



There And Back Again

A Homelab Story



Before we get started, there's some housekeeping that needs to happen.

The content presented in this presentation is my own opinions and do not reflect the opinions of my employer or this organization.



Something of Note Before We Move On

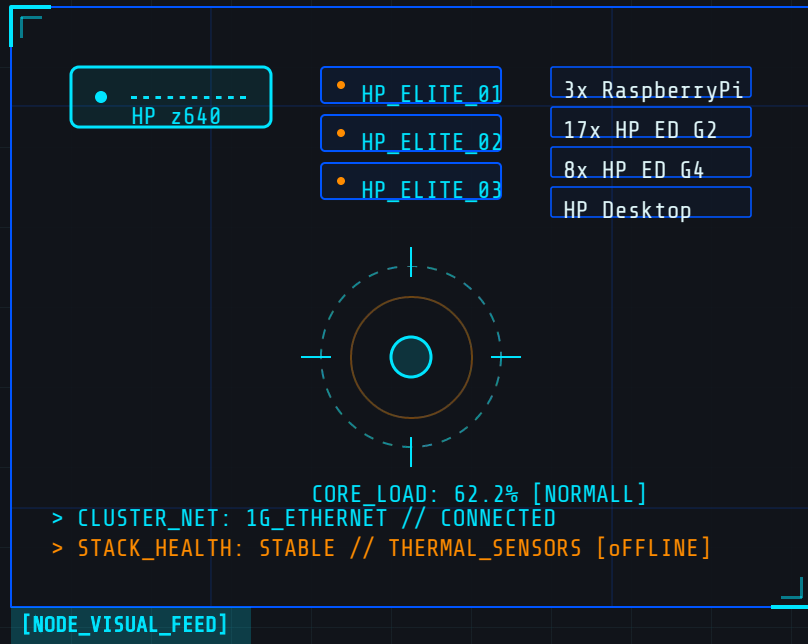
Opinions on Linux Distro's are like opinions on politics. Everybody has them, thinks they are right, and will try to convince you why your opinion is the wrong one. In MY opinion, it's one of the biggest reasons Linux hasn't been a contender to date with Windows and Mac. I treat conversations on the merits of one Linux distro over another like I treated arguments on Facebook...when I had one.



The Original Use Case

Originally, I created the home lab to learn Linux effectively in my off hours from work. I worked overnight at a local datacenter, and my mentor worked day shift. I would meet with him once a week and he would give me projects to work on during the week. I studied almost every waking hour, and in between responsibilities at work. Others were playing games or watching funny videos, I was taking courses.

Home Lab Mark 1.0 (2019-2021)



CORE COUNT

129 Physical Cores
44 Virtual Cores

ARCHITECTURE TYPES

x86_64 / ARM64

CLUSTER INFRA

32 Nodes Active

PRIMARY USAGE

Linux Admin / WinAdmin

[NODE_INVENTORY_REPORT]

[>] 1x HP z640 Z-Station

[>] 3x HP Mini-Elitedesk 800 Gen 5

[>] 8x HP Mini EliteDesk 800 Gen 4

[>] 17x HP Mini EliteDesk 800 Gen 2

[>] 3x Raspberry Pi

[>] 1x HP Gaming Desktop



Home Lab Mark 1.0

Self-Hosted Software of note.

At this time, I was learning Windows and Linux Systems Admin, primarily around backup, group policy, RSA, security, and patching. Ansible was supposed to be the answer, but the cost was well beyond anything we could afford.

