ICN – Project

Batch B – Group 17

Minecraft Game Server Hosting

and Administration via Webpage

The Team

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What is

Minecraft

Minecraft is a popular sandbox video game known for its creative and open-ended gameplay. Players are immersed in a virtual world where they can explore, gather resources, build structures, and engage in various activities. The game offers a unique blend of adventure, survival, and limitless possibilities for players to shape and craft their own virtual realms.

Minecraft Multiplayer

- A Minecraft server is a software application that allows multiple players to connect and interact in a shared virtual world.
- It is hosted on a server platform, and players connect to the server using specific IP addresses and ports.
- Server administrators can customize and modify the server using plugins or mods to add new features, adjust gameplay mechanics, and manage server settings.

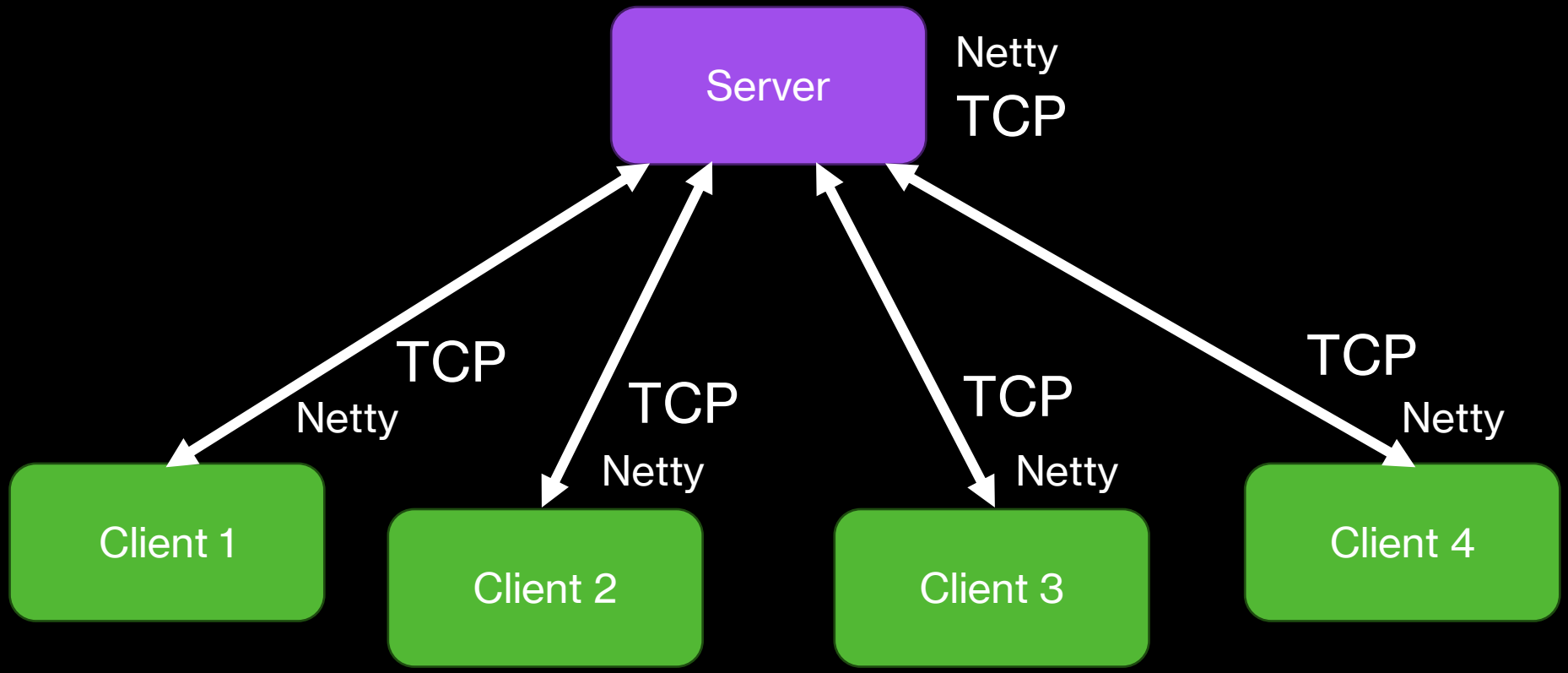
The Networking behind a Minecraft Server

- Minecraft servers use TCP/IP networking protocols.
- Players connect to servers using the Minecraft client software.
- Server administrators can configure and setup server properties in configuration files.
- Server software manages player authentication.
- Server plugins extend server functionality with additional features and commands.
- The server maintains synchronized game state across connected clients.
- Server hosting options include dedicated hardware, VPS, or third-party hosting services like aternos.org

What is Netty?

