# Jason Paul Homelab Tour

March 6, 2023

Who is Jason Paul?

- Born in Winnipeg, MB.

- Been using Linux since 2001.

- Living in Waterloo Region since 2004.

- Find out more about me at my website:
  https://www.linuxtek.ca/

- Connect with me on LinkedIn:
  https://www.linkedin.com/in/jason-paul-it/

Physical Hardware - Rack

- Hammond 16U Vented Mobile Rack

- 2x 24 Port Cat6/Cat6A Patch Panels
- Ubiquiti UniFi Switch Pro 48 (USW-PRO-48)
- Ubiquiti Switch Aggregation

- 1x Dell PowerEdge R640 1U
- 2x Dell PowerEdge R630 1U
- 1x Dell PowerEdge R730XD 2U

- Startech Power Distribution Unit
- Eaton 5PX 1500VA Extended Battery Module
- Eaton 5PX 1440VA UPS (5PX1500RTN)
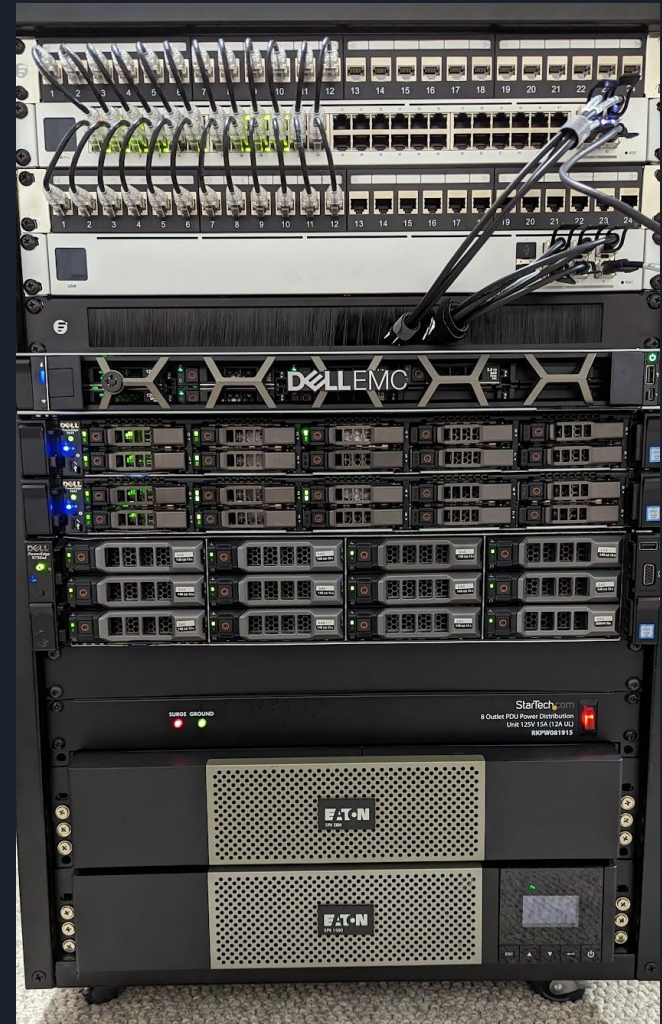
Physical Hardware - Compute - Dell R640

Dell PowerEdge R640 10 Bay - 1U Rackmount
- 2x Intel Xeon Silver 4110 CPU @ 2.10Ghz
  - 2x 8 Core/16 Thread CPU

- 256GB DDR4 ECC RAM @ 2400Mhz
  - 8x 32GB Memory Modules

- 2x 10Gbps SFP+ and 2x 1Gbps RJ45 Network Daughter Card

- PERC H740 Mini RAID Controller (in HBA mode)
- 2x 960GB 6Gbps Samsung Enterprise SATA 2.5" SSD
- 3x 3.84TB 6Gbps HP (Sandisk) SAS 2.5" SSD
- 2x 750W Power Supplies

Physical Hardware - Compute - Dell R630

Dell PowerEdge R630 10 Bay - 1U Rackmount
- 2x Intel Xeon E5-2697 v3 @ 2.60GHz
  - 2x 14 Core/28 Thread CPU

- 256GB DDR4 ECC RAM @ 2133Mhz
  - 4x 32GB, 8x16GB Memory Modules

- 2x 10Gbps RJ45 and 2x 1Gbps RJ45 Network Daughter Card
- 2x 10Gbps SFP+ PCI-E Network Card

- PERC H730P Mini RAID Controller (in HBA mode)
- 2x 480GB 6Gbps Dell EMC 2.5" SATA SSD
- 3x 3.84TB 6Gbps HP (Sandisk) SAS 2.5" SSD
- 2x 750W Power Supplies

Physical Hardware - Compute - Dell R630

Dell PowerEdge R630 10 Bay - 1U Rackmount
- 2x Intel Xeon E5-2690 v4 @ 2.60GHz
  - 2x 14 Core/28 Thread CPU

- 256GB DDR4 ECC RAM @ 2400Mhz
  - 8x 32GB Memory Modules

- 2x 10Gbps RJ45 and 2x 1Gbps RJ45 Network Daughter Card
- 2x 10Gbps SFP+ PCI-E Network Card

- PERC H730P Mini RAID Controller (in HBA mode)
- 2x 480GB 6Gbps Intel Enterprise 2.5" SATA SSD
- 3x 3.84TB 6Gbps HP (Sandisk) SAS 2.5" SSD
- 2x 750W Power Supplies

Physical Hardware - Compute - Dell R730XD

Dell PowerEdge R730XD 10 Bay - 2U Rackmount
- 2x Intel Xeon E5-2660 v3 @ 2.60GHz
  - 2x 10 Core/20 Thread CPU