- Ansible CE
- Ansible AWX
- Terraform
- VMware
- Home Assistant

- Plex
- Pi Hole
- Docker
- FreeNAS
- KdenLive
- Audacity

What Operating Systems Were Used



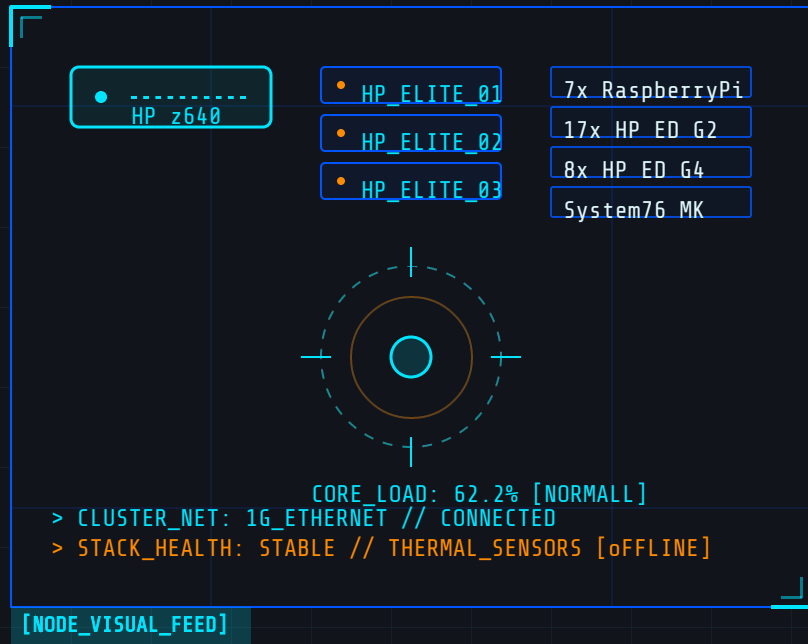
- Raspian (later named Raspberry OS)
- Ubuntu
- Debian
- OpenSUSE Leap
- CentOS 7
- Linux Mint
- Zorin OS
- Manjaro
- Endeavor
- Garuda Linux (Golden Eagle)
- Parrot OS
- Kali Linux
- Unbreakable OS
- MX Linux
- Arch Linux
- Elementary OS
- Solus
- Fedora
- Windows 10



The Second Use Case

Moving from the datacenter into the Systems Group and then leaving the org, for my new role as a Platform Engineer meant a change in direction for my lab. I virtualized many of my Linux Distro's for testing, and turned the majority of my HP minis into K8s machines. I created a production cluster, mostly mirroring my clusters at work until RH killed OKD, I then moved to k3s and Rancher.

Home Lab Mark 2.0 (2022-2024)



CORE COUNT

129 Physical Cores
44 Virtual Cores

ARCHITECTURE TYPES

x86_64 / ARM64

CLUSTER INFRA

32 Nodes Active

PRIMARY USAGE

Linux Admin / Container

[NODE_INVENTORY_REPORT]

[>] 1x HP z640 Z-Station
[>] 3x HP Mini-Elitedesk 800 Gen 5
[>] 8x HP Mini EliteDesk 800 Gen 4
[>] 17x HP Mini EliteDesk 800 Gen 2
[>] 7x Raspberry Pi
[>] 1x System76 Meerkat (Daily Driver)



Home Lab Mark 2.0

Self-Hosted Software of note.

At this time, I was transitioning from Windows/Linux administration into Platform Engineering. The number of distros shrank slightly, and I made some of my decisions based on principle, so you will notice some popular software and big names missing.

- Ansible CE
- Ansible Semaphore
- Spacelift
- Proxmox
- Home Assistant

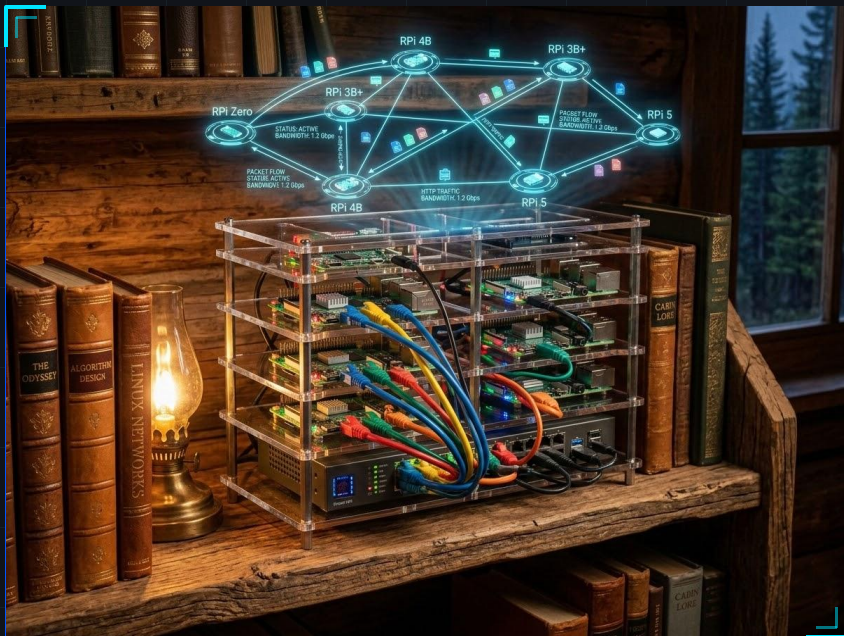
- Jellyfin
- DaVinci Resolve
- Docker
- Ceph
- Obsidian
- Audacity