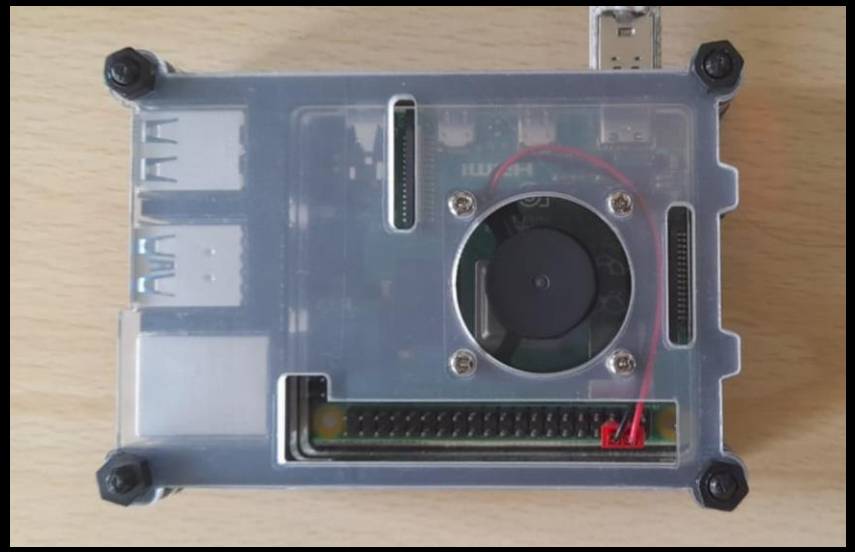
- Netty is a asynchronous event-driven network application framework
- The way Netty works for Minecraft is that Minecraft Clients and servers have their own "Protocol" for each type of information that they'd like to send
- This is not the same as TCP/IP Protocol, This is more of a format for the packets
- For example, if the Minecraft Client wants to know the server information like number people online, it can send a packet called "info_players", which can be received and decoded by the server to then send a response
- We will be trying to capture some of these packets and analyze them using a Minecraft Client mod from modrinth.com

The Structure of Minecraft Server Communication



Raspberry Pi

- The Raspberry Pi is a series of small, single-board computers (SBCs) developed by the Raspberry Pi Foundation. These compact and affordable computers are designed to promote computer science education and enable users to learn programming and electronics.

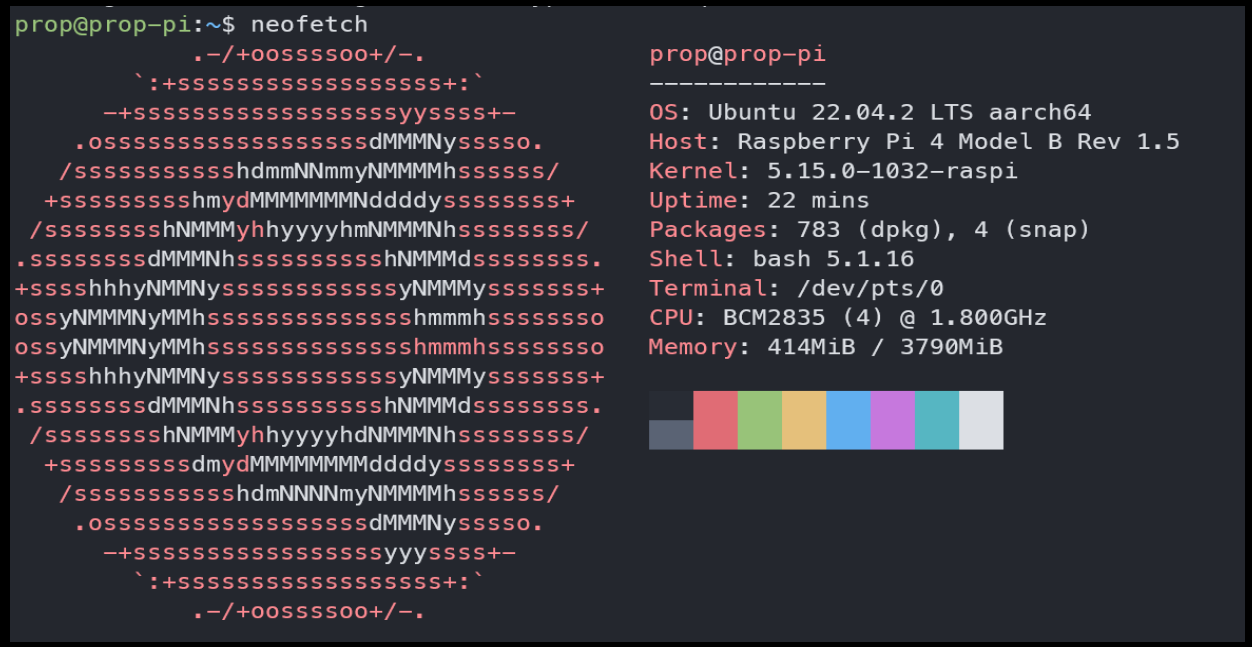


Raspberry Pi Minecraft Server

- Raspberry Pi is a low-cost, credit card-sized computer used for hosting Minecraft servers.
- Minecraft server software can be installed and run on a Raspberry Pi.
- Consider the hardware limitations of the Raspberry Pi, which may affect server performance.
- Stable network connectivity is necessary for players to connect to the Raspberry Pi Minecraft server.

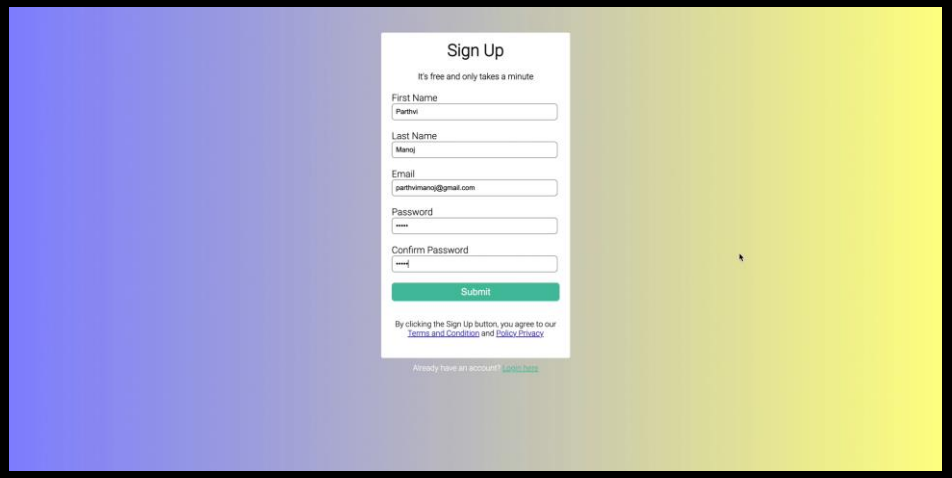
Details of our Raspberry Pi Board we used...

