Technical Design Document

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Contents

1 Project Goal

Reya's Light is a free-to-play hero-shooter, 2D platform game for PC, accessible through the client provided by Steam 24/7. It consists of a client-server architecture with a permanent and stable internet connection, suitable for competitive and cooperative real-time online multiplayer with low latency in real time.

2 Provided Services

Beside the game	
Steam community	Millions of gamers use the Steam Community every day to browse and create content with their friends. Provided by the steam client.
Global Leaderboard	Display global and friend leaderboards on the Steam community webpage.
Discord channel	dedicated discord channel to help train teams in the game, to get to know each other and have fun with the community of players.
Account statistics	Statistics of your account with the scores of the last 10 games.
Customer support	To provide support to the community in case of problems in the game (loss of login data, problems on transactions in the game shop, etc.).
Official Website	Used to communicate new game updates to the community and to introduce the development team and their work.

In game	
Matchmaking	Process of connecting players together for online play sessions.
Dedicated servers	Accessible 24/7 with low latency
Local Leaderboard	Used to rank players based on the number of kills made, the number of deaths, the number of assists and the number of bases conquered.
Shop	For the purchase of heroes skins.
Friendlist	It allows the addition of friend so that players can invite them to play matches together.
Ranking system	Try to match players of more or less equal skill together.
Chat	There is a written and voice chat that allows you to communicate with all the players in the game.
Periodic updates	- Heroes: new champions with new skills.
	- Maps: new maps and settings
	- Skins: released every season or particular event such as holidays (Christmas, Easter, etc.)
	- Game modes
	- Heroes stat balancing
	- Server maintenance
	- Infrastructure bugfix

3 Client side

3.1 Hardware Requirements

	Minimum requirements	Recommended requirements
Memory	At least 1 GB di RAM 2 GB of available space	2 GB di RAM 2 GB of available space
Network	Discreet connection	Broadband internet connection
Graphics card	NVIDIA GeForce 9500 GS or AMD Radeon HD 6450A	NVIDIA GeForce GTX 760A or AMD Radeon HD 7560D + HD 7600 Dual
CPU	Windows: Intel Core 2 Duo E8400 MacOS: Apple M1	Windows: Intel Core 2 Duo E8400 MacOS: Apple M1
Audio Card	Yes	Yes

3.2 Software Requirements

	Minimum requirements	Recommended requirements
System version	Windows: 8, 32-bit MacOS: 12.0.1 SteamOS: 3.0	Windows: 10, 64-bit MacOS: 12.0.1 SteamOS: 3.0
Other	Steam Client	Steam Client

4   Workload Estimation

We have taken the top-performer competitors of our game genre and of games with same game style or graphics as a reference. We analyzed the data relating to the number of players, current, in the span of 24 hours (24-hour peak) and in the over the last few years / months (all-time peak).

4.1   Dota 2

One of the games we can refer to is Dota 2. Analyzing its data we can observe that the current active users are 572,619, in fact this game despite being always set on the same map, thanks to the presence of a large amount of heroes and the possibility to buy skins online, attracts a large number of players every day who form teams to compete against opponents and rise in the rankings, not only locally but also globally. These factors have contributed to the achievement of this number of users, reaching a peak of 625,656 users within 24 hours and a peak of 1,295,114 users, and show that a game with this setting keeps the amount of users constant over time.

Figure 1: Dota 2 steam chart provided by steamdb.info

4.2   Brawlhalla

Brawlhalla is another game we can refer to as it shares a graphic style similar to Reya's Light and a competitive online 2D-platform genre. Brawlhalla currently has 14,412 players, with a daily peak of 15,715 and an all-time peak of 34,816 users. These numbers were achieved thanks to the cartoony graphics and the captivating fighting style.

Figure 2: Brawlhalla steam chart provided by steamdb.info

4.3 Our Estimation

Observing the above data found by steamDB.info, which reports the data relating to the number of users of the competitors, we have made our own estimate:

24-hour peak concurrent users	6000
24-hour average concurrent users	4450
24-hour minimum concurrent users	2000
24-hour average connected users	71200
Monthly connected users	160000

5 General Architecture

5.1 Frontend

To implement the frontend it is necessary to use a reverse proxy server which forwards client requests towards the correct back-end servers and applications. Also, a reverse proxy can improve scalability, performance, resilience and security.