- 256GB DDR4 ECC RAM @ 2133Mhz
  - 8x 32GB Memory Modules

- 2x 10Gbps RJ45 and 2x 1Gbps RJ45 Network Daughter Card
- 2x 10Gbps SFP+ PCI-E Network Card

- PERC H730 Mini RAID Controller (in HBA mode)

- 2x 480GB 6Gbps Intel Enterprise SATA 2.5" SSD (Rear Enclosure)
- 10x 14TB Western Digital White Label SATA 3.5" Drive
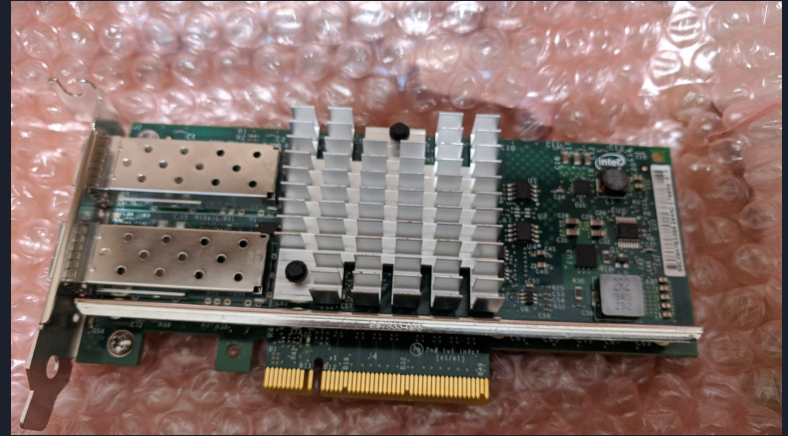- 2x 8TB Western Digital Purple Surveilance SATA 3.5" Drive

- 2x 750W Power Supplies

Dell PowerEdge R630 CPU Surgery
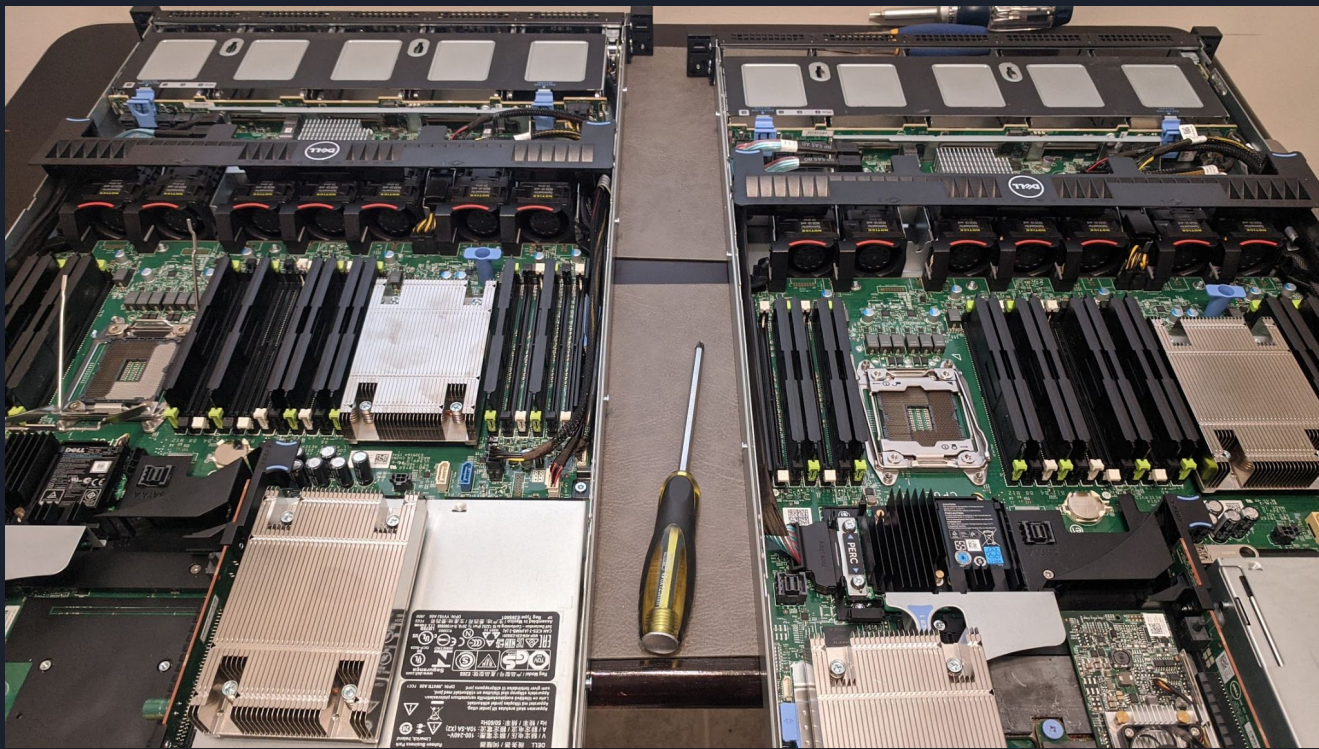
PCI-E 10Gbps SFP+ NIC

- QLogic 577xx/578xx 10 Gb Ethernet BCM57810 Adapter
- Dell Broadcom 10GbE 2P 57810S Adapter

10G SFP+ Direct Attach Copper Twinax Cable

Physical Hardware - Storage - 3.5" Drives

TrueNAS SCALE Storage
- 10x 14TB Western Digital WD140EDGZ 3.5" SATA
  - 5400RPM CMR Helium White Label WD Red Pro/Gold
- 2x 8TB Western Digital Purple 3.5" SATA
- Article on www.linuxtek.ca on drive shucking
- Some shucked drives have a 3.3V pin that needs to be taped