- We are using a Raspberry Pi 4, Model B with 4GB of RAM
- We are using a Sandisk 32 GB Micro SD Card with Ubuntu Server OS 22.04



The Initial Idea

- Initially we had installed the Minecraft Server (Vanilla Version 1.19.4) without any server or web ui, that ran purely out of the terminal when we ran the server.jar file using the java command
- After getting the idea to have a webpage where admins could login and manage the server configuration, we tried giving a ssh connection from a webpage to the raspberry pi board directly, which ended up being not possible
- We had developed the following Abstract page for this idea:



How do we set it up in our Raspberry Pi?

- After a bit of searching, we discovered Pterodactyl Panels
- Pterodactyl is an open-source game server management panel designed to simplify the process of hosting and managing game servers. It provides a user-friendly web interface that allows server administrators to easily deploy, configure, and monitor game servers.
- Originally created specifically for Minecraft servers, Pterodactyl has expanded to support a wide range of popular games, including but not limited to Minecraft, Terraria, ARK: Survival Evolved, Rust, and Counter-Strike: Global Offensive (CS:GO).

Pterodactyl

Layers of Pterodactyl

Pterodactyl

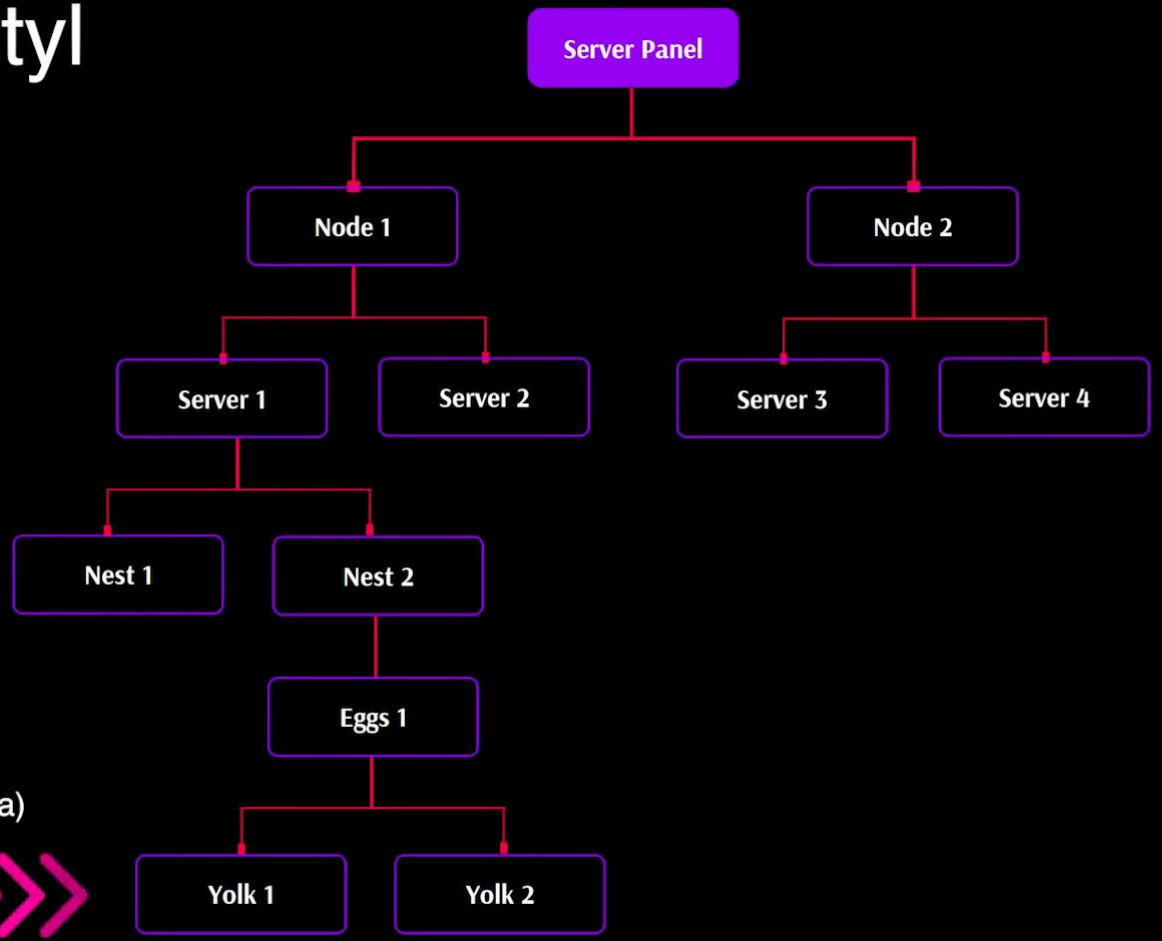
server
(runs wings agent)

games

nests
(Minecraft)