To implement our multiplayer infrastructure we decided to rely on AWS (Amazon Web Services) and Amazon GameLift (Amazon dedicated game server hosting solution). Therefore to implement the frontend we chose the Amazon EC2 M6g instances.

Amazon EC2 M6g instances are powered by Arm-based AWS Graviton2 processors. They deliver up to 40% better price/performance over current generation M5 instances and offer a balance of compute, memory, and networking resources for a broad set of workloads. Amazon EC2 M6g instances are recommended for applications built on open-source software such as application servers, microservices, gaming servers, mid-size data stores, and caching fleets. After the release of the game the quantity of server instances will be scaled depending on users' demands. In the following tables we illustrate the two instances chosen to implement our frontend servers.

Amazon EC2	
Feature	**Description**
Model	m6g.xlarge
Operating System	Linux
Virtual CPU	4
Memory	16 GiB
Storage	EBS-Only (Amazon Elastic Block Store)
Network Bandwidth (Gbps)	Up to 10
EBS Bandwidth (Mbps)	Up to 4,750
Cost for hour	€0.06346

Amazon EC2	
Feature	Description
Model	m6g.2xlarge
Operating System	Linux
Virtual CPU	8
Memory	32 GiB
Storage	EBS-Only (Amazon Elastic Block Store)
Network Bandwidth (Gbps)	Up to 10
EBS Bandwidth (Mbps)	Up to 4,750
Cost for hour	€0,12692

5.2 Backend

5.2.1 Database and dedicated game server

To implement our Backend infrastructure we chose to rely on Amazon Web Services and Amazon GameLift servers.

We need two different backend services: a database and a dedicated game server.

The role of the database will be to store players' account information, including last matches results, player ranks and stats and global leaderboard data. The dedicated game server role is to host matches and compute real-time data, running the Unity server build version.

To implement the database we chose to use Amazon DynamoDB, a fully managed, serverless, key-value NoSQL database designed to run high-performance applications at any scale. It offers built-in security, continuous backups, automated multi-Region replication, in-memory caching and data export tools. DynamoDB is used to develop software applications, to create media metadata stores, to deliver seamless retail experiences and to scale gaming platforms, allowing the construction of a game platform with player data, session history and leaderboard for millions of concurrent users.

To implement the dedicated game servers we chose to use Amazon GameLift services. We plan to use Amazon M6g instances and to scale the number of dedicated servers depending on the quantity of concurrent online users. Typical multiplayer games use 50% of their peak server capacity on average. This means that half of the time their game servers have no active players. Amazon GameLift's auto-scaling feature can automatically turns off game servers when they are not needed and adds new game servers when more players arrive.
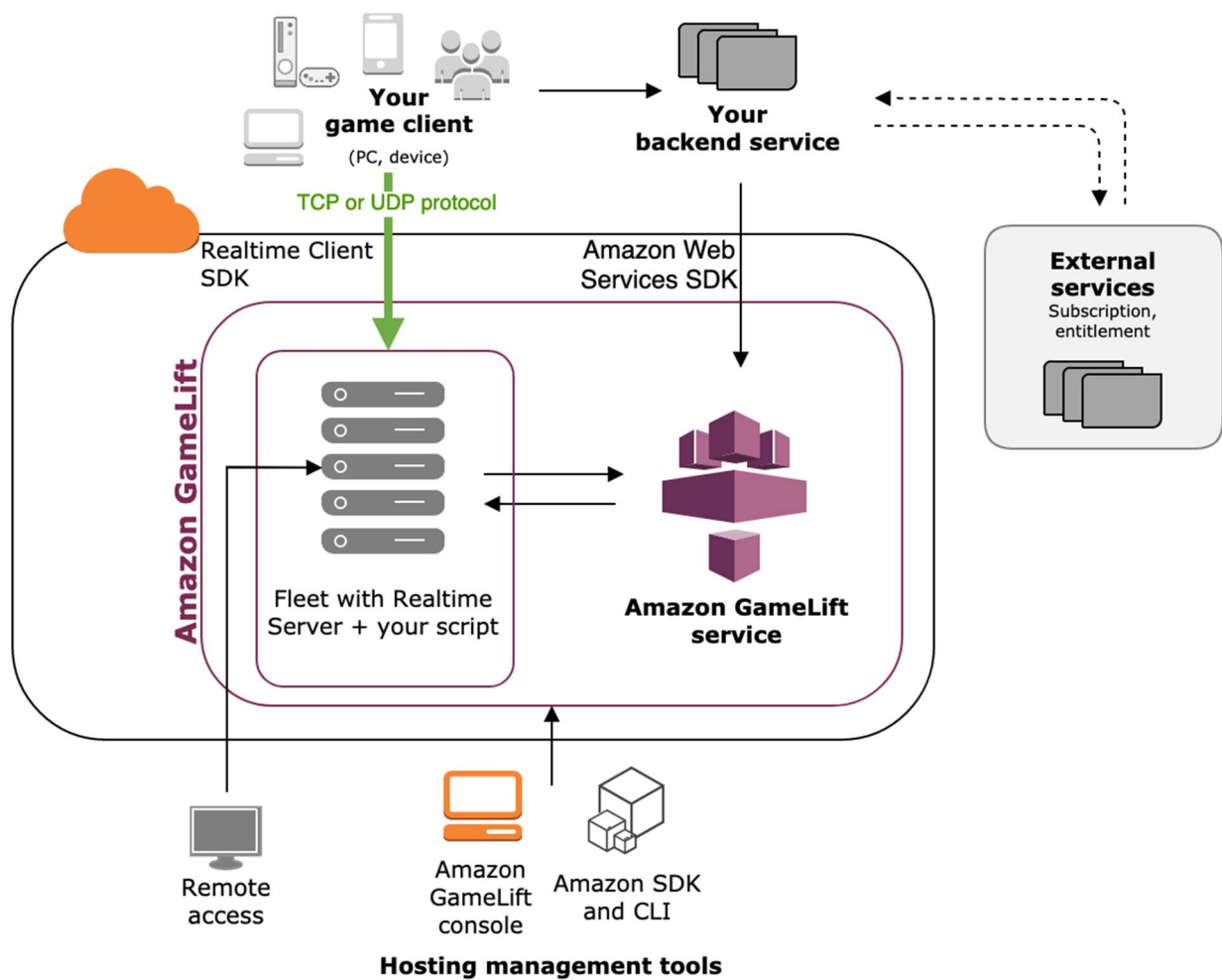
Figure 3: Amazon Game Lift infrastructure

