3D Game Server Design

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Science, Discovery and the Universe

Computer Science

Mission

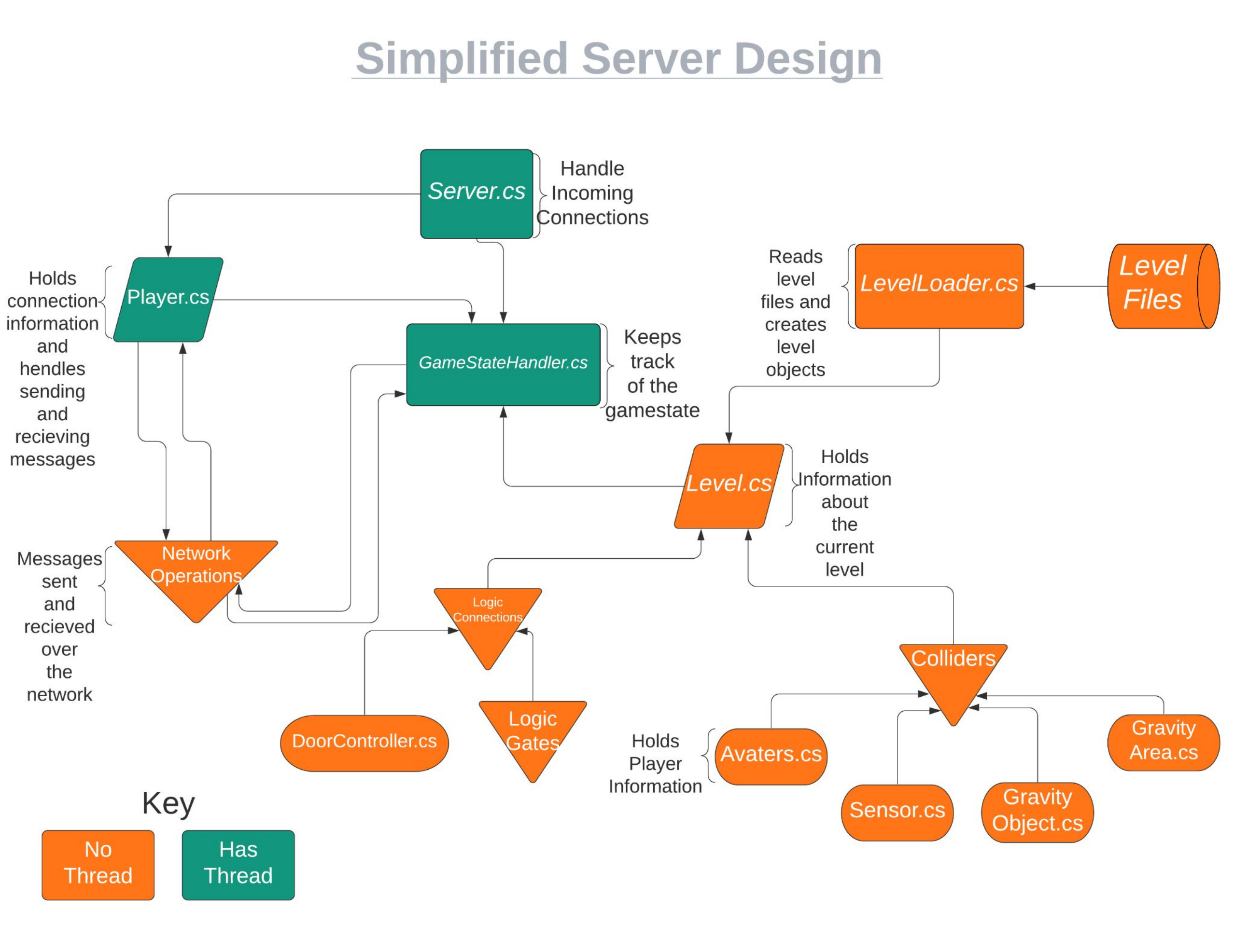
Make a game server that would allow for two people running instances of the game we made (called clients) to play the game together over the internet.

Goals

- Synchronize server and client gamestates
- Make sure the server has the final say on what the gamestate is.
- Minimize lag from network latency.

Communication

The server and clients communicate over the internet using Transmission Control Protocol, which makes sure all the data gets sent and received in the same order. The client and server use this to send messages to one another that contain information about the gamestate, such as movement updates, what object the player is holding, and what direction players set gravity to, etc. This system allows for the client and server to reliantly communicate what is happening in the game, allowing us to have a synchronized game state.



Server Collisions

Because the server needs to move the player back to their last position when they try to move out of bounds, the server needed a way to know when the player collided with other objects. To accomplish this the server has different type of box colliders which can tell when they intersect. Depending on the type of collider different things happen when a collision occurs, such as changing gravity or activating switches. This allows the server to have the final say on the gamestate because it can tell when invalid movements are made by the players. These colliders are read from a file that the game can generate, which insures the game and server have the same level information.

