaking part of the game we will rely on AWS GameLift FlexMatch². We will also rely on AWS for both Frontend and Backend because of the use of Amazon GameOn³ plugin APIs that will allow us to create cross-platforms competition and tournaments.

5.1.1 Hardware

For the Steam part and the Google Play Service part of our front-end, the work is delegated and it's not necessary to use special hardware or software for that.

There will be a one time **80€** cost for the Steam submission fee and a one time **20€** cost for the Google Play Service submission fee.

Our website platform, instead, will require dedicated hardware using AWS. Since our platform will be medium-weight, we decided to use a t2.medium instance⁴ of Amazon EC2 service to handle the standard website traffic and the game traffic generated when playing through browser.

We decided to rely on T2 instances because they can expand their performances based on the workload (using CPU credit system) and have the possibility to temporarily overcome the base CPU performance given.

Website and web applications are the most suitable tasks for those type of EC2 instances.

Service	Location	Memory	vCPUs	Network Perf.	Storage	On-Demand cost/h
t2.medium	EU (Frankfurt)	4GiB	2	Low/Moderate	EBS only	0.044 €

¹<https://partner.steamgames.com/doc/api>

²<https://docs.aws.amazon.com/gamelift/latest/flexmatchguide/match-intro.html>

³<https://developer.amazon.com/it/blogs/appstore/post/226f8a6f-ab31-437b-af91-4416e88f019a/yoyo-games-introduces-the-amazon-gameon-plugin-for-gamemaker-studio-2>

⁴<https://aws.amazon.com/it/ec2/instance-types/>



Amazon Elastic Block Storage (EBS)/monthly	18.90€ + VAT
Amazon EC2 t2.medium on demand/monthly	73.35€ + VAT
Total Monthly cost	92.25€ + VAT = 110.70€

5.1.2 Software

We will use an Apache Web Server that will be set up in Amazon EC2 instance. The server will be managed using AWS Elastic Beanstalk which will allow us to quickly deploy and manage application in AWS Cloud. We will use Elastic Beanstalk⁵ web interface for application health monitoring and automatic scaling based on our needs.

5.1.3 Scalability and Extensibility

Both our frontend service support automatic workload adaptation and scalability, allowing to scale up the system in few minutes if required.

5.2 Backend

For backend part, considering the turn-based mechanics and almost no physics involved, we didn't require high-performance game servers. We decided to use Amazon GameLift⁶ service, as part of Amazon Web Services, to ease us from hardware failures, data security issues, scalability and storage options. Moreover, monthly prices are calculated based on the real use of our game servers.

Regarding the Database part, we will use Amazon DynamoDB to keep memory of players' data like collectables, ranking and also match history.

Amazon DynamoDB⁷ is a NoSQL service that supports document-type and key-value data models and provide constant latency and low response time on global scale.

DynamoDB has no operative cost if paired with other AWS services, so it's the most complete option for our system that heavily relies on Amazon Web Services.

Moreover, it supports global database tables, to allow developers to expand game borders to other regions.

5.2.1 Hardware

For the main Game Server we have chosen a c4.xlarge instance⁸ that have a better cost/computational power ratio providing us the right amount of resources needed.

In order to grant the best coverage and performances we wanted to use 3 Game Servers located in North America, Europe, Asia.

Service	Location	Memory	vCPUs	Network Perf.	Storage	On-Demand cost/h
c4.xlarge	EU (Frankfurt)	7.5GiB	4	High	EBS only	0.19 €

Amazon Elastic Block Storage (EBS)/monthly	18,86€ + VAT
Amazon EC2 c4.xlarge on demand/monthly	310,65€ + VAT
Total Monthly cost	329.51€ + VAT = 402,10€