Physical Hardware - Storage - 2.5" Drives

OS Drives
- Each compute node has 2x 480GB 2.5" Enterprise SATA SSD
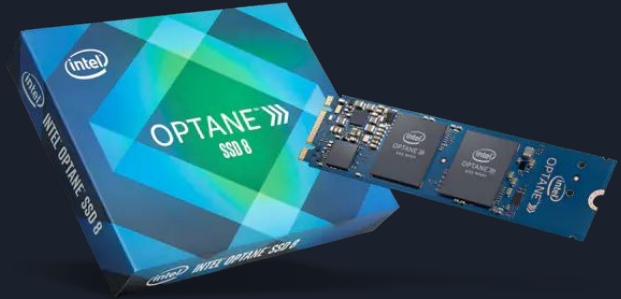- Using ZFS RAID1 Mirror for Proxmox install

Ceph Cluster
- 10x 3.84TB HP (Sandisk) Enterprise 6Gbps SAS SSD
- 3 drives in each 1U compute node, 1 offline spare
- Article on www.linuxtek.ca on Ceph cluster

Physical Hardware - Storage - Intel Optane

- 1x Intel Optane 900P 480GB SSD - PCI-E 3.0 16x
- 4x Intel Optane P1600X 118GB NVME M.2
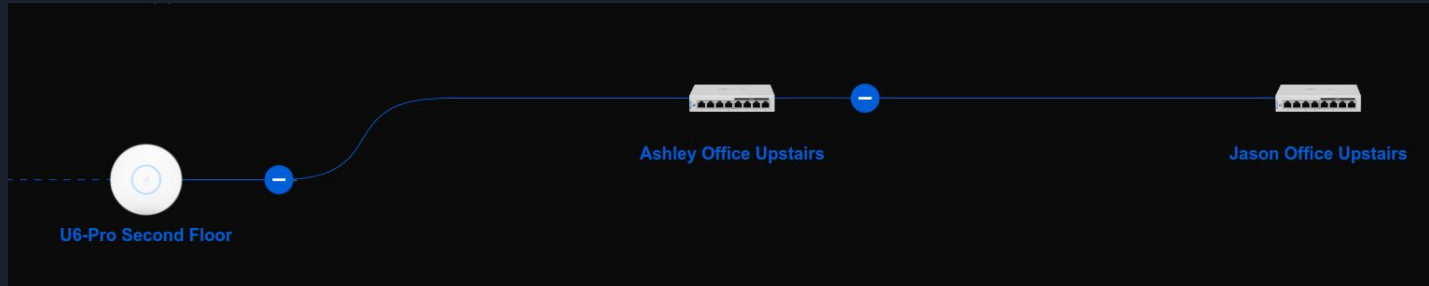- 1x Asus Hyper M.2 X16 Gen 4 Card

Physical Hardware - Network

- 1x UniFi USW-Pro-48
  - 48 1Gbps RJ45
  - 4x 10Gbps SFP+

- 1x UniFi USW-Aggregation
  - 8x 10Gbps SFP+

- 5x UniFi US-8-60W
  - 4x 1Gbps, 4x 1Gbps POE (48W total)

- 2x UniFi Access Point 6 Pro (U6-Pro-US)
  - WiFi 6
  - 2.4Ghz 2x2 UL MU-MIMO (573.5 Mbps)
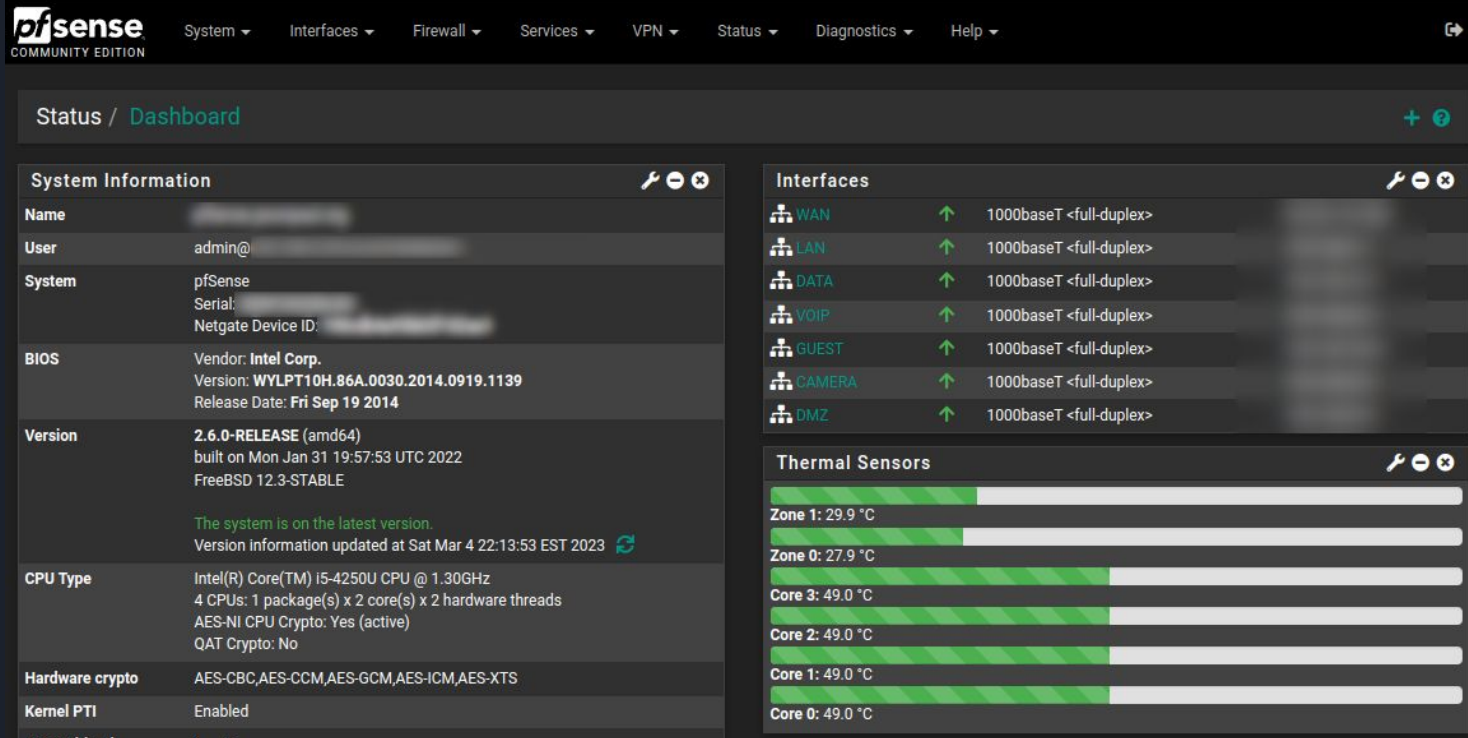 - 5Ghz 4x4 DL/UL MU-MIMO (4.8Gbps)
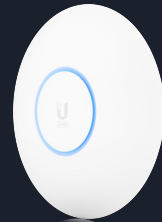
Physical Hardware - Network

