

Converged Engineering Homelab

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Chapter 1

Abstract

This project consolidates storage, development, and high-end gaming into a single 4U rack-mount server. It uses Proxmox VE and PCIe Passthrough to dynamically assign hardware to virtual machines. The network is managed by a low-power Gateway (Mac Mini M1) and controlled via a high-end client (Mac Mini M4).

The grounds for this project are the need for a powerful, flexible, and efficient home lab that can handle various workloads without the need for multiple devices and the desire to setup and tear down environments on the fly, without the need to reboot or reconfigure hardware.

With this kind of infrastructure, I can easily switch between different operating systems and software configurations, making it ideal for development, testing, and gaming. Also switching between different development environments through the use of containers and virtual machines, without the need to reboot or reconfigure hardware, is a key feature of this project.

Chapter 2

Introduction

2.1 Bill of Materials

Here is a detailed bill of materials for the project; obviously the prices may vary based on retailer, availability and location, but this should give a pretty accurate estimate for the costs of the project's hardware components.

Note: the prices are shown in Swiss Francs (CHF) and components marked with (U) are used but in good condition.

Some of the components, such as the switch and the Mac Mini M1 are recycled from my personal hardware collection, and the price listed is an estimate of what I paid for them when I bought them, but they are still in good condition and fully functional, so they are a crucial part of the project.

Category	Description	Price	Notes
Chassis	Lanberg SC01-5204-12B	129.—	4U Rackmount Case
CPU	Ryzen 7 7700	220.—	65W TDP and iGPU
GPU	nVidia RTX 5070	575.—	PNY
Motherboard	AsRock B850 LiveMixer	164.—	AM5, ATX
RAM	Crucial Pro	629.—	64GB 5600MHz DDR5
Storage	WD Black SN7100	151.—	1TB M.2 2280
Storage	Seagate IronWolf	276.—	2x4TB 3.5" HDD
Fans	Noctua NF-A12X25 PWM	31.—	120mm
Rack Cabinet	Digitus DN-48000	88.—	8RU 19"
Patch Panel	Digitus DN93651	50.—	24-Port Cat6
Rack Shelf	Digitus DN-19 Tray	15.—	19" Rack Shelf
Server	Mac Mini M1	700.—	M1, 16GB RAM
Switch	Aruba 2530-48G-PoE+ (U)	400.—	48-Port PoE+ Switch
Cables	Various	50.—	Ethernet, Power, etc.
Misc	Miscellaneous	50.—	HDMI Dummy, Screws
Total		3528.—	

Table 2.1: Rack Components

These are the materials used to build the core rack of the project, any other material (i.e. peripherals, consoles, etc...) are not crucial to the project and are not listed here. Any peripheral with a network interface can be used with the rack, as long as it supports the necessary protocols and standards.

2.2 Requisiti

ID	Descrizione	Note
R-01	X	
R-02	X	
R-04	X	

Table 2.2: Requisiti del progetto

Chapter 3

Design e implementazione

3.1 API

Di seguito è riportato un esempio di codice per l'inizializzazione.

```
// Esempio di inizializzazione
float x = 0.5f;
std::vector<float> input = {x, x, x}; // Input per il modello
// Altri parametri...
```


Chapter 4

Conclusioni