⁵<https://docs.aws.amazon.com/elasticbeanstalk/latest/dg/Welcome.html>

⁶<https://aws.amazon.com/it/gamelift/>

⁷<https://aws.amazon.com/it/dynamodb/>

⁸<https://aws.amazon.com/it/ec2/instance-types/>



Service	Location	Memory	vCPUs	Network Perf.	Storage	On-Demand cost/h
c4.xlarge	US West (Oregon)	7.5GiB	4	High	EBS only	0.16 €

Amazon Elastic Block Storage (EBS)/monthly	16.88€ + VAT
Amazon EC2 c4.xlarge on demand/monthly	272.33€ + VAT
Total Monthly cost	289.21€ + VAT = 352,84€

Service	Location	Memory	vCPUs	Network Perf.	Storage	On-Demand cost/h
c4.xlarge	Asia Pacific (Tokyo)	7.5GiB	4	High	EBS only	0.21 €

Amazon Elastic Block Storage (EBS)/monthly	18.00€ + VAT
Amazon EC2 c4.xlarge on demand/monthly	344,87€ + VAT
Total Monthly cost	362,87€ + VAT = 442,70€

Regarding the Database, DynamoDB is serverless and will automatically resize data table to adapt capacity and performances. We decided to use the on-demand capacity mode to optimize costs, paying only the resources used.

We estimated up to 50KB of data to be stored for every player, with a player base of 100.000 players and up to 10.000 peak players connected at the same time. We will need up to 5TB for the storage that can be resized flexibly with the on-demand capacity mode.

Moreover, we estimated up to 4 games per hour, with 1 hour of play per player. This will mean up to 20.000 writing and reading to the database.

Considering all of those variables our costs are:

Monthly writing cost	38.02€ + VAT
Monthly reading cost	1€ + VAT
Monthly DynamoDB data storage costs	1284.98€ + VAT
Total Monthly cost	1,324€ + VAT = 1615.28€

For more detail about all our estimation check here⁹.

5.2.2 Software

AWS services will use Linux OS. We can communicate with Amazon GameLift Services using dedicated GameLift Services API.

5.2.3 Scalability and Extensibility

Both our game servers and database service infrastructure support automatic workload adaptation and scalability, allowing to scale up the system if required.

⁹<https://tinyurl.com/calculatorAWS>



5.3 Workload Capacity

According to the estimations done in the **Workload Estimation** section, our Frontend and Backend infrastructure should not suffer from Workload Capacity issues.

For our servers we specifically choose T2 instances for Web application, whose key feature is the possibility to scale up the computational power according to our needs, and C4 instances for Game Servers with auto-scaling system to deactivate unused servers or activate new ones when needed, while avoiding useless resource usage.

Moreover, our DynamoDB database is adapting capacity and performances using on-demand capacity mode, to overcome every possible scenarios.



6 Development

6.1 Hardware

Note: The pricing is based on prices at date 24/05/2021.

Development computers:

<https://it.pcpartpicker.com/list/jLbgW3>

CPU	AMD Ryzen 5 3600	198.15€
MOBO	Gigabyte B450M DS3H V2 Micro ATX	65.00€
RAM	G.Skill Aegis 2x8gb DDR4-3000 CL16	86.69€
GPU	Zotac GeForce GTX 1660 6GB GAMING Twin Fan	299.99€
PSU	be quiet! Pure Power 11 CM 400W 80+ Gold	71.00€
Storage	Western Digital Blue 500GB M.2-2280	66.50€
Storage	Seagate Barracuda 2TB 3.5" 7200RPM	79.89€
Case	Deepcool MAATREXX 55 MESH ATX Mid Tower	44.99€
Screen	BenQ GW2480 23.7" 1920x1080 60Hz	144.99€
Keyb.	Redragon K552	54.99€
Mouse	Logitech B100	23.73€
TOT		1125.62€

6.2 Software

Note: The pricing is based on prices at date 24/05/2021.

Note: Game Maker Studio 2 licenses are valid for concurrent usage on up to 3 devices.