What Operating Systems Were Used



- Raspberry OS
- Rocky Linux
- Debian
- OpenSUSE Leap
- OpenSUSE Tumbleweed
- Linux Mint
- Zorin OS
- Vanilla OS
- Garuda Linux (Dr4gonized)
- Parrot OS
- Kali Linux
- Pop!_OS
- Nix OS
- Cachy OS
- Nobar Linux
- Blend OS

Multi-Generational Pi Cluster



[NODE_VISUAL]

RPI GEN 2
2x NODES

RPI GEN 3
2x NODES

RPI GEN 4
1x NODES

RPI GEN 5
2x NODE

CLUSTER SPECIFICATION

[SYS.INFO] Total Nodes: 7 Active Compute Units

[SYS.INFO] Topology: 2x Gen 2 | 2x Gen 3 | 1x Gen 4
| 2x Gen 5

[MISSION] Primary Purpose:

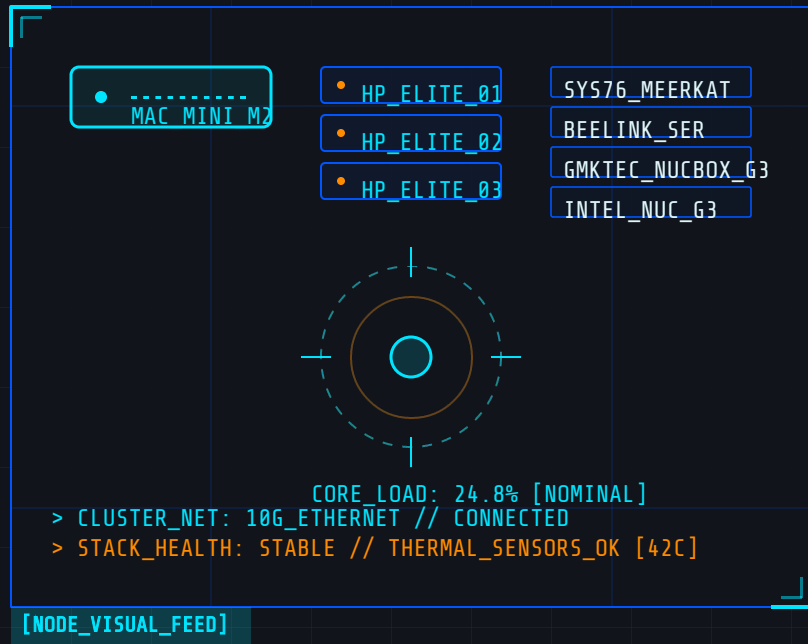
- > Lightweight container orchestration
- > Edge network routing & core services



The Current Use Case

Moving from Platform team into more of a liaison role freed me, and my home lab, up to do more things. I shrank my K8s cluster to just 3 nodes and moved to RKE2. I have spent the last year exploring n8n, local LLMs, online LLMs, and continuing my learning at a slower pace. I am also using my lab to work on several locally hosted apps to help me finish my books, host my media, track the weather, develop apps for me and my Jeep groups, but also to have fun again.