Physical Hardware - Network

Physical Hardware - Network Router

pfsense
COMMUNITY EDITION

Status / Dashboard

System Information

Name	
User	admin@
System	pfSense Serial: Netgate Device ID:
BIOS	Vendor: **Intel Corp.** Version: **WYLPT10H.86A.0030.2014.0919.1139** Release Date: **Fri Sep 19 2014**
Version	**2.6.0-RELEASE** (amd64) built on Mon Jan 31 19:57:53 UTC 2022 FreeBSD 12.3-STABLE The system is on the latest version. Version information updated at Sat Mar 4 22:13:53 EST 2023
CPU Type	Intel(R) Core(TM) i5-4250U CPU @ 1.30GHz 4 CPUs: 1 package(s) x 2 core(s) x 2 hardware threads AES-NI CPU Crypto: Yes (active) QAT Crypto: No
Hardware crypto	AES-CBC,AES-CCM,AES-GCM,AES-ICM,AES-XTS
Kernel PTI	Enabled

Interfaces

WAN	↑	1000baseT <full-duplex>
LAN	↑	1000baseT <full-duplex>
DATA	↑	1000baseT <full-duplex>
VOIP	↑	1000baseT <full-duplex>
GUEST	↑	1000baseT <full-duplex>
CAMERA	↑	1000baseT <full-duplex>
DMZ	↑	1000baseT <full-duplex>

Thermal Sensors

Zone 1: 29.9 °C

Zone 0: 27.9 °C

Core 3: 49.0 °C

Core 2: 49.0 °C

Core 1: 49.0 °C

Core 0: 49.0 °C

Network VLANS

- WAN   - WAN Network In
- LAN   - Server Network (Default Network)
- DATA   - Workstations and General Access
- GUEST   - Restricted Internet Only Wi-Fi Network
- CAMERA   - IP Camera network - No Egress Traffic
- VOIP   - IP Phone Network (FreePBX)
- PROXMOX   - Proxmox Cluster Traffic (CoroSync)
- CEPH   - Ceph Cluster Replication Traffic
- DMZ   - Restricted Network Access / External Applications

Hardware - Power Usage
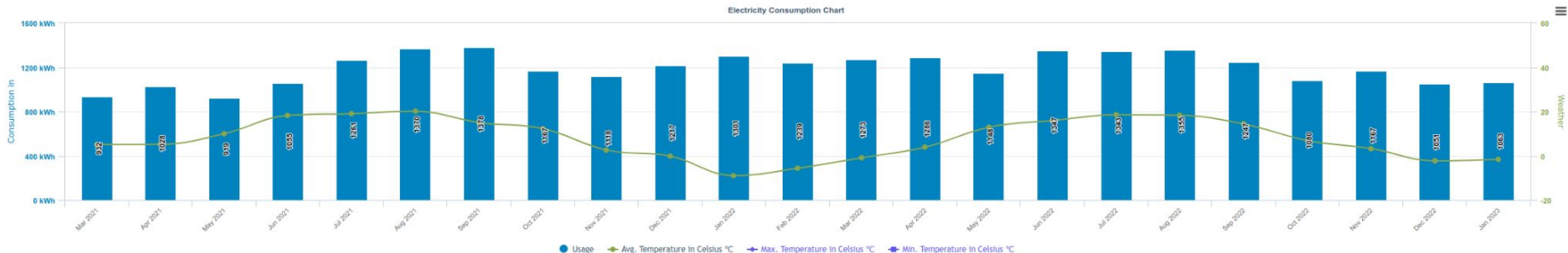
Electricity Consumption Inquiry

Welcome to our Consumption Inquiry. This tool shows your meter readings over the past 24 months. A convenient temperature overlay may be displayed to show how the weather has affected your consumption.

⊞ Download

919.0 kWh / $136.16	1189.0 kWh	1378.0 kWh / $188.22
Lowest Usage on 2021-05-20	Average Usage / Read	Highest Usage on 2021-09-21

Electricity Consumption Chart

● Usage ─●─ Avg. Temperature in Celsius °C ─●─ Max. Temperature in Celsius °C ─●─ Min. Temperature in Celsius °C

Reading Date	Reading Description	Days	Previous Reading	Current Reading	Consumption	Amount in $	Average/Day
20-Jan-2023	Meter# -	31			1,063.45	$156.49	34.30
20-Dec-2022	Meter# -	28			1,050.62	$152.71	37.52
22-Nov-2022	Meter# -	32			1,167.23	$166.74	36.48
21-Oct-2022	Meter# -	30			1,080.23	$159.31	36.01
21-Sep-2022	Meter# -	30			1,246.62	$181.13	41.55
22-Aug-2022	Meter# -	31			1,355.38	$191.47	43.72
22-Jul-2022	Meter# -	31			1,342.60	$191.83	43.31
21-Jun-2022	Meter# -	32			1,346.64	$190.07	42.08
20-May-2022	Meter# -	28			1,147.90	$167.09	41.00
22-Apr-2022	Meter# -	32			1,285.63	$182.99	40.18