	Generic	
OS	Windows 10 x64 Professional	199.99€
Communication	Discord	0.00€
	Programming	
software	Game Maker Studio 2 (Developer Desktop)	84.00€
software	Game Maker Studio 2 (Developer Web)	84.00€
software	Game Maker Studio 2 (Developer Mobile)	84.00€
Text editor	Notepad++	0.00€
Versioning	Git & github	0.00€
Mobile testing	Nox Emulator	0.00€
	Assets	
Textures	paint.net	0.00€
Textures	gimp	0.00€
Music	anvil studio	0.00€



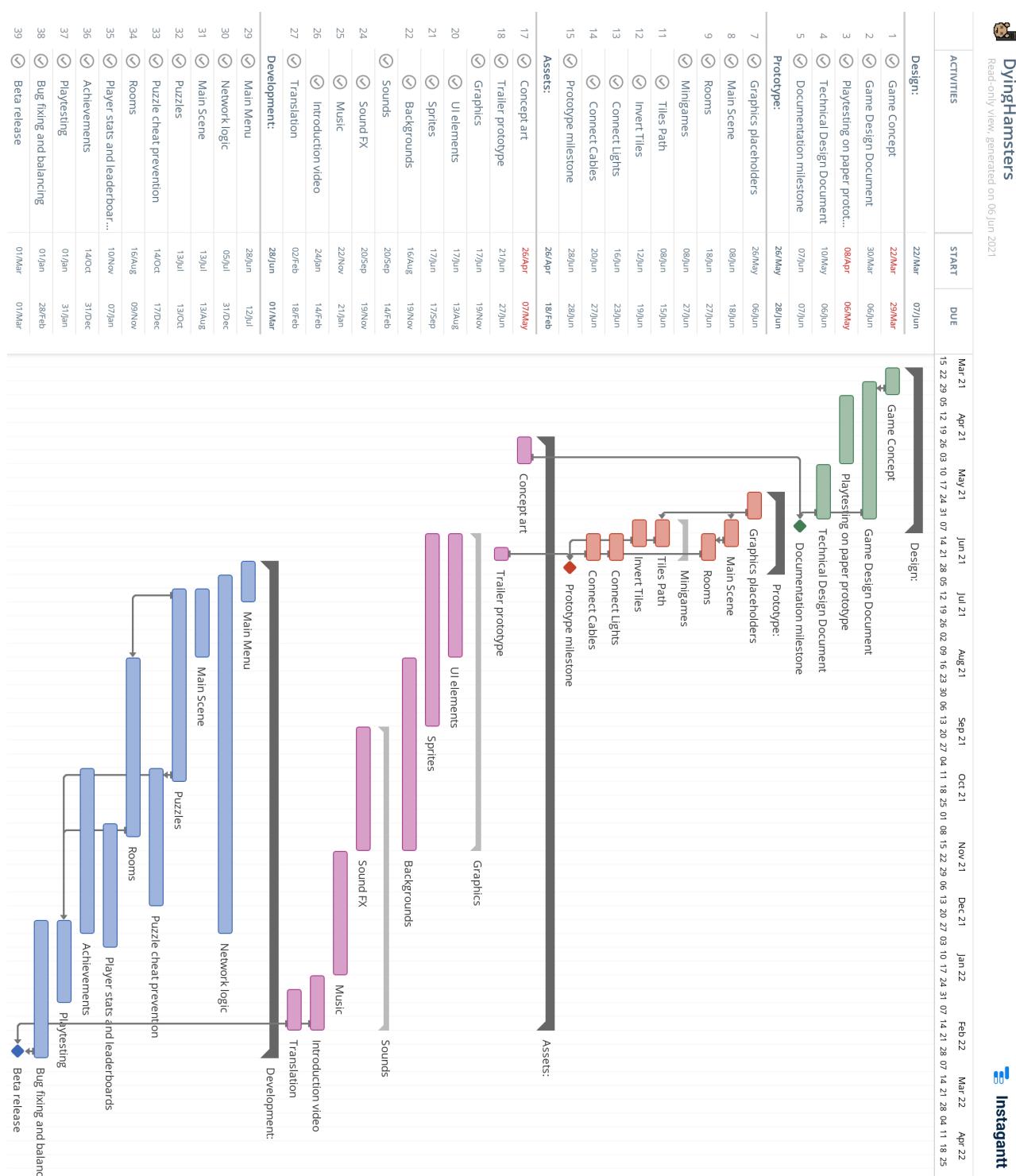
6.3 Major Software Development Tasks

In this section, we'll enumerate the major tasks that we'll encounter throughout the game development:

- **Main menu:** design and development of an affordable menu UI
- **Network logic:** everything regarding the network infrastructure and connection between the agents in the Connection diagram: authentication and billing interfaces, connection to game session, synchronization of the gamestate between users in the same match
- **Main Scene:** design and development of the in-game UI and the turn-based main loop, effect statuses and actions
- **Puzzles:** puzzle design and random generation
- **Puzzles cheat prevention:** puzzle-specific cheating countermeasures (real-time puzzles: send game state every tot time for checking, non real-time puzzles: get game state from server after sending your input)
- **Rooms:** rooms design, puzzle association implementation, positive or negative effects implementation
- **Stats, leaderboards and achievements:** data gathering and storing after every match



6.4 Development Gantt



7 Connection

7.1 Global Infrastructure

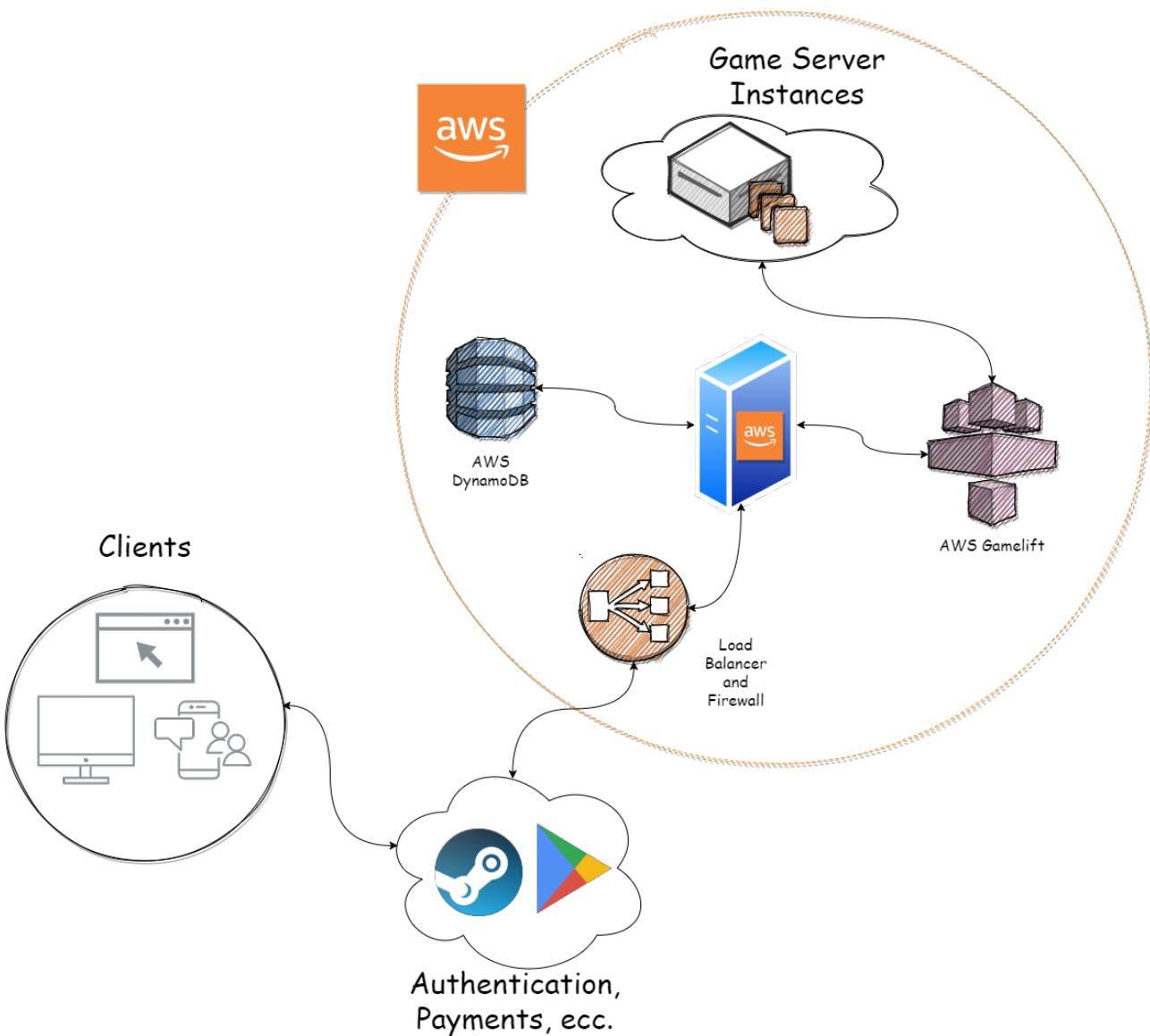


Figure 5: Network Infrastructure



7.2 Network Requirements

7.2.1 Outside

Our bandwidth requirements are minimal, since we only have to exchange small TCP packets for every game turn between players and server, and only a couple of minigames require real-time communication between an individual client and the server for cheating-prevention. Similarly there are not strict requirements for latency, an high latency can be tolerated. Moreover any exceptional latency can be masked pretending other players still have to make their actions choice for the ongoing turn. For real time minigames, the only purpose of the network usage is checking for cheating, which even on high latency can be achieved through time deltas and positions interpolation. Since there's no real-time multiplayer noone will notice it.

A latency of 200ms on average should be fine, with 1s+ starting to get noticeable in case the timer for choosing actions has already expired before receiving the information about the next turn. But again, it doesn't affect gameplay.