Home Lab Mark 3.0 (2025-Present)



CORE COUNT

36 Physical vCPUs

ARCHITECTURE TYPES

x86_64 / ARM64

CLUSTER INFRA

8 Nodes Active

PRIMARY USAGE

K8s Core / Linux DDs

[NODE_INVENTORY_REPORT]

- [>] 1x Mac Mini M2 (AI workloads)
- [>] 3x HP mini-elitedesk 800 Gen 9 (RKE2 K8s)
- [>] 1x System 76 Meerkat (Daily Driver)
- [>] 1x Beelink Model:SER (RAGs)
- [>] 1x GMKtec Nucbox Gen 3 (Self-hosted Apps)
- [>] 1x Intel Nuc Gen 3 (Home Assistant)
- [>] 2x Raspberry Pi Gen 5 (Weather Station, Cam)



What About the Pis?



What started with a Raspberry Pi morphed beyond what was required to do what I want to do. Most have been relegated to sporadic use and reside within one of my drawers. I currently have 2 Raspberry Pis running in my environment. If I need a quick cluster, I will pull them out and set one up, so I still use them from time to time.

What Operating Systems Are Used



[Linux First but others recognized]

[Video Editing and Gaming]

Windows
11

[AI Workloads]

MacOS
Tahoe

[Primary Linux Distros]

>Linux Mint

>Pop_OS!

>OpenSUSE Leap 15.6

[Examples of use]

Self-hosting DNS - Debian

Self-hosting Applications - Zorin OS

Multi-Use Machines - Linux Mint

Kubernetes - OpenSUSE Leap



Home Lab Mark 3.0

Self-Hosted Software of note.

As my roles continue to change, and with technology evolving at such a quick and uncertain rate, I have adapted my current home lab to be streamlined, resilient, and able to be disconnected from the internet and still (mostly) run effectively. I have reduced the blast radius of vulnerabilities to the best of my ability and wallet. I am far less focused on 'can I do something' than whether 'I should do something'. My network is segmented into zones, and will continue to grow in this area. Kubernetes is still very present, working with Linux and MacOS together to maximize the performance of the local AI to function as the heart of my lab.

- Ansible CE
- Whisper
- Spacelift
- Harvester
- Home Assistant
- NeuVector
- n8n

- Jellyfin
- Longhorn
- Docker
- RKE2
- Obsidian
- MycroftAI
- Ollama

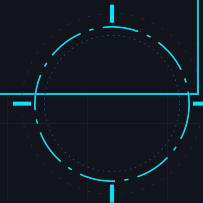
Infrastructure: Linux is the heart



[There is a tool for every task, and every task has its tool]

When all you have is a hammer, everything looks like a nail.

- > active_operating systems: 8
- > each system has a purpose: confirmed
- > environment: multi-os



[The Heavy Hitters]

[01 / The Daily Driver]

1x S76 Meerkat: Pop_OS!

[02 / Self-Hosted Applications]

4x GMKtec: ZorinOS

[03 / Local AI and related]

1x Mac Mini M2: MacOS

[04 / K8s and related locally hosted CN]

3X HP MED: OpenSUSE Leap 15.6
(reached EOS 4/26/26)

