

Pixformer

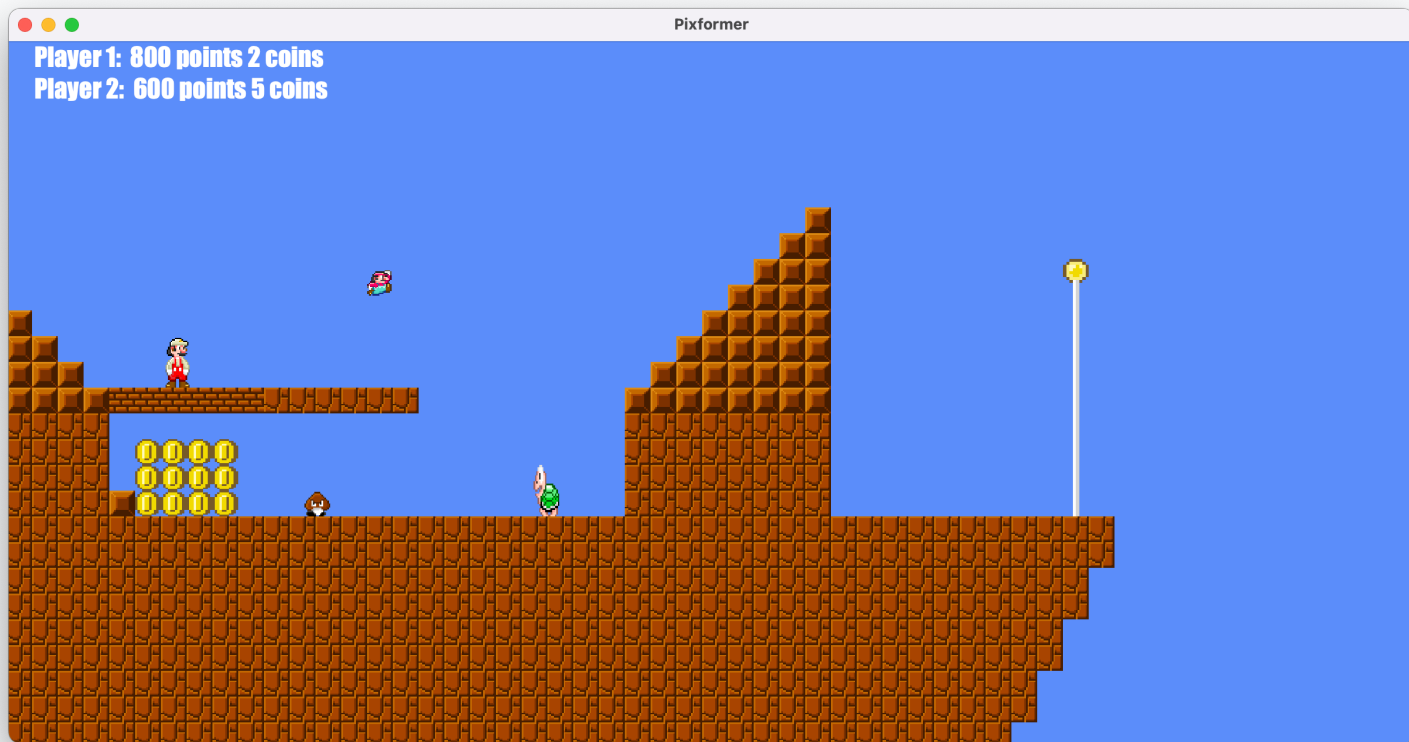
A multiplayer **Super Mario Bros.** clone

<https://github.com/iamgio/distributed-pixformer>

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Distributed Systems, A.Y. 2024-2025 @ Unibo