Bandwidth: 1Kbit/s should be more than enough for a full lobby. In the worst case we have to share the action choices for each characters, the coordinates of the rooms targeted by an action, the index of the player targeted by an action, and eventual room effects. Sending 100 to each player integers is more than enough, with a lot of headroom. Cheat-prevention for the most real-time minigame (Bullet hell) can be achieved sending a coordinates pair from the client to the server around two times per second.

7.2.2 Inside

The inside network doesn't require particular attention because the AWS infrastructure is efficient and powerful enough.

7.3 Network Hardware

Relying on the services offered by renting machines using AWS, it isn't necessary to manage the hardware physically. Amazon Web Services guarantee remote access to those machines using AWS Elastic Beanstalk software.

7.4 Network Software

No additional specialized software is required for our network.



8 Delivery

8.1 Estimated Delivery Time

We estimate that the game is going to be developed in 8 months, starting from the end of June 2021 up until the beta release on the 1st of March 2022.

8.2 Delivery Platform

The PC version of the game will be delivered through Steam. The Android version of the game will be delivered through the Google App Store. The HTML version of the game will be available in a dedicated page within our website.

8.3 Delivery Methodology

The Steam and Android version are available for free through the Steam store and Google App Store respectively, with advertisements, but an in-app purchase will be available on both services for 4.99€ to prevent the advertisements. The HTML version in our website will be playable for free, but will require a login through Google or Steam accounts.

Achievements and purchases information is kept in our database, associated with the user-id. In all the versions, the user can link an existing user-id to his account on the other service.

When a player obtains an achievement in the Steam or Android client, the achievement is added both to his platform-specific account (using Steam/Google API) and to our database; when a player obtains an achievement in the HTTP client, the achievement is added only to our database; when that player logs in with a different client, all the new achievements stored in our database will be added to the relative service as well.