The Pinch Hitters



R PI Fleet: Edge



Beelink: RA65

Container & Automation Stack



DNS RESOLVER

port 53

TRAEFIK PROXY

ports 80/443

KUBERNETES CLUSTER

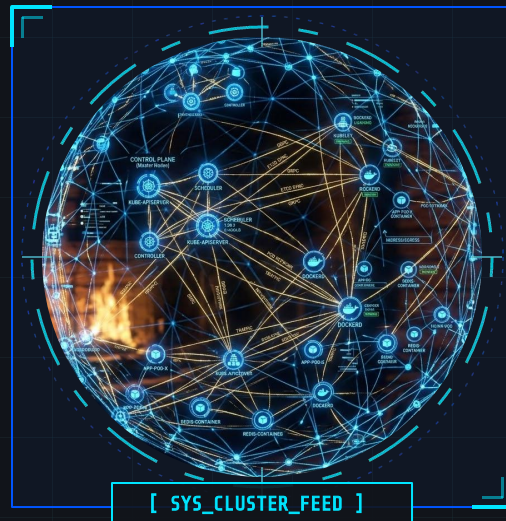
api endpoint

```

sysadmin@mountain-core: ~/ansible_playbooks

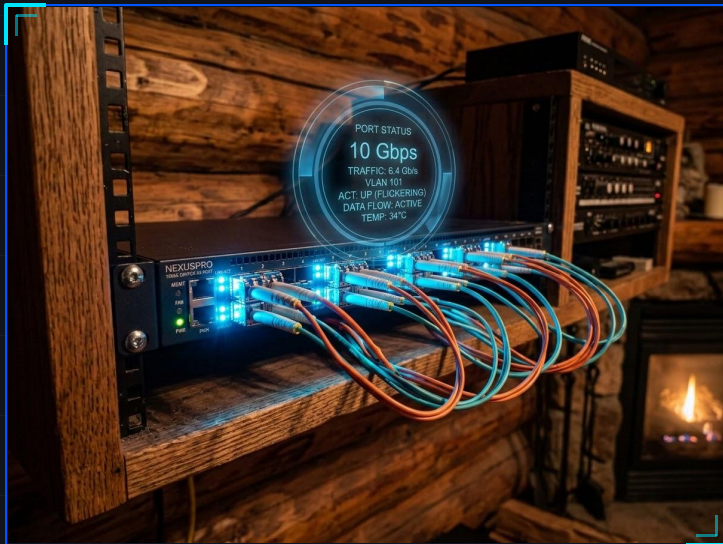
finch@northern-lights:~$ ansible-playbook deploy_homelab.yml
PLAY [PROVISION DOCKER & KUBERNETES NODES] *****
TASK [Gathering Facts] *****
ok: [library.northern-lights] [subway.northern-lights]
TASK [Docker Swarm : Setup Master Orchestration Node] *****
ok: [library.northern-lights] => {"swarm_active": true}
TASK [Kubernetes Core : Apply Manifests and Services] *****
changed: [bear.northern-lights] => (item=kubelet-daemon)
changed: [shaw.northern-lights] => (item=kube-proxy-rules)

PLAY RECAP *****
bear.northern-lights : ok=24 changed=4 failed=0
shaw.northern-lights : ok=18 changed=2 failed=0
finch@northern-lights:~$
  
```



- [01] Docker Swarm and Kubernetes orchestration.
- [02] RKE2 for K8s, NeuVector for k8s security, Harvester for VMs, and Longhorn for storage.
- [03] Semaphore and n8n for autonomous patching.
- [04] NeuVector and MAKO for observability and security.

Home Networking

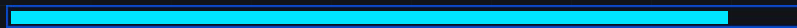


[NODE_VISUAL_FEED]

```
sysadmin@mountain-core:~$ ./uplink_check.sh
[STATUS] CORE 10GbE BACKBONE - ACTIVE (90% COM)
[HARDWARE] NVMe TIER MOUNTED // IOPS: OPTIMAL
```

STAGE 01 // Frustration

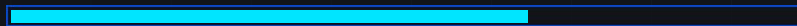
Old switch, now just use router installed software.



90%

STAGE 02 // Locally Hosted DNS

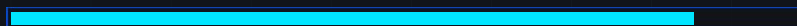
Locally hosted DNS several times, usually Ubuntu.



65%

STAGE 03 // TailScale

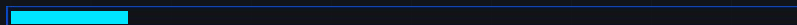
Decentralized Mesh Network/VPN in one.



80%

STAGE 04 // Multiple VLANs

Ended up with TP-Link Omada.



15%

Visual & Storage Infrastructure



[COMMAND_SETUP_STATUS]

Setup: Panoramic data visualization and redundant local storage.

- > active_displays: 5
- > storage_redundancy: enabled
- > environment: cozy_cabin_core



[IMG_FEED_ACTIVE]

[01 / ULTRA-WIDE MAIN]

1x LG 35-inch curved monitor

[02 / MONITOR ARRAY]

4x LG 34-inch monitors

[03 / LOCAL BACKUP]

1x ThemaMaster 2-bay drive

[04 / ARCHITECTURE]

Redundant local storage setup

THEMAMASTER 2-BAY ACTIVE DRIVE



BAY_01 // ONLINE



BAY_02 // SYNCING

Plans for the Future



[Sleek and Purpose Built]

[Finally get rid of]

**Windows
11**

[AI Workloads]

**Full
Access**

[3 RAGS for AI]

- >Financial
- >Recreational
- >Operational

[Split half of production to offline]