Physical Hardware - Suppliers

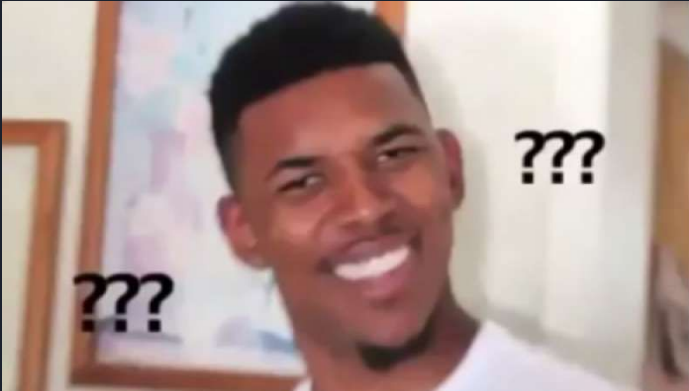- FS.com
- Primespec
- DeployDepot
- Reddit /r/homelabsales
- DeltaServerStore Toronto
- UsedServers.ca (Montreal)
- Facebook Marketplace

But what does he even do with all that hardware?

Software - Proxmox Cluster

- Three Compute Nodes in High Availability Cluster
- Able to seamlessly move VMs between servers without downtime
- Optional automated failover between servers
- Shared VM Network Storage via Ceph
- Automated Daily Backups to TrueNAS server via NFS share
- Proxmox and Ceph Articles on www.linuxtek.ca

Server View

- Datacenter (Proxmox)
  - pve1
    - 105 (Bitwarden)
    - ceph-vm (pve1)
    - local (pve1)
    - local-zfs (pve1)
    - nfs-truenas (pve1)
  - pve2
   - 106 (Shinobi)
    - 107 (CephTest)
    - 108 (Minecraft-Vanilla)
    - ceph-vm (pve2)
    - local (pve2)
    - local-zfs (pve2)
    - nfs-truenas (pve2)
  - pve3
    - 100 (Asterisk)
    - 101 (Docker)
    - 102 (PLEX)
    - 103 (Newsgroups)
    - 104 (OpenVPN)
    - ceph-vm (pve3)
    - local (pve3)
    - local-zfs (pve3)
    - nfs-truenas (pve3)

Edit: Backup Job

General | Retention | Note Template

Node:	-- All --	Send email to:	
Storage:	nfs-truenas	Email:	On failure only
Schedule:	03:00	Compression:	ZSTD (fast and good)
Selection mode:	All	Mode:	Snapshot
		Enable:	☑

Status

| Type	Status
quorum	OK
master	pve3 (active, Sun Mar 5 00:07:15 2023)
lrm	pve1 (idle, Sun Mar 5 00:07:20 2023)
lrm	pve2 (active, Sun Mar 5 00:07:20 2023)
lrm	pve3 (idle, Sun Mar 5 00:07:18 2023)

Software - Virtual Machines

- Bitwarden Server
- Shinobi - Network Video Recording
- Minecraft Servers
- FreePBX VOIP Server
- UniFi Controller (Docker Container)
- PLEX Media Server
- OpenVPN Server
- Newsgroup Tools
- Dev Environments
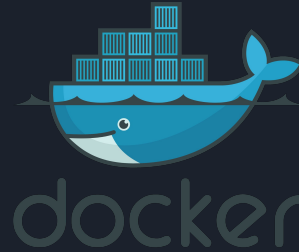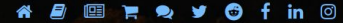
BitWarden Server - Password Storage

- Free, open-source software
- Switched from LastPass after recent security breaches
- Tested running on AWS but felt safer having it locally behind firewall
- Not accessible to the internet - local or VPN access only
- Free self-hosting, free mobile app, browser extension
- Optional paid plans for additional features or family sharing
- VaultWarden - free open-source alternative rewritten in Rust
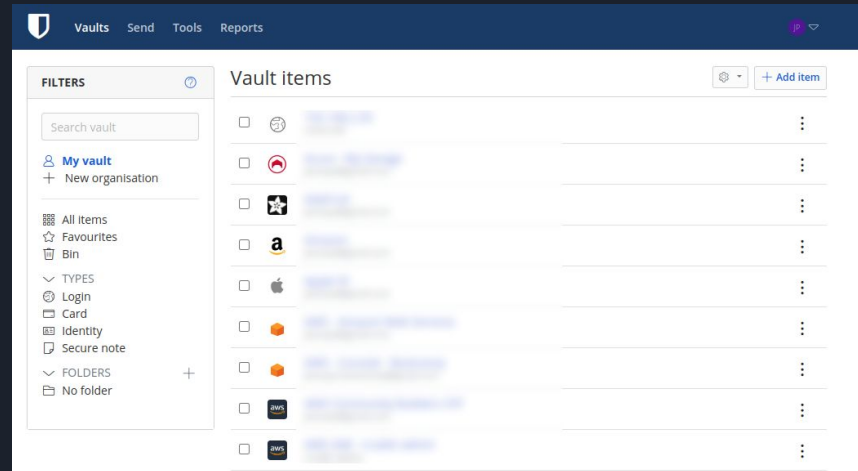
Shinobi NVR - Network Video Recorder