Amazon GameLift	
Feature	**Description**
Model	m6g.xlarge
vCPU	4
Memory	16GiB
Hourly On-Demand	€0,03515
Monthly On-Demand w/ Autoscaling (365 hours)	€12,8345

Amazon GameLift	
Feature	**Description**
Model	m6g.2xlarge
vCPU	8
Memory	32GiB
Hourly On-Demand	€0,0703
Monthly On-Demand w/ Autoscaling (365 hours)	€25,6595

5.2.2 Matchmaking

To implement Reya's Light multiplayer system we need a matchmaking service to automatically match players of similar ranks.
Amazon GameLift allows the use of a customizable matchmaking service for multiplayer games: GameLift FlexMatch. With FlexMatch, we can build a custom set of rules that defines what a multiplayer match looks like for our game, and determines how to evaluate and select compatible players for each match. We can also customize key aspects of the matchmaking process to fit our game, including fine-tuning the matching algorithm. FlexMatch gives us the flexibility to set matchmaking priorities depending on our game requirements. FlexMatch usage is included in the fees for Amazon GameLift.

5.3 Workload Capacity

Since we are relying on Amazon GameLift services, workload capacity can be scaled and adapted depending on the number of concurrent connected users. Thanks to the scalability of our infrastructure and Amazon GameLift services, workload capacity will be adapted to the current demand, adding extra servers when necessary, improving the performance of the game.

6 External Services

6.1 Payment System

The payment system is managed using world class support for in game purchases provided by Steam, through the use of the Steam Microtransaction APIs. In this way, Steam customers can make purchases directly from their Steam Wallet. The security of the payment system is controlled by Steam with fraud checks.

6.2 Personal Data Management

The personal Data of our player's community is managed by the Steamworks API. Steamworks API creates or links automatically the Steam customer's account with our system, rather than requiring the customer to manually create an account through our game or website. Creating a new account through another service can be a huge hurdle for some customers, and can significantly impact your potential audience. Linking a user's Steam account to our system can be done by retrieving and verifying a user's SteamID, which is a unique identifier for a Steam account.