- Self-hosted Applications
- Self-hosted Storage
- Multiple Sets of replacement components

Your Environment Matters



[My Setup]

[01 / STANDING DESK]

36in Deep. Rated to lift 250 pounds

[03 / DRAWERS FOR STORAGE]

2x Alex Drawers with butcher block connect

[02 / GOOD CHAIR]

Maxnomic Gaming Chair

[04 / KVM SWITCHES AND DOCKING STATION]

CalDigit & Anker DS, 3 & 4 monitor KVMs

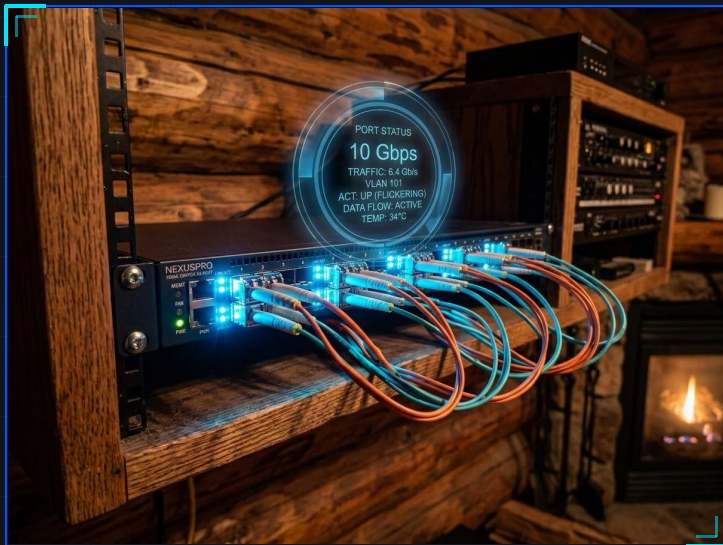
[Have a primary workstation]

Setup: Designated workstation should have access to your environment, with the following attributes.

- > designated dev area w/ monitors
- > kept neat and clean
- > overall dimly lit with task lighting for eye health



Sayings I Have Adopted



[NODE_VISUAL_FEED]

```
sysadmin@mountain-core:~$ ./uplink_check.sh
[STATUS] CORE 10GbE BACKBONE - ACTIVE (90% COM)
[HARDWARE] NVMe TIER MOUNTED // IOPS: OPTIMAL
```

#1-Is the juice worth the squeeze? - Timothy Olyphant (the girl next door)
Constant evaluate the cost=benefit ratio.



98%

#2-A system must be both desirable and reliable to be production
Products for prod, projects for dev. See #1



95%

#3-There are no solutions. There are only trade-offs - Thomas Sowell
You rarely get to have your cake and eat it too.



80%

#4-Failing Fast is overrated
Failing Fast rewards quantity over quality.



65%



Advice On Getting Started

Shop The Sale.

Your home lab is either an investment in yourself, or a hobby. You need to decide this up front and buy accordingly. If you don't know, come at it from the perspective of a hobby, because it is less expensive to go up. Avoid Amazon items with gibberish before name. I shop a few sites regularly and O.T.I.S. (when operational) reads me the top deals from the sites I frequent every morning over coffee. I have listed the things he looks for below.

- Mini PCs at 40%+ off
- Mac Mini M3+ at \$499 or less
- nVMEs 1tb and up at 50%+ off
- 3.5 inch spinning drives 8tb+
- 32in+ Monitors at 50% off
- NAS 4 drive bays at 40% off
- Arduino Kits under \$35
- Monitor Light Bar w/puck at 25% off
- Bankers lamps at 25%+ off
- Flipper Zero at 25%+ off
- Cisco or Ubiquiti Switch at 40%+ off
- 32gb RAM DDR4 and up at 40%+ off
- Infra-red sensors any% off
- Used Mycroft interfaces

If I Were To Start Over Today



[Sleek and Purpose Built for learning]

[Video Editing/Gaming]

**Windows
11**

[AI Workloads]

**Mac Mini
M2+**

[Nodes for Primary Objective & Daily Driver]

>GMKtec Mini PC G10 R5 3500U (4 core,16 gb Dual Channel RAM, 2.5gb NIC, 3X 4K Display, WiFi) \$319.00 (Amazon) Best bang for buck)