Example

- Player #12345 logs in through his 12345@google.com Google account
- Unlocks achievement A. A is added to his Google Play Achievements and in our database, associated with #12345.
- Links his id #12345 with his Steam account.
- Buys the game on Steam
- Logs in on the Steam client
- All the achievements associated with id #12345 are added automatically to his Steam Achievements

We also take advantage of the platforms in-app purchase API to manage the purchase of cosmetics. The HTML platform won't have in-app purchases. Buying cosmetics in one platform will make them available in all the clients when logging in with the same user-id. Such information is shared the same way achievements are shared.

This also applies to advertisements. If the "no advertisement" version is purchased and associated with an user-id, logging in with that user will block advertisements in all the clients, including the HTML one (note that the purchase still has to happen through Steam or Google Play in order to be available in the HTML client).



All the 3 clients can host private matches and share an "invitation" keyword to invite friends to play. Crossplay is available across all clients.

The clients with advertisements behave as follows: A fullscreen advertisement before each match, plus an advertisement will play every time the player is in a room without a puzzle while the other players are completing their own puzzles.



9 Staff

9.1 Infrastructure

An AWS developer will be hired to setup the required infrastructure needed by the game and maintain it throughout its lifespan.

	Count	Cost	Amount	TOT
AWS Developer	1	2800.00€/month	8 months	22400.00€

9.2 Ingame

To develop our game we will hire:

- Three Game Designers which will also take the role of Game Developers
- A 2D Artist to create sprites and other visual assets for our game
- A Music Artist to give shape to the soundtrack and the sound effects in our game
- Two testers to playtest our game prior the launch
- A professional translation service to translate the game from English to Simplified Chinese and Japanese

Regarding translation, we calculated that if we have 27 rooms per 100 words each (room description), plus 20 puzzles per 50 words each (puzzle description) plus 300 words for various UI elements, we reach a grand total of 4000 words.

Since good context-sensitive translation is around 0.12 € per word, the foreseen cost is around 480 € per language, making it extremely cheap to appeal to non-english speaking audiences at launch.

	Count	Cost	Amount	TOT
Game Developer	3	2500€/month	8 months	60000.00€
Tester	2	1500€/month	2 months	6000.00€
2D artist	1	20€/asset	500 assets	10000.00€
Music artist	1	750€/minute	15 minutes	11250.00€
Translation	2	0.12€/word	4000 words	960.00€
Total				88210.00€



9.3 Other

We will also employ:

- A Web Developer to setup the main site for our game
- A Social Media Manager to handle the Twitter account of our game, in order to create content, increase player's engagement and attract new possible customers through advertisements
- Two Community Managers to moderate the Discord channel and interact with the community
- An accountant to manage financial issues
- A legal assistant to handle legal matters such as EULA, privacy policy and so on.

	Count	Cost	Amount	TOT
Web Developer	1	2500€/month	1 month	2500.00€
Social Media Manager	1	1200/month	4 months	4800.00€
Community Manager	2	1000€/month	2 months	4000.00€
Accountant	1	1500€/month	8 months	12000.00€
Legal assistant	1	25€/hour	720 hours	18000.00€
Total				41300.00€



10 Location

10.1 Monthly expenses

For the development of the game we will need enough space to host the members of the staff that need in person coordination the most, which are: the 3 game designers/developers, the AWS developer, the web developer and the 2D artist. For this reason we will choose an office with at least 70mq, which should give enough room to everyone including the playtesters when they'll come to test our game on site.

We found that we can get a reasonable price of about 10€/mq in the city of Trento that also has high speed Internet connection and good transport services.