6.3 Customer Support

In order to help customers with in-game problems like bugs or with transaction problems in the game-shop, we decided to insert a system of customer support through the use of tickets. A user can open a ticket in which he/she asks for help writing down the relative problems. A ticket management staff will take care of answering users in an exhaustive way by providing them with support. We decided to choose 5CA, a customer care company, that provides scalable customer support in any language, in any time zone and for any type of player. Thanks to their tried and tested work-from-home model, we can offer truly worldwide customer support through a single point of contact. 5CA uses a pay-per-use model that will scale based on our playerbase.

6.4 In-game Chat

In Reya's Light we want to insert an in-game voice and text chat in order to make the players communicate during the match so that they can discuss strategies to use against the enemy and so that they can meet new people to have fun and play with. This chat is implemented using Vivox Unity SDK that boost player engagement, retention rates and create immersive multiplayer experiences by leveraging an easy-to-implement, feature-rich voice and text chat service. Vivox is trusted by the industry's leading titles – like VALORANT, PUBG, League of Legends, and Rainbow Six Siege – to deliver the best comms service to their players. It's an easily integrated and managed hosted solution that works with any game engine for any platform. The service is officially free for up to 5,000 peak concurrent users, while for more users, it provides a custom pricing.

6.5 Global Leaderboard

Steam supports persistent leaderboards with automatically ordered entries. These leaderboards can be used to display global and friend leaderboards on the Steam community webpage. Each Steamworks title can create up to 10,000 leaderboards, and each leaderboard can be retrieved immediately after a player's score has been inserted. For each leaderboard, a player can have one entry. There is no limit on the number of players per leaderboard. Each entry contains a score for the leaderboard (an int32) and optionally up to 64 int32s of associated data. The associated data can be used to store game specific information about the play session that resulted in the user's leaderboard entry. This data is not sorted or parsed by Steam, and is replaced when a new leaderboard entry is created for the user. It is also possible to view and administer leaderboards for our game in the Steamworks Game Admin.