- Multiple Amcrest 4K cameras outside and inside house, plus doorbell
- Separate VLAN to block cameras from accessing internet
- Cameras are H.264/H.265 ONVIF compliant, open RTSP streams
- Shinobi records when it detects movement, stores video to TrueNAS
- Western Digital Purple 8TB surveillance grade drives in ZFS RAID 1 (mirror)
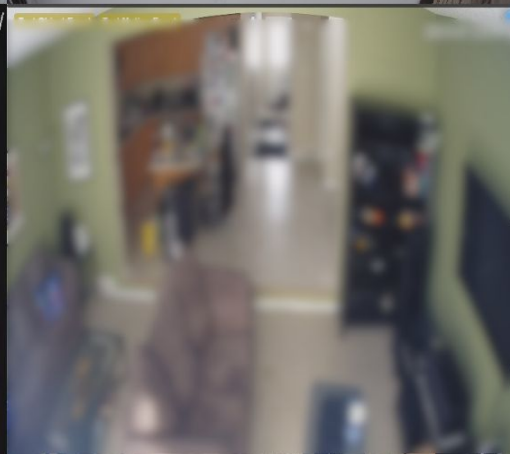
Front Porch

MINECRAFT

- Vanilla Minecraft and lightly modded servers
- Automated Minecraft server install via Ansible - info on linuxtek.ca
- More information on Minecraft community and Discord at linuxtek.ca/minecraft
- Server whitelist - invite only
- Performance issues with heavily modded servers (Minecraft server limitations)

FreePBX VOIP Server

- FreePBX - Asterisk based IP Telephony developed by Sangoma
- Free Open Source License, paid extensions (e.g. Admin Tools)
- Uses open standards like SIP and RTSP
- Hardware - Grandstream GXP2140, Cisco SPA112 ATA
- Used to run Linphone as a free VOIP client but had lots of problems
- Zoiper - PC phone client - multiple platform support
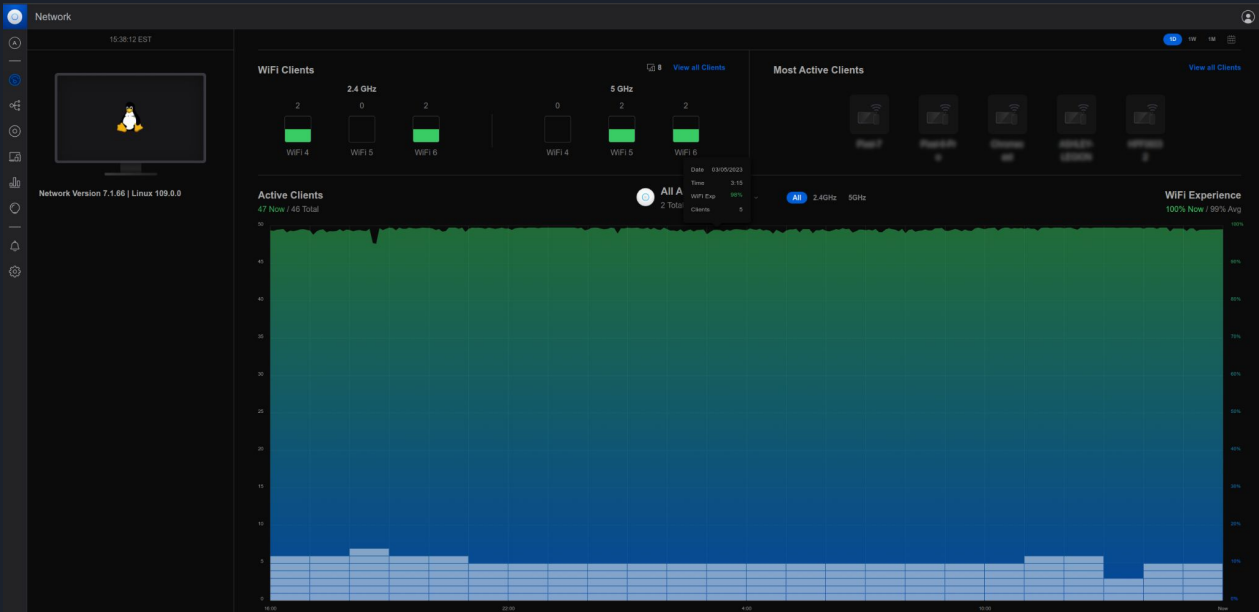- Using VOIP.ms for SIP Trunking
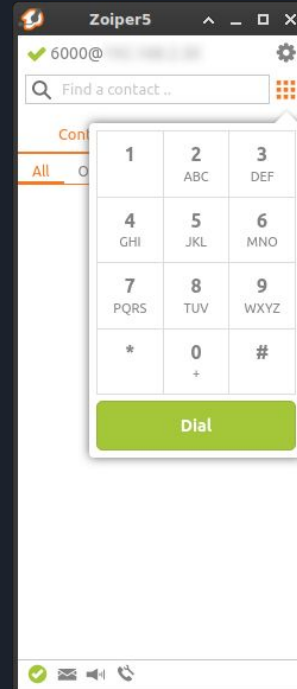
FreePBX Dashboard
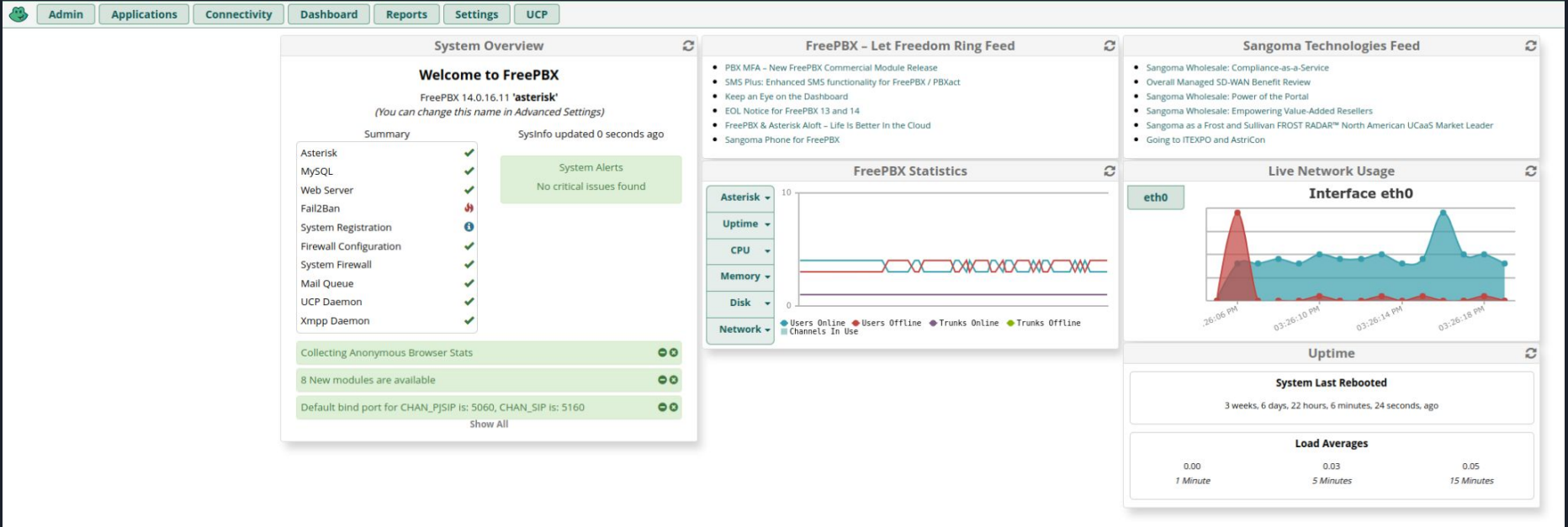
UniFi Controller