In addition to that we have to also consider:

- Electricity and heating
- Landline + Internet plan
- Cleaning costs

	Cost	Months	TOT
Rent	760€	8	6080.00€
Electricity and heating	300€	8	2400.00€
Internet Plan	30€	8	240.00€
Cleaning	300€	8	2400.00€
Total			11120.00€

10.2 Furniture

To make our office livable and to suit our needs we will buy some furniture and additional hardware such as:

	Count	Cost	TOT
Office chairs	7	63.99€	447.93€
Office desks	7	114.00€	798.00€
Printer	1	179.00€	179.00€
Toner	1	43.99€	43.99€
Printing paper	1	24.99€	24.99€
Whiteboard and markers	1	40.00€	40.00€
Landline telephone receiver	1	66.50€	66.50€
Microwave oven	1	100.00€	100.00€
Fridge	1	259.00€	259.00€
Total			1959.41€



11 Cost Estimation

11.1 External Services

See section 5.1.1

Store fees:

Steam	80€
Google Play Service	20€
Total	100€

Website:

	Time		+VAT
Amazon Elastic Block Storage (EBS)	Monthly	18.90€	
Amazon EC2 t2.medium on demand	Monthly	73.35€	
Total	Monthly	92.25€	110.70€

11.2 Game Servers

See section 5.2.1

	Time	Cost	+VAT
Amazon Elastic Block Storage (EBS)	EU Monthly	18.90€	
Amazon EC2 c4.xlarge on demand	EU Monthly	310.65€	
Total	EU Monthly	329.51€	402.10€
Amazon Elastic Block Storage (EBS)	US Monthly	16.88€	
Amazon EC2 c4.xlarge on demand	US Monthly	272.33€	
Total	US Monthly	289.21€	352.84€
Amazon Elastic Block Storage (EBS)	Asia Monthly	18.00€	
Amazon EC2 c4.xlarge on demand	Asia Monthly	344.87€	
Total	Asia Monthly	362.87€	442.70€
Total	Monthly		1197.64€

11.3 Development

See sections 6.1 and 11

	Count	Cost	TOT
Developer PC	5	1125.62€	5628.10€
Windows 10 x64 Professional	5	199.99€	999.95€
Game Maker Studio 2 (Developer Desktop)	1	84.00€	84.00€
Game Maker Studio 2 (Developer Web)	1	84.00€	84.00€
Game Maker Studio 2 (Developer Mobile)	1	84.00€	84.00€
Total			6880.05€



11.4 Staff

See section 9

	Count	Months	Cost/Mo	TOT
Junior Developer	3	8	2500.00€	60000.00€
Web Developer	1	1	2500.00€	2500.00€
AWS Developer	1	8	2800.00€	22400.00€
Tester	2	2	1500.00€	6000.00€
Social Media Manager	1	4	1200.00€	4800.00€
Community Manager	2	2	1000.00€	4000.00€
Accountant	1	8	1500.00€	12000.00€
	Count	Hours	Cost/Ho	TOT
Legal assistant	1	720	25.00€	18000.00€
Outsourced	Per	Amount	Cost	TOT
2d Artist	Asset	500	20.00€	10000.00€
Composer	Minute	15	750.00€	11250.00€
Translation	Word	4000	0.12€	960.00€
Total				TODO€

11.5 Location

See section 10

	Months	Cost/Mo	TOT
Rent	8	760.00€	6080.00€
Cleaning	8	300.00€	2400.00€
Electricity, heating	8	30.00€	240.00€
Internet plan	8	300.00€	2400.00€
Total			11120.00€

Furniture:

	Count	Cost	TOT
Office chairs	7	63.99€	447.93€
Office desks	7	114.00€	798.00€
Printer	1	179.00€	179.00€
Toner	1	43.99€	43.99€
Printing paper	1	24.99€	24.99€
Whiteboard and markers	1	40.00€	40.00€
Landline telephone receiver	1	66.50€	66.50€
Microwave oven	1	100.00€	100.00€
Fridge	1	259.00€	259.00€
Total			1959.41€



11.6 Totals

TOTAL	175'653.77€
BUDGET	185'000.00€
SURPLUS	9'346.23€

The surplus is enough to sustain the game servers on all 3 continents for 5-6 months assuming the game has 0 revenue.