>system76 Meerkat - Intel Core 4.7ghz, 6 core, 16gb RAM, 2.5gb NIC, 2X 4K Display, WiFi) \$849.00 or \$53 per month (system76)

>Minisforum mini PC UM750L Slim R5 7545U (# core, 16gb RAM, 1tb nVME, 2X HD Display, 2.5bg NIC, AMD 740M Graphics) \$445.54 (Amazon)

[Secondary Objectives]

•3x - Used/Refurb HP MED 800 Gen3 or up.
Low as \$88 on Ebay, \$142 PCliquidations

•UGREEN NAS DXP2800 2 Bay - \$389.99 Amazon

My Budget Build (Clean Start)



[My Setup]

[01 / Primary Linux Machine]

The GMKtec mini is more than enough. Learn Linux, then move to adjacent work

[03 / Local Storage]

Learn storage and networking, trust me learn it early...ask me how I know...

[02 / Mac Mini for Local AI]

AI is here, learn it locally. Will pay for itself by not paying for Agentic workflows

[04 / Bonus, because I like Keyboards]

Aula F108 Pro w/Carmel Latte switches (Chef's Kiss at ~\$90 on Amazon down from \$106)

[primary workstation]

- GMKtec Mini PC G10 R5 3500U (4 core, 16 gb Dual Channel RAM, 2.5gb NIC, 3X 4K Display, WiFi) \$319.00 (Amazon)
- UGREEN NAS DXP2800 2 Bay - \$389.99 w/ 2x WD 4tb 3.5" at ~\$200 (Amazon)
- Mac Mini M4 (16gb RAM, 256gb SSD - \$529.99 (Costco) w/Ugreen Dock \$55 (Amazon) and 1tb WD_Black SN7100 nVME Gen 4 \$190 (Amazon)OC
- Cisco 2960 Series 24p switch WS-C2960-24LT-L - \$90 Cables and kits
- Total (including bonus) - \$2,100



How I Would Build It Out.

- Install Zorin OS Premium on GMKtec machine. Do 90% of work on this machine. This is for primarily learning Linux in a comfortable environment. Once familiar with the basics, distro hop to find the Linux that fits your general use preference. For me, this would be PopOS because I love the COSMIC GUI (graphical user interface)
- Install and configure Ollama and n8n natively on Mac Mini. These are the only workloads I would run on this machine. Learn Agentic Workflows natively before switching to containerization.
- Connect UGreen NAS and start learning to manage Network Attached Storage. Use one of the 4tb drives for storage and set the other up with RAID for backup. Either learn the UGreen native software, or something else, this would be up to you.
- Set up your wireless network via your router, then use a switch for a private vLAN to do the bulk of your work in.

Let's Swing Big, 6k Budget (Clean Start)



[Learn and host production services]

[RKE2 Machines for K8s]

**HP MED
Gen 9**

[AI Workloads]

**Mac Mini
M4 Pro**

[Primary Objective & Daily Driver]

>Thelio Prime Custom w/PopOS 24.04 LTS- 5.6ghz Ryzen 9 9900X (12 Cores-24 Threads) 8gb Geforce RTX 5060, 48gb DDR5 5600mhz, 500gb PCIe4 M.2 nVME HD, 120mm GPU Cool Air Intake Fan - \$2663 System76 website.

>Mac Mini M4 Pro - 10 core CPU, 10 core GPU, 16 core Neural Engine

>Dell 34" Monitor S3425DW, WQHD VA, 120Hz, FreeSync Premium, HDR10, Anti-glare, USB-C 65W Power Delivery - \$330 Amazon

Honorable Mention - LG 29WP60G-B 29" 21:9 FHD (2560 x1080) IPS Display, HDR 10 - \$240 - Amazon

- Cons = Power adapter is brick, no adjustable height, only 60hz.