The game



Enemies



Goomba



Koopa



Koopa in its shell

Power-ups



Default state



Mushroom

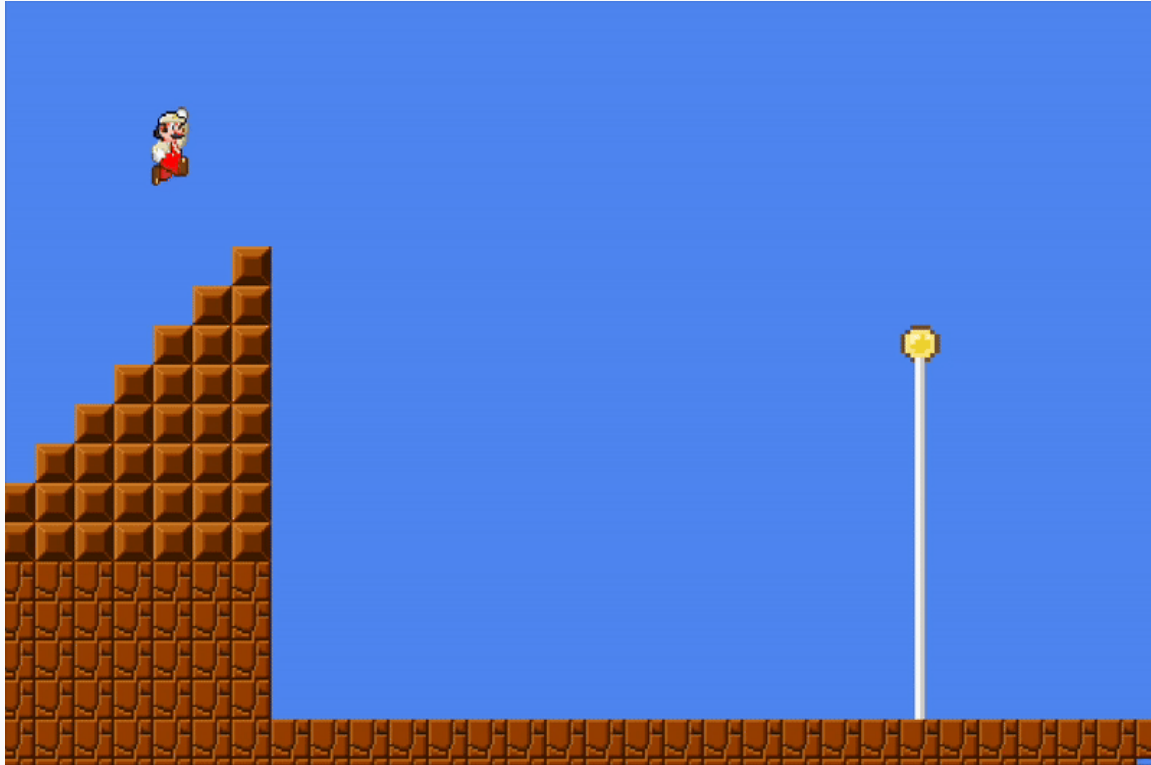


Fire Flower

Game over

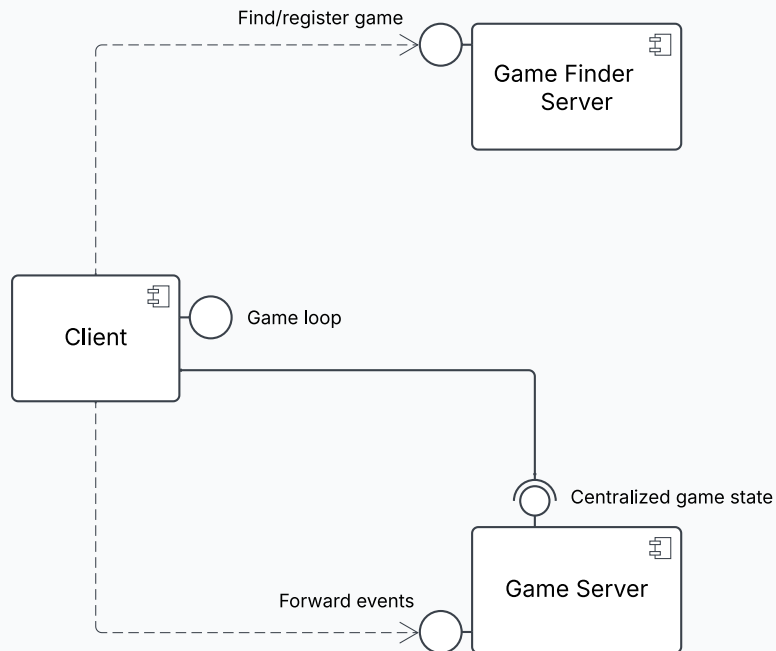


Success



Demo

Architecture

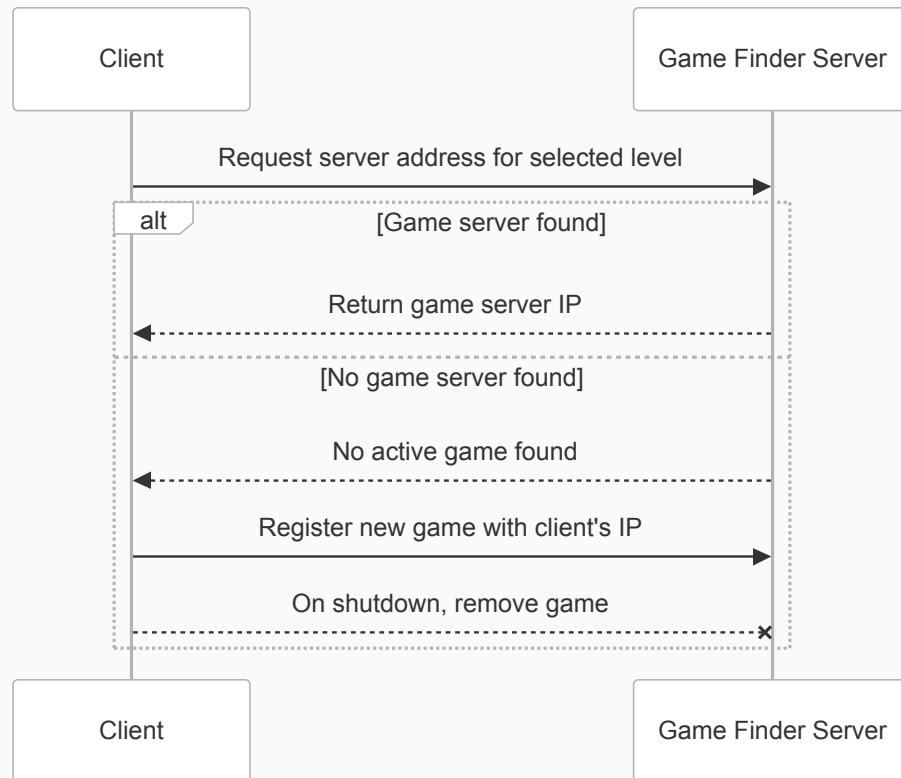


- **Leader-follower pattern:** one client overlaps with the game server, becoming the *leader*.