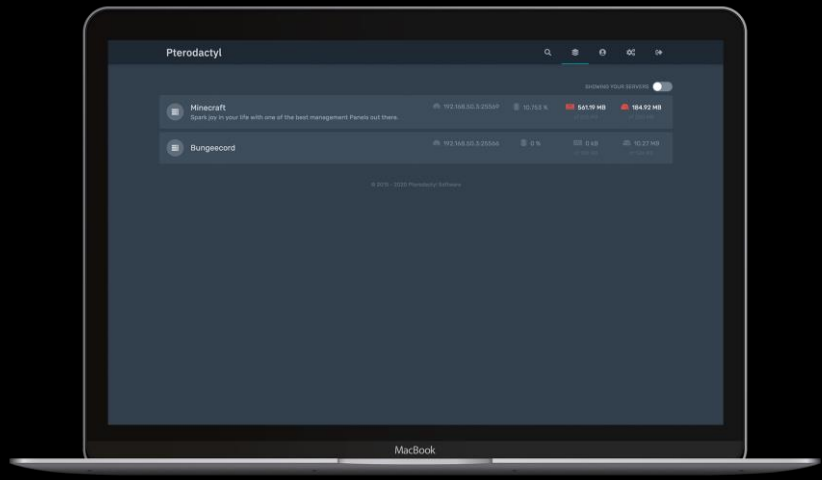
eggs
(Bedrock, Paper, Vanilla)

yolks
(Docker Image)



Uses Of Pterodactyl

- Server management: Pterodactyl simplifies the creation, management, and monitoring of game servers through a user-friendly web interface.
- Multi-game support: It accommodates various game servers, allowing users to host multiple games on a single platform.
- Resource allocation: Pterodactyl enables users to allocate CPU, RAM, and disk space resources to individual game servers.
- We must understand that pterodactyl is just a panel for handling wings.



How do we set it up in our Raspberry Pi?

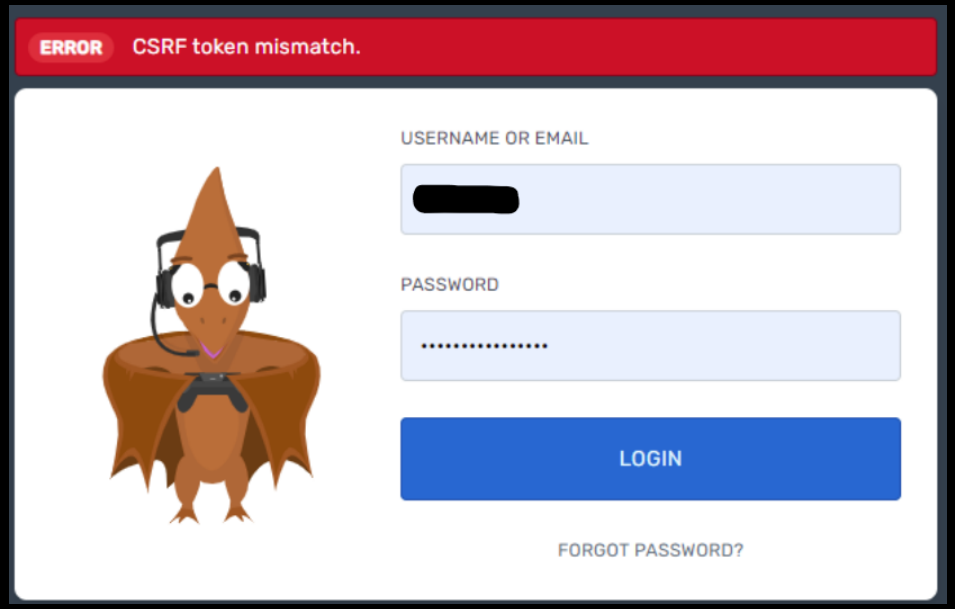
- We will be using the instructions from pterodactyl documentation
- We will be looking into the unique issues and challenges we faced during installation for this presentation
  - **IP Configuration Issue:** We initially tried to use *duckdns.org* and have a https page on a sub-domain under *duckdns.org* but it interfered with other networks and ended up exposing the router configuration page to the sub-domain instead.
    - We fixed this issue by opting to use http with our local ip addresses instead of *duckdns.org*
    - This reduced the time required for installation
    - If the server was to be set up permanently on a permanent network connection, then the issue could have been resolved by assigning a static ip in the router for the raspberry pi specifically

How do we set it up in our Raspberry Pi?

- **CSRF Token Mismatch Issue:** After setting up pterodactyl we had an issue while trying to login to the panel saying “CSRF Mismatch”, This issue occurs when the panel is creates a cookie to secure the connection on a unsecure (http) page.
  - This issue was resolved by disabling secure cookie tokens in the pterodactyl environment
  - If it wasn’t for the previous issue