- Controller required for configuring UniFi networking equipment
- Hosts single pane of glass interface for configuration and metrics
- Can be run off some UniFi hardware - Cloud Key, UniFi Dream Machine, etc
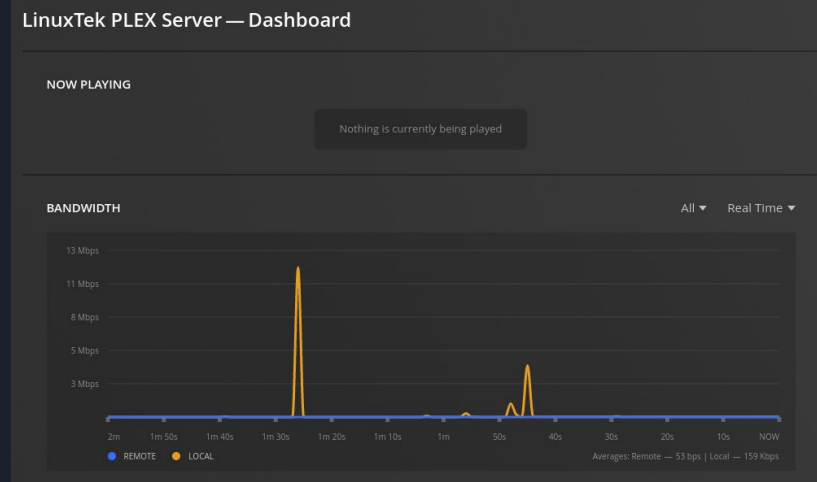- Can be self hosted installed on OS, or running as a container

15:38:12 EST

WiFi Clients

2.4 GHz
2	0	2
WiFi 4	WiFi 5	WiFi 6

5 GHz
0	2	2
WiFi 4	WiFi 5	WiFi 6

Most Active Clients

Pixel 7   Pixel 6 Pro   Chromecast   ASHLEY LENON   HP7800 2

Network Version 7.1.66 | Linux 109.0.0

Active Clients
47 Now / 46 Total

All A...
2 Total

Date	03/05/2023
Time	3:15
WiFi Exp	99%
Clients	5

All   2.4GHz   5GHz

WiFi Experience
100% Now / 99% Avg

Network

Search   UniFi Devices

| TYPE	NAME	STATUS	IP ADDRESS	CONNECTION	NETWORK
	Ashley Office Upstairs	Online		Wired	Default
	Basement Demarc	Online		Wired	Default
	Basement to Upstairs	Online		Wired	Default
	Jason Office Upstairs	Online		Wired	Default
	Main Floor Living Room	Online		Wired	Default
	USW-Aggregation	Online		Wired	Default
	USW-PRO-48	Online		Wired	Default
	U6-Pro Main Floor	Online		Wired	Default
	U6-Pro Second Floor	Online		U6-Pro Main Floor	-

PLEX Media Server

- Paid software - occasional sales on lifetime licences (PLEX Pass)
- Client for many devices - Android, iPhone, TVs, PC, web client, gaming consoles
- Able to share media library to family members
- Dashboards for user activity, bandwidth, CPU, memory, etc
- Jellyfin - free open source alternative
- We don't talk about 🏴‍☠️

LinuxTek PLEX Server — Dashboard

NOW PLAYING

Nothing is currently being played

BANDWIDTH   All ▼   Real Time ▼

13 Mbps

11 Mbps

8 Mbps

5 Mbps

3 Mbps

2m   1m 50s   1m 40s   1m 30s   1m 20s   1m 10s   1m   50s   40s   30s   20s   10s   NOW