- The **Game Finder Server** acts like a DDNS, mapping active game names to their server address.

Interaction

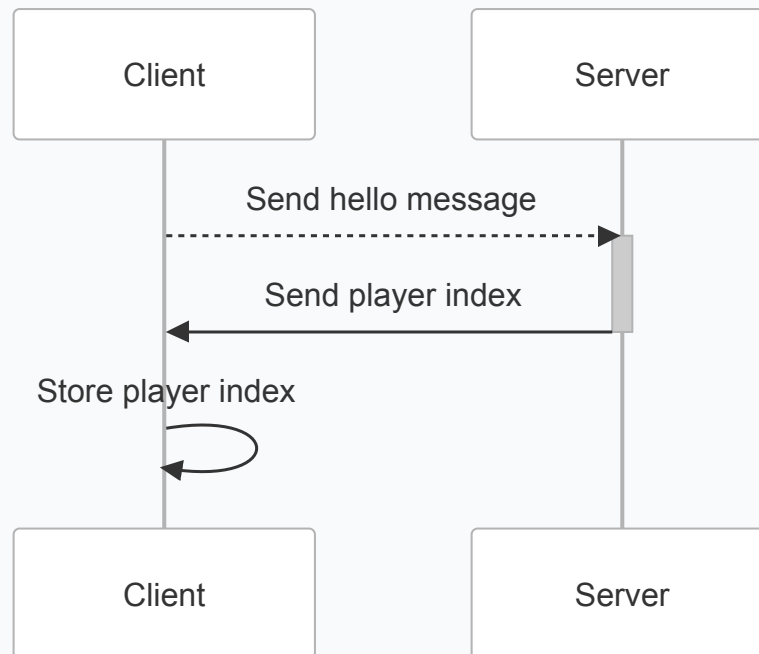
Game finding

When a client chooses a level to play, the game finder server is reached to look for any active games on the same level, or to create one otherwise.