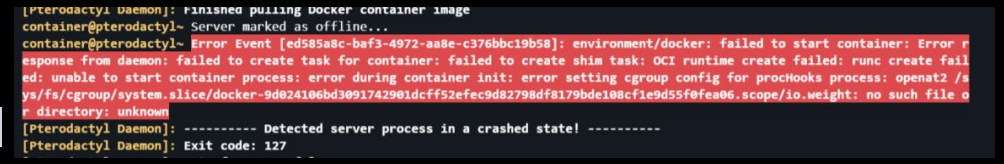
  we could have left the secure

  cookie tokens enabled



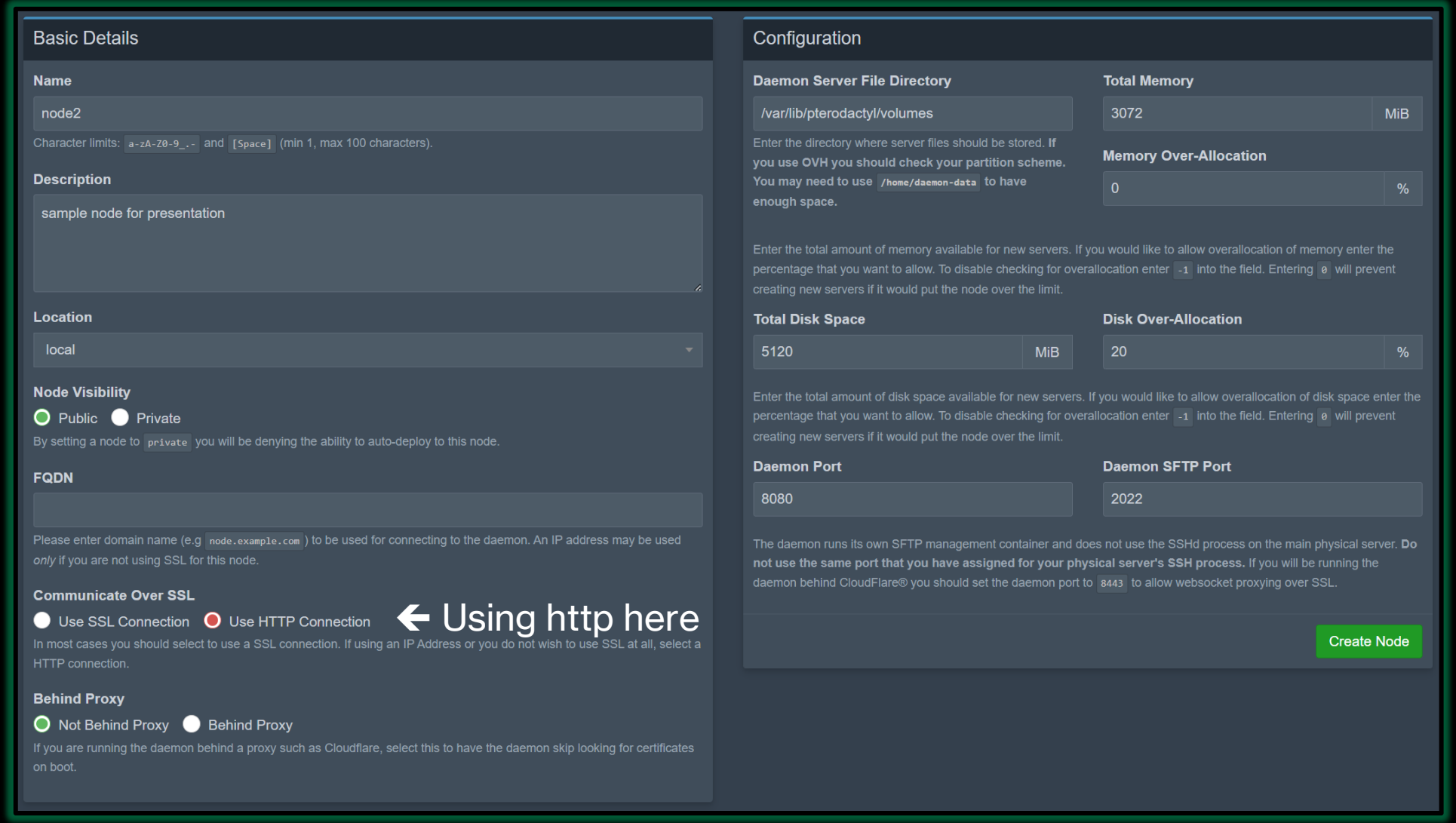
How do we set it up in our Raspberry Pi?

- **Control Group Error:** This was the hardest issue to solve since there was no clear way of understanding the error. We tried the following fixes which didn't work:
  - Installing Third Party open source Eggs for Minecraft
  - Recreating Nodes with various configuration
  - Recreating Servers multiple times
  - Reinstalling entire OS and Pterodactyl