7   Connection

7.1   Global Infrastructure
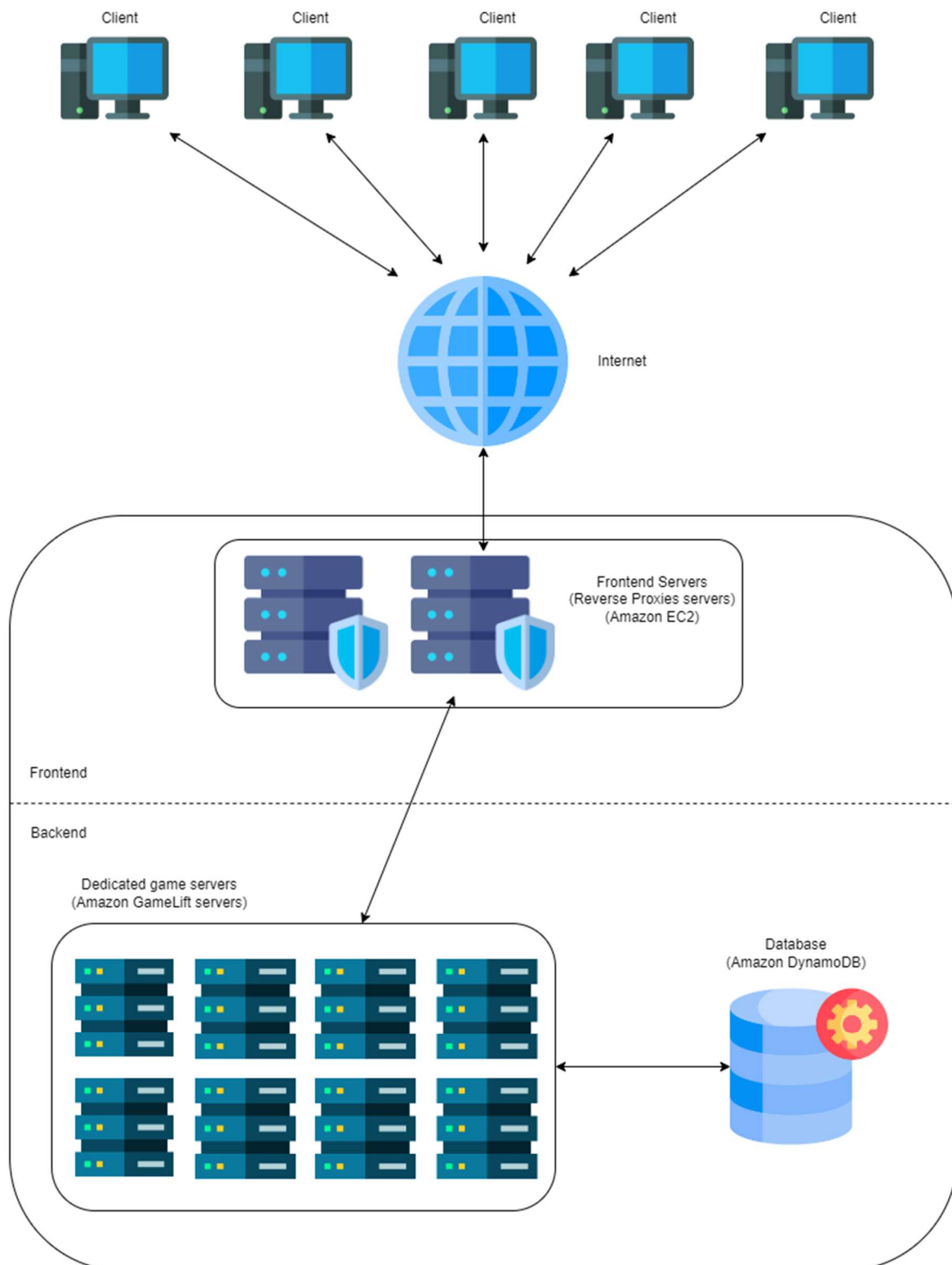
7.2 Network Requirements

Players are expected to connect from a broadband internet connection. To provide an excellent user experience, dedicated game servers will be made available using Amazon GameLift services. Dedicated game servers will offer to the user a low latency connection and a good gameplay experience, as long as the user has a decent internet connection. Amazon GameLift services can provide servers in all regions over the world, minimizing user's network latency.

7.3 Networking Framework & SDK

To implement the network functionalities we need a networking framework that supports Unity Engine to simplify development using already built libraries optimized for realtime multiplayer games.
We chose to rely on Photon Fusion technology, the newest release of the Photon framework. Photon Fusion is a high-end state transfer netcode SDK made for Unity Professionals. It is built with the intention to give players the best experience for any gameplay with multiple Network Topology choices.

Figure 3: provided by https://www.photonengine.com/en-US/fusion

7.4 Network Topology

The prototype of the project will be implemented using Client-Host topology to quickly build a working prototype. In this topology, a user will create a lobby, hosting a server instance, while other players will connect to the user.

Instead, the final release of the game (as well as the open beta) will feature a true Dedicated Server topology, using Photon Fusion SDK to manage Unity's netcode, while relying on Amazon GameLift services to host dedicated game servers and matchmaking service (using Amazon MatchFlex technology).
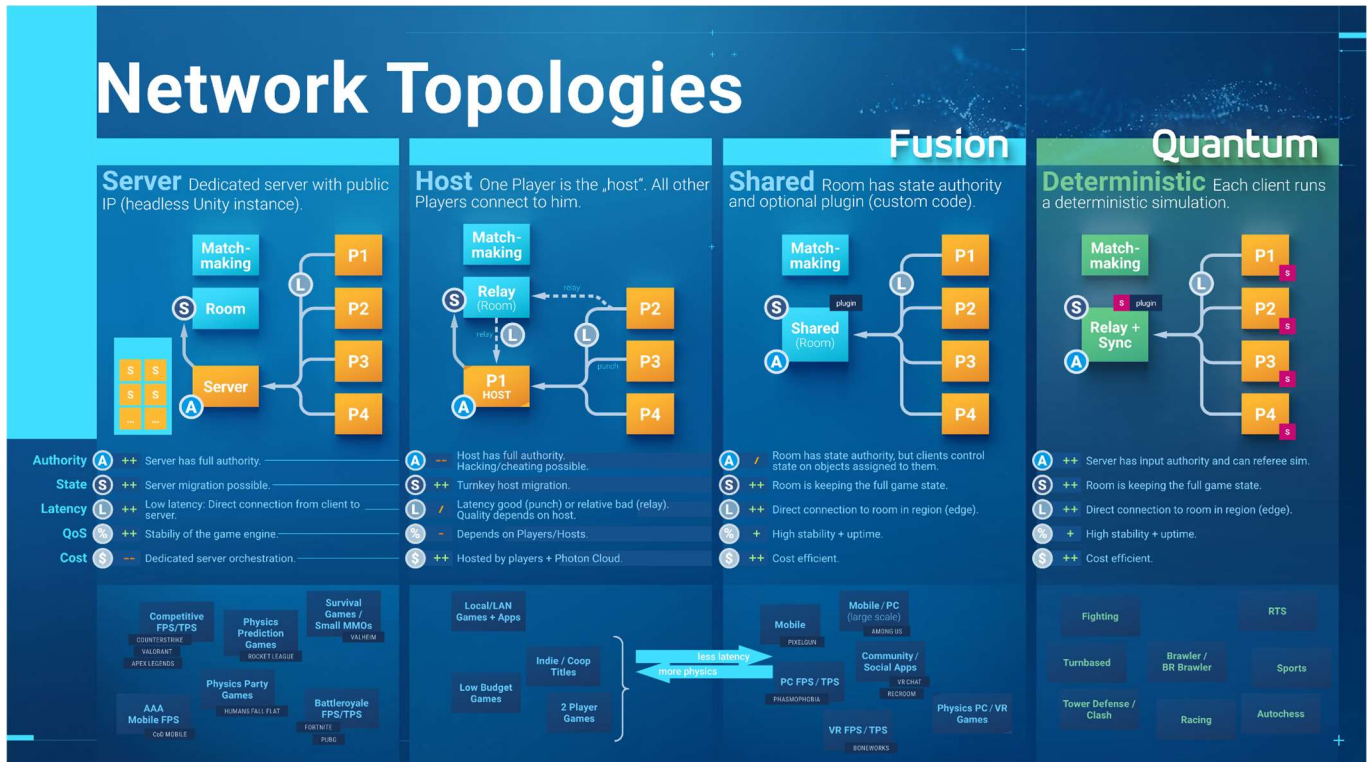
Figure 4: provided by https://www.photonengine.com/en-US/fusion