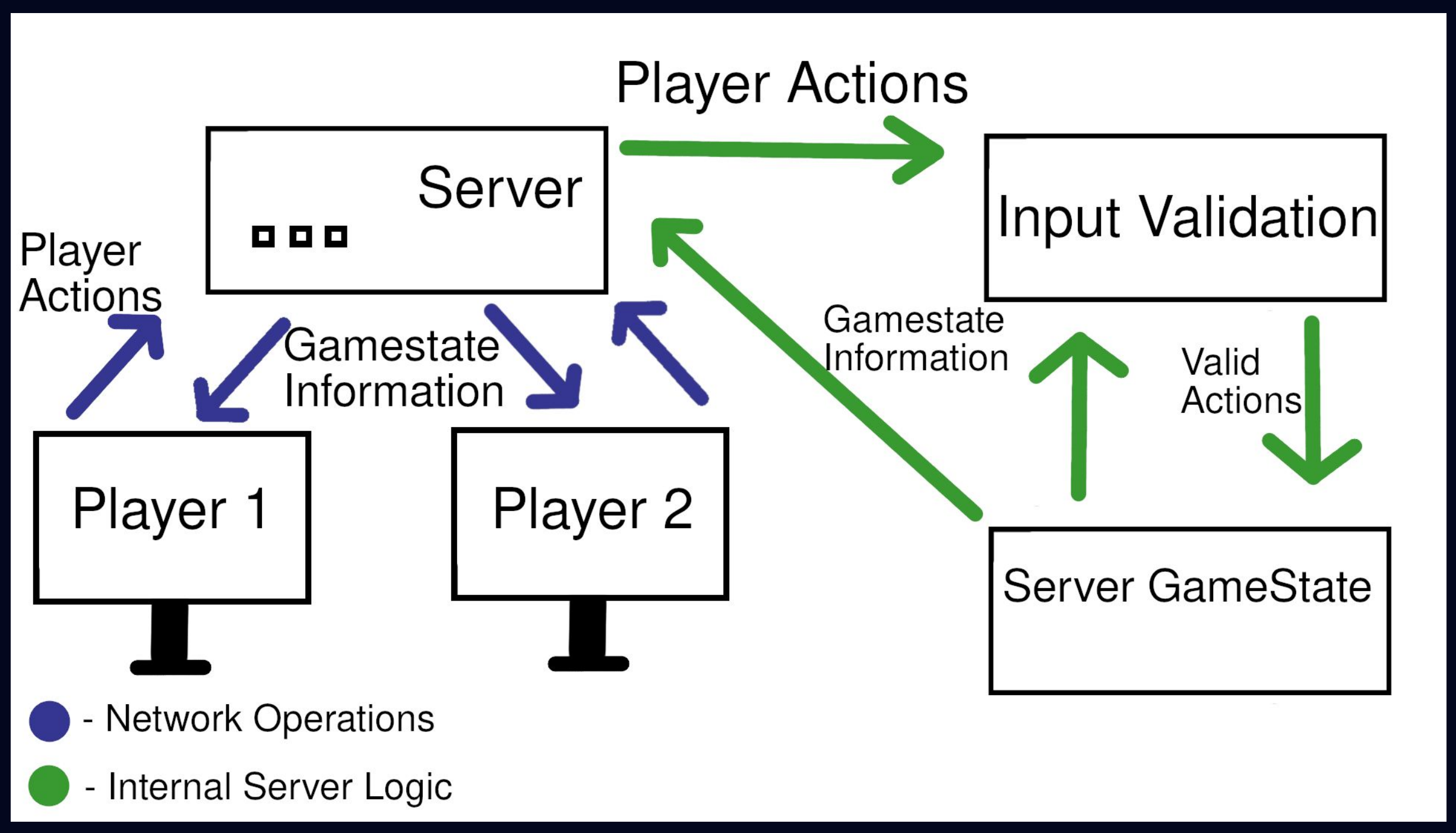


Diagram explaining how the server maintains and synchronises the gamestate

Outcome

In the end, the server I created was able to keep the gamestate of the two games synchronized most of the time, and is able to correct the gamestate of the player that got desynced. The server and clients are also able to send less messages to each other by extrapolating where objects should be based off of where they were moving the last time the server/client received a message about them. This technique allows us to hide a lot of the lag that would occur due to the latency of the connection, creating a better gameplay experience.

Future Work

Working on the server has tought me a lot about writing programs that communicate with other computers. While the Server I created is pretty specialized to work with this game, the communication protocol it uses is very general, so I could easily reuse that code for future projects that require networking.

I hope in the future to be able to continue working on this project by adding content to the game and further improving the server.

Acknowledgments:

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