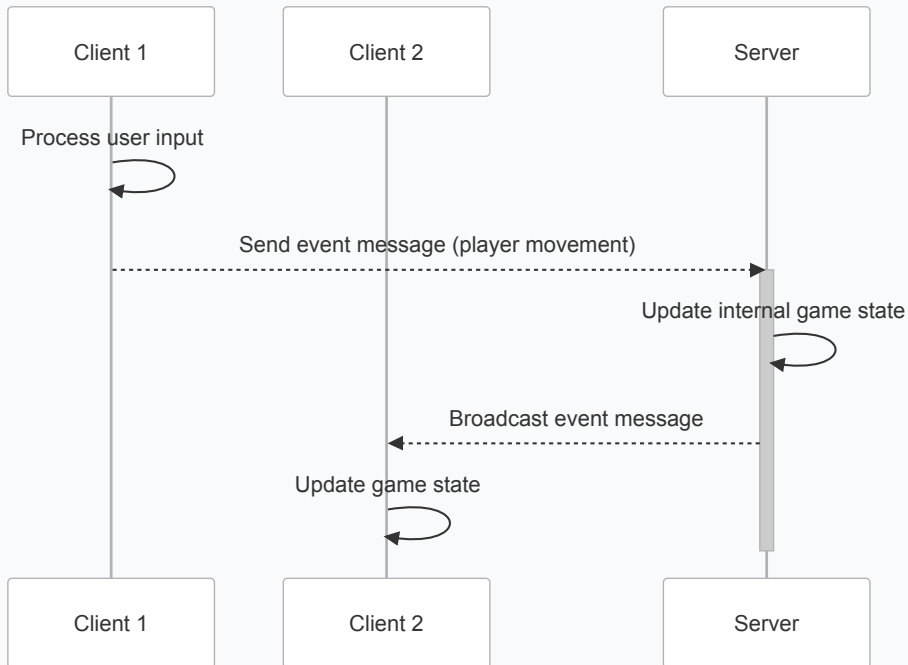
Handshake

On join, the client waits to be assigned a player index from the server.
When the handshake is complete, the persistent WebSocket session is kept active.



User input

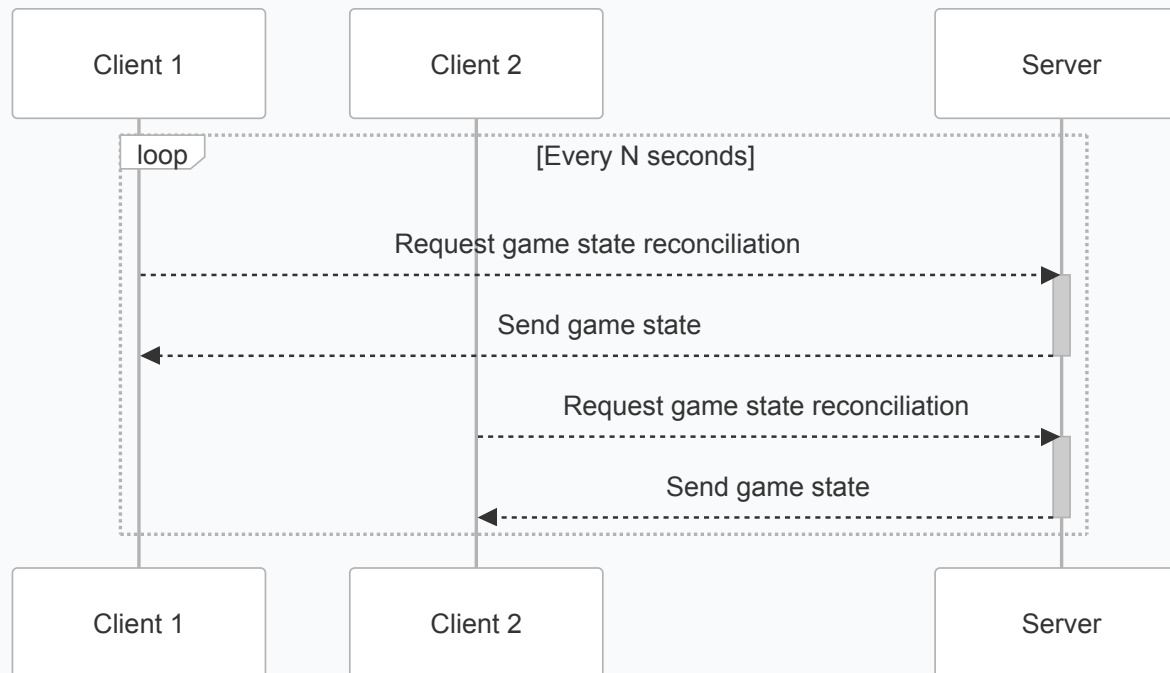
The system adopts a *client-side prediction and server reconciliation* pattern, prioritizing **availability over consistency** for a smooth user experience.



- The client processes user inputs immediately, sending them to the server;
- The server updates its internal game state and blindly forwards the message to all other clients, which update their game state as well.
- The message format is `n|action`, with `n` being the player index.
Example: `2|jump`.

Game state reconciliation

Each client periodically sends a reconciliation request to the server, to ensure consistency is kept.
When the state is received, the internal game state is updated.



Game state reconciliation

Sample game state shared from server to client

```
1  {
2    "name": "Level 1",
3    "spawnPointX": 5,
4    "spawnPointY": 2,
5    "scores": {
6      "1": {
7        "points": 2,
8        "coinsNumber": 10
9      },
10     "2": {
11       "points": 5,
12       "coinsNumber": 20
13     }
14   },
15   "entities": [
16     {
17       "type": "player",
18       "x": 5.0,
19       "y": 2.0,
20       "velocity": {
21         "x": 0.1,
22         "y": 0.0
23       },
24       "playerIndex": 1,
25       "powerup": "Mushroom"
26     },
27     ...
28   ]
29 }
```