8 Delivery

8.1 Estimated Delivery Time

Reya's Light is planned to be released as a free-to-play game on Steam. Currently, multiple versions release dates are scheduled:
- A first working Prototype is planned for 13th June 2022
- The public Steam page of the game is planned to be published in Q3 2022, with trailers and screenshots of the game, as well as the opportunity to wishlist the game and some marketing advertising.
- An open beta version with limited available seats is planned to be released in Q4 2022, and will be accessible for the duration of a weekend. We plan to use this opportunity to test our network infrastructure and receive the first public players' feedback on the game. Further open beta sessions could be scheduled in future, depending on the results of the first open beta version.
- The first public release of the game is planned for Q1 2023, as an early access release on Steam Client.
- The final release (version 1.0) of the game is planned for Q2 2023.

After the release of the 1.0 version of the game, we plan to support the game consistently with newer constant updates:
- Bugfixed will be released weekly when necessary.
- Main updates, which includes new content like heroes and maps, are planned to be released every 6 weeks. We plan to release more characters than maps, estimating a new map release every 4 new characters.

8.2 Delivery Platform

Reya's Light will be delivered through the Steam Client, supporting only PC versions. Windows, Mac and SteamOS versions are scheduled to be released at the same time.
For marketing purposes, we plan to use other platforms such as YouTube to deliver trailers of the game, as well as a custom website, on which will be published news of the game.

9 Cost Estimation

In the following section we defined the main expenses that we expect to have to face in terms of personnel and equipment necessary for the development of the project.

9.1 Staff and Salaries

Professional Figure	Amount	Months	Salary per Month	Total Price
Team connAction Games	3	12	€ 3,000.00	€ 108,000.00
Senior Programmer	1	9	€ 4,500.00	€ 40,500.00
Junior Programmer	1	12	€ 3,000.00	€ 36,000.00
Sound Designer	1	6	€ 2,700.00	€ 16,200.00
2D Artist	1	12	€ 2,500.00	€ 30,000.00
Tester	1	2	€ 1,500.00	€ 3,000.00
Translator	1	2	€ 1,000.00	€ 2,000.00
Pofessional Social Media Manager	1	2	€ 2,800.00	€ 5,600.00
Web Developer	1	2	€ 3,600.00	€ 7,200.00
Legal Assistant	1	12	€ 15.000,00 (whole project)	€ 15,000.00
Security Consultant	1	1	€ 4.500,00 (whole project)	€ 4,500.00
Accountant	1	12	€ 4.500,00 (whole project)	€ 4,500.00
Office Cleaning	1	12	€ 350.00	€ 4,200.00
Total expenses				€ 276,700.00