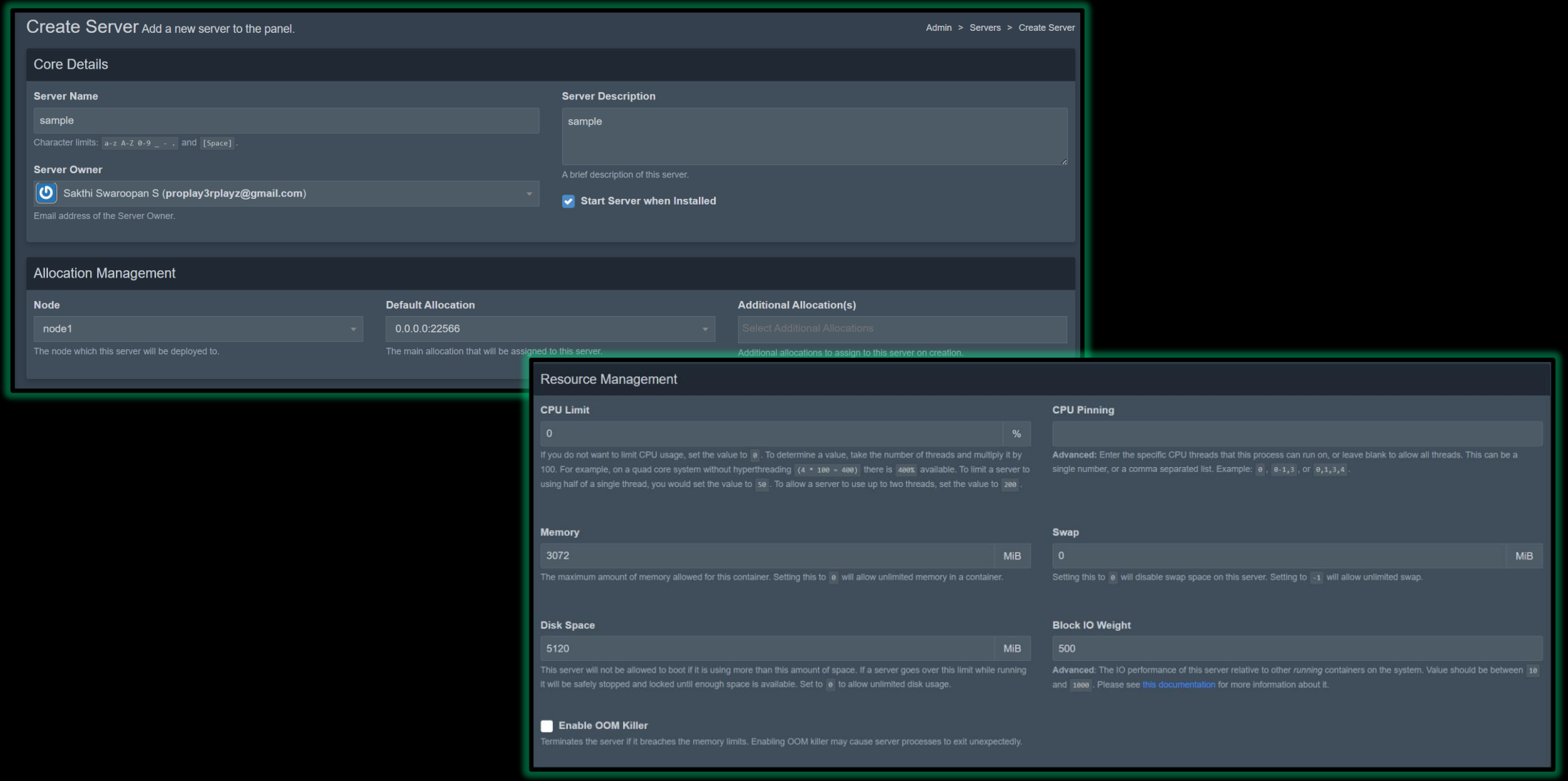


- Finnally we found where the issue was originating from, pterodactyl was trying to use *"cgroups v2"* using mounts that was meant for *"cgroups v1"*
- **The Solution** was to add `systemd.unified_cgroup_hierarchy=0` to the boot command line attributes which sets the *"cgroups v1"* as the first one to be used by processes instead of *"cgroups v2"*