>3x Used/Refurb HP MED 800 Gen9. \$1536 or \$512 per unit

>UGREEN NAS DXP2800 2 Bay - \$389.99 w/ 2x WD 4tb 3.5" at ~\$200 (Amazon)

>Cisco 2960 Series 24p switch WS-C2960-24LT-L - \$90 Cablesandkits



Advice For Once You Are Up and Running

- Embrace Failure - It's going to happen, so get used to it. Learn the thrive on it.
- Don't just invest in hardware and software, find instruction where you can. YouTube is a great source of free education and I have had great luck with Udemy.
- The internet will be full of advice. Some will work for you, some won't. There is a 'right' way to do it in the workplace, not necessarily in your home lab. Don't be afraid to experiment. Don't be content with doing things the way they have always been done.
- Learn Linux, it doesn't matter which one, just learn one. The world's infrastructure increasingly runs on Linux. I would consider that a necessary skill moving forward.
- Learn containers. I would recommend both Docker and K8s, but at least learn Docker. I believe AI will mostly run on K8s for horizontal scaling.
- My last piece of advice was one given to me when I first started...which I promptly ignored. This is a marathon, not a sprint.

Questions?

Find me on LinkedIn:

[linkedin.com/in/alex-franklin-61159713b](https://www.linkedin.com/in/alex-franklin-61159713b)

Or email me at: alex@etsa.tech



Wishful Thinking

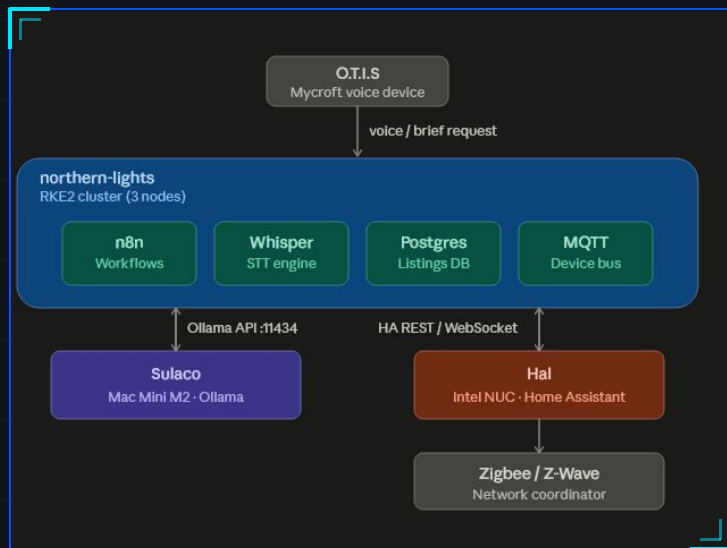


[IMG_FEED_ACTIVE]

[>] Off-grid with a bunch of rescue dogs...

[>] and a library of real books.

Bonus Slide - O.T.I.S. Setup



[O.T.I.S. Setup]

#1-O.T.I.S. existed before LLMs and Ollama.

I combined OTIS with n8n, Ollama, and HA for a 'Hand Scooped Voice Assistant'.

#2-Everything but Ollama, O.T.I.S., and HA run in K8s

Everything runs in K8s except Ollama and HA. This provides high availability, observability, and security via NeuVector.

#3-Ollama installed natively on Mac Mini for performance

The n8n Ollama chat node just points to LAN IP port. The unified memory makes up for the lack of a large, dedicated GPU.

#4-Home Assistant decoupled for hardware passthrough

Chose "boring & isolated" over "elegant & clustered". Most likely point of cluster upgrade issues.

```
finch@northen-lights: bonus it you get this reference.
```



Recommended Reading

Below is a recommended reading and course list. Again, this is one person's opinion, but I found these sources to be excellent sources of knowledge as I built my home lab.

BOOK LIST

- The Linux Bible - Christopher Negus
- The Kubernetes Book - Nigel Poulton
- Ansible for DevOps - Jeff Geerling
- Network Warrior - Gary Donahue
- The Linux Command Line - William Shotts
- Mastering Linux System Administration - Christine Bresnahan and Richard blum

VIDEO LEARNING

- YouTube - TechnoTim
- YouTube - LearnLinuxTV
- YouTube - ChristianLempa
- YouTube - NetworkChuck
- Udemy - Linux Administration Bootcamp: Go from Beginner to Advanced - Jason Cannon
- Udemy - Kubernetes for the absolute beginners - Hands-on - Mumshad Manambeth