Team connAction Games	Amount	Months	Salary per Month	Total Price
Game Designer	1	12	€ 3,000.00	€ 36,000.00
Game Designer / 2D Artist	1	12	€ 3,000.00	€ 36,000.00
Game Designer / Programmer	1	12	€ 3,000.00	€ 36,000.00
Total expenses				€ 108,000.00

9.2 Location

We have decided to rent an office of about 82 square meters in Tor Sapienza, Giuseppe Capogrossi street, consisting of four rooms, entrance, hallway and bathroom with an anteroom. The office is located in a well-connected area and close to the main services. The office is furnished and is located on the fifth and top floor of the building, with a lift. The cost is €700/month plus €50 for condominium fees. We opted for this office knowing that it will not host all professional figures as the possibility of smart-working will be provided for all employees.

Location	Months	Total Price
Office rental	17	€12.750,00
Light	17	€2.000,00
Water	17	€300,00
TARI	17	€541,50
Internet Connection (TIM)	17	€508,30
Total expenses		€16.099,80

9.3 Hardware

Hardware	Type	Description	Amount	Unit Price	Total Price
Developer Computer	HP Pavilion 15-eg1009nl Notebook	**CPU:** Intel® Core™ i7 1195G7 **RAM:** 16 GB **Internal Storage:** SSD 1 TB **Screen Size:** Display 15.6" **Operating System:** Windows 11 Home	6	€900,00	€5.400,00
Artist Computer	Apple MacBook Air	**CPU:** Apple M1 Chip 8-core; 16-core Neural Engine **RAM:** 8 Gigabytes **Internal Storage:** 256 GB SSD **Screen Size:** 13.3-inch LED-backlit widescreen display **Operating System:** Mac OS	1	€1.249,00	€1.249,00
Graphic tablet	Apple iPad Pro	**Memory capacity:** 1TB **Screen Size:** 12.9 Inches **Operating System:** IOS 14	1	€1.989,00	€1.989,00
Mouse	BOMENYA Mouse	Ergonomic, vertical, wireless with USB Microreceive, rechargeable high precision optical mouse 2.4G, adjustable 800/1200/1600 DPI, compatible with Mac	7	€25,99	€181,93
Headset	Logitech G335	Wired gaming headphones, flip to mute microphone, 3.5mm audio jack, memory foam earpads,lightweight	7	€71,99	€503,93
Print and Scanner	HP ENVY 6430e	Wi-Fi + USB 2.0, Print, Scan, Photo, Fax, Copy in black / white and color; print speeds of up to 10 ppm in black and white and 7 ppm in color	1	€129,00	€129,00
Total expenses					€9.452,86

9.4 Software

Software	Version	Amount	Unit Price	Months	Total Price
Unity Professional	2020.3.32f1	6	€ 141.50/month	12	€ 10,188.00
Visual Studio Professional	2022	6	€ 42.48/month	12	€ 3,058.56
Pro tools Studio	2022.4	1	€ 340.38/year	-	€ 340.38
Procreate	4.1	1	€9.50	-	€ 9.50
Adobe Creative Cloud	2022	1	€ 438.92/year	-	€ 438.92
Total expenses					€ 14,035.36

9.5 Frontend and Backend

The following costs for servers are estimated until first public release. After the release, the amount of servers will be scaled according to user demands.

Frontend + Backend	Cost per hour	Cost per Month	Amount	Months	Total Price
EC2 m6g.xlarge	€ 0.06346	€ 45.69	1	6	€ 274.15
EC2 m6g.2xlarge	€ 0.12692	€ 91.38	0	3	€ 0.00
GameLift m6g.xlarge	€ 0.03515	€ 25.31	1	6	€ 151.85
GameLift m6g.2xlarge	€ 0.07030	€ 50.62	0	6	€ 0.00
DynamoDB	-	€ 40.63	1	6	€ 243.78
Total expenses					€ 669.78

9.6 Delivery

Delivery Costs	Cost ($)	Cost (€)
Publish a game on Steam	$100.00	€ 94.33
Total expenses		€ 94.33

9.7 Total expenses

Total expenses	Total Price
Salaries	€ 276,700.00
Location	€ 16,099.80
Hardware	€ 9,452.86
Software	€ 14,035.36
Servers	€ 669.78
Delivery	€ 94.33
Total expenses	€ 316,957.80