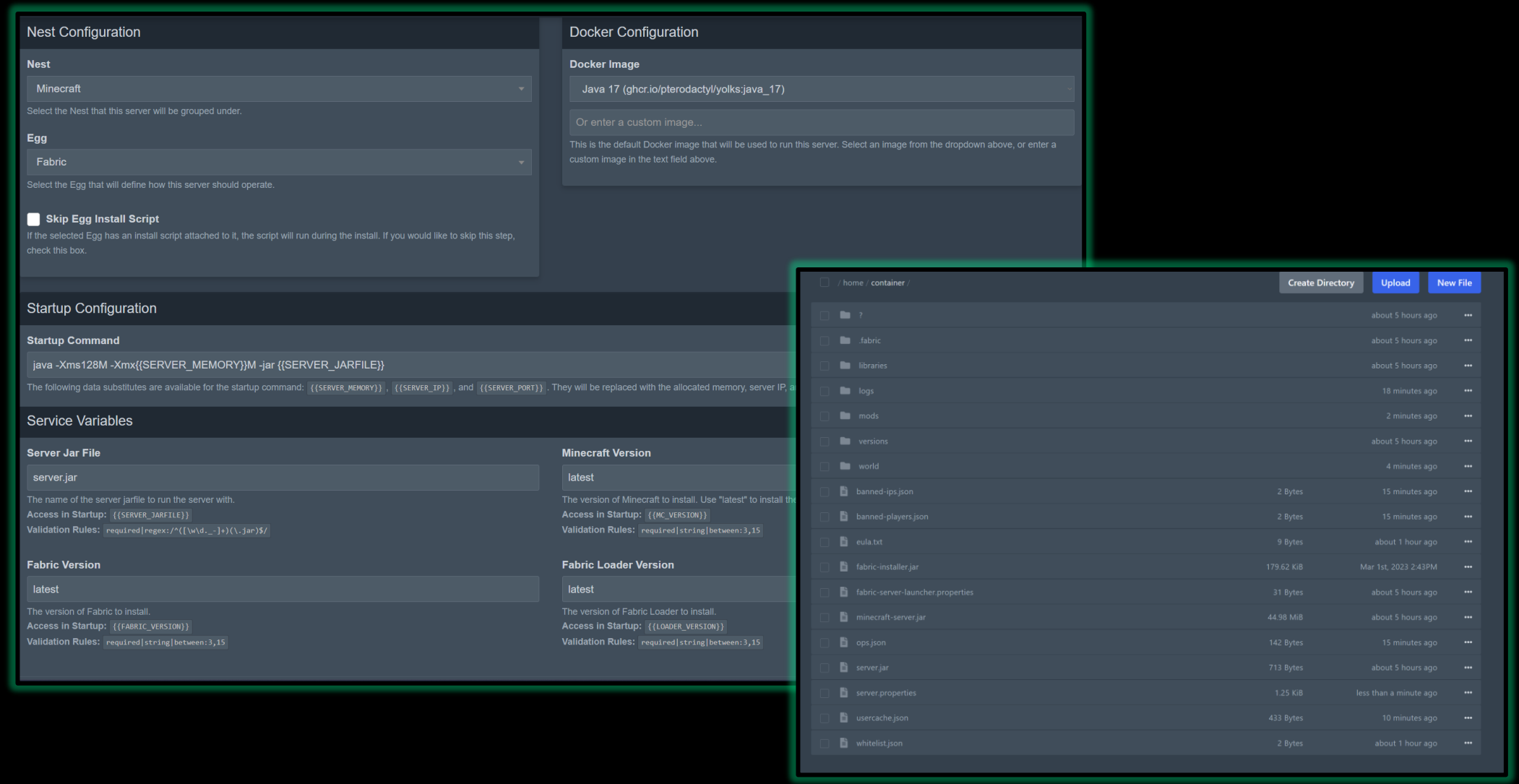
Setting up Node



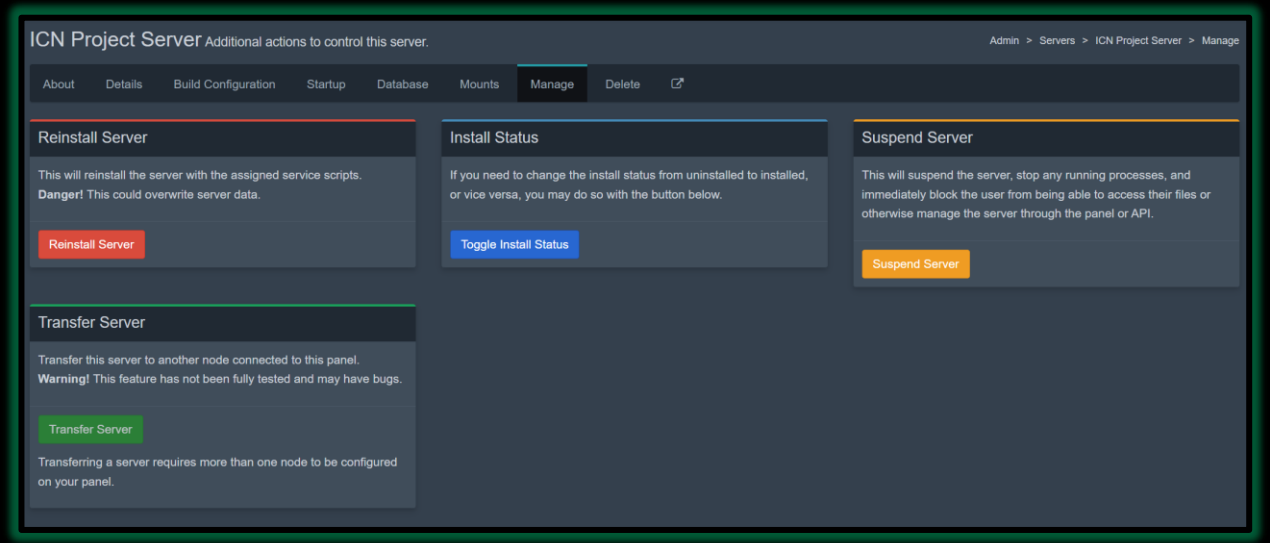
Setting up the Server



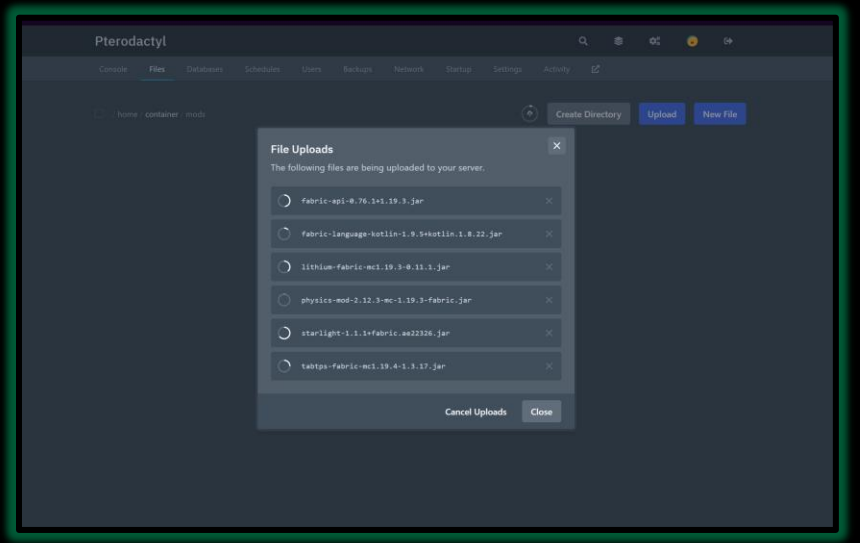
Setting up the Server



Managing the Server

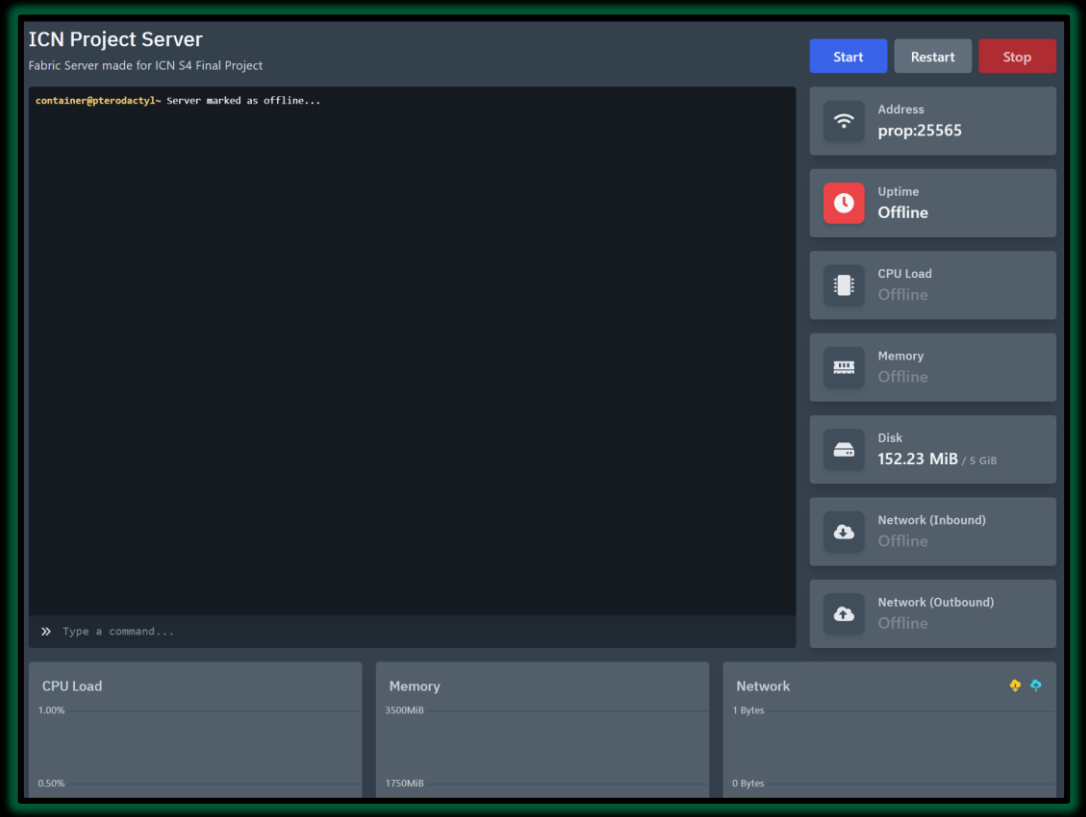


Easy UI for managing Server Status

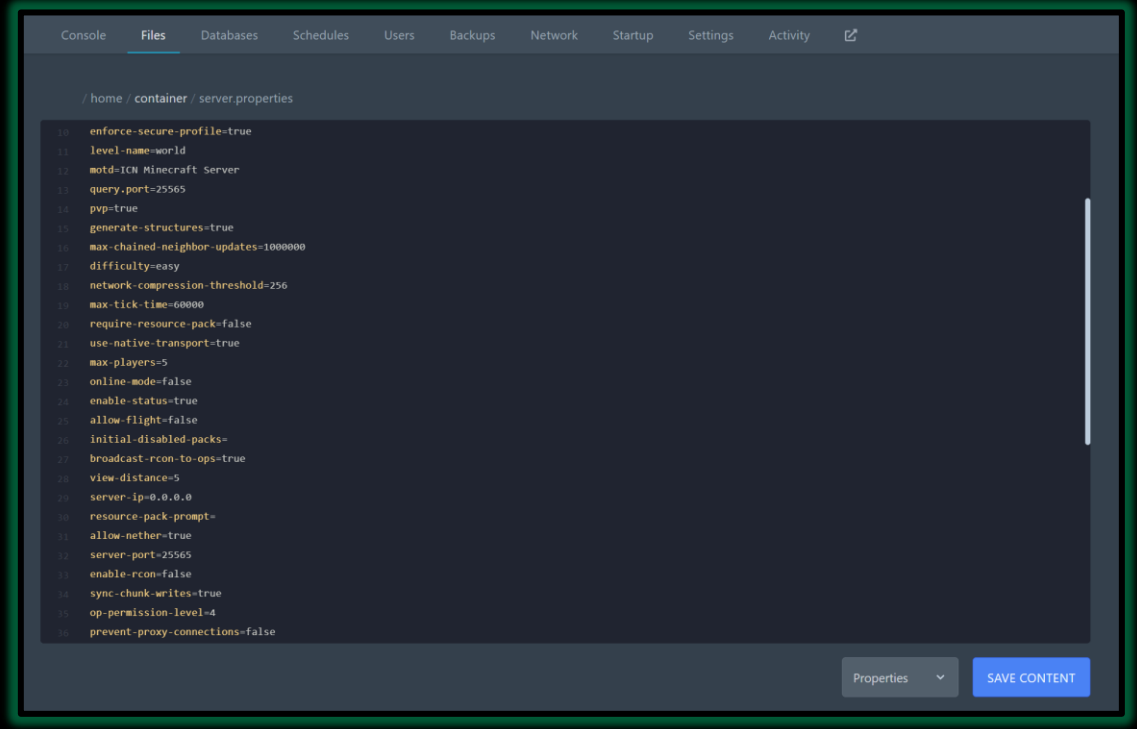


Uploading Mods and Plugins to the Server

Managing the Server



Console Access for the Server
and Server stats available at a glance



Updating Config files of the server directly
on the panel

Scope of Improvement

- Hardware **needs** to be upgraded since a Raspberry Pi has very limited RAM and Processing power to allocate for servers
- Pterodactyl works on both ARM and AMD chips, so using higher end server grade CPUs like Threadripper is supported
- Using optimization mods such as **Ferrit-Core** and **Starlight** improves performance and RAM usage of the server [implemented]
- Using Domain to expose the panel over a Domain so that admins can manage the server by accessing the panel from anywhere (requires static ip and continuous power for the pi)

Demonstration


Thank
you