● REMOTE   ● LOCAL   Averages: Remote — 53 bps | Local — 159 Kbps

Software - Dev Environments

- Dev environments for coding
- SSH into VMs using Visual Studio Code
- Temporary Databases
- Environments for testing automation scripts
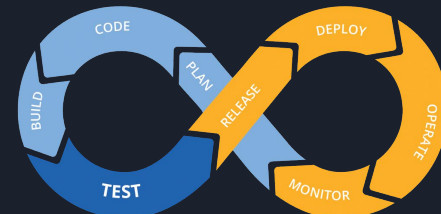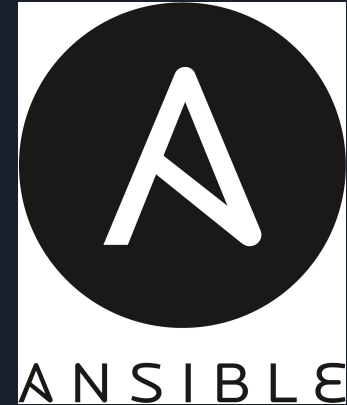
Software - TrueNAS SCALE

- TrueNAS CORE based on FreeBSD, TrueNAS SCALE based on Debian Linux
- ZFS enterprise grade file system originally developed by Sun Microsystems
- Automated offsite backups, file sharing via SMB, NFS, iSCSI
- Virtual Machine Support via multiple hypervisors
- Docker containers as applications via k3s (Rancher)
- Can deploy individual Docker images manually or applications using Helm charts
- Custom pre-built Helm Charts via truecharts.org

Software - TrueNAS SCALE
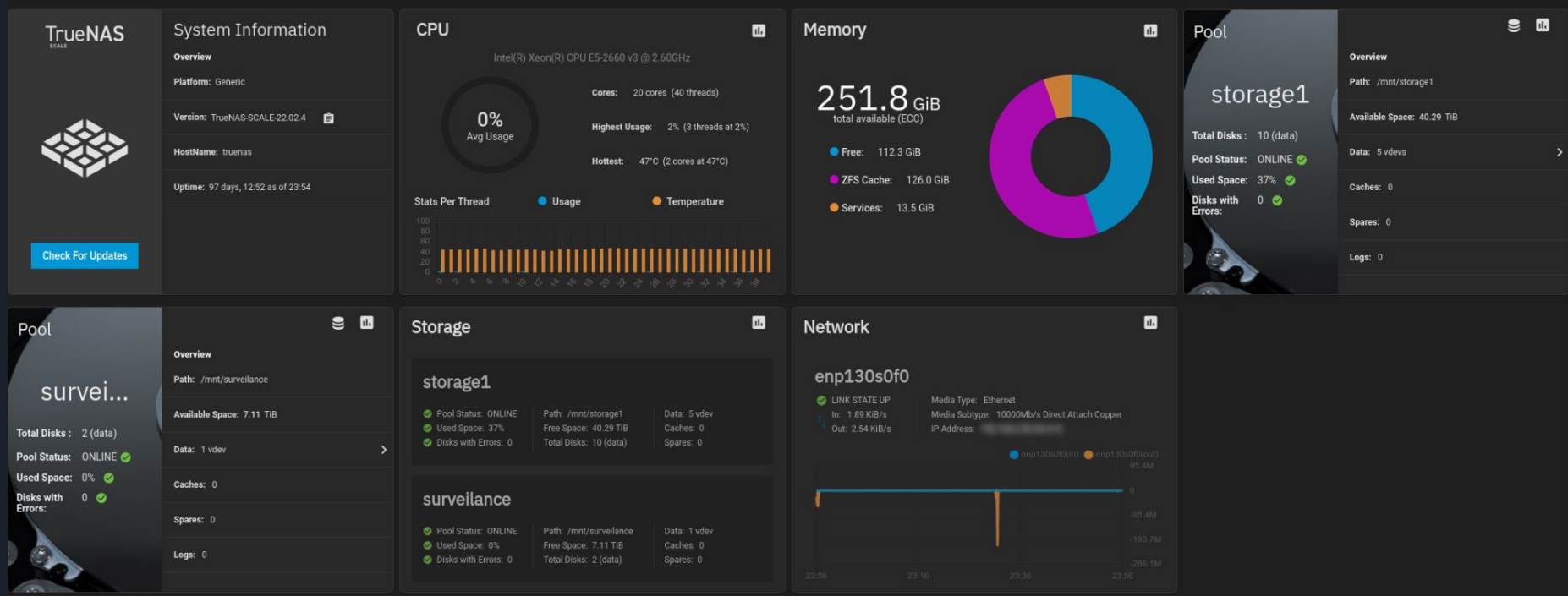
Software - TrueNAS SCALE

- Centralized backups for virtual machines and server data
- Workstation OS Backups
- Personal Picture and Video Backup
- Media Storage
- Surveillance Footage Storage
- Applications via TrueCharts (k3s - Rancher)
- Offsite Backups to AWS S3 or Backblaze B2

Software - TrueNAS SCALE

storage1 (System Dataset Pool)   ONLINE ✅ | 23.16 TiB (37%) Used | 40.29 TiB Free

Name	Type	Used	Available	Compression	Compression Ratio
⌄ storage1	FILESYSTEM	23.16 TiB	40.29 TiB	lz4	1.00
apps	FILESYSTEM	4.82 GiB	40.29 TiB	Inherits (lz4)	1.00
ix-applications	FILESYSTEM	9.14 GiB	40.29 TiB	Inherits (lz4)	1.93
media	FILESYSTEM	13.62 TiB	40.29 TiB	Inherits (lz4)	1.00

surveilance   ONLINE ✅ | 33.22 GiB (0%) Used | 7.11 TiB Free

Name	Type	Used	Available	Compression	Compression Ratio
⌄ surveilance	FILESYSTEM	33.22 GiB	7.11 TiB	lz4	1.00
cameras	FILESYSTEM	33.21 GiB	7.11 TiB	Inherits (lz4)	1.00

Pi-hole

≡   hostname: `pihole-5cf888494d-65bnh`   Pi-hole

Status
- Active
- Load: 0.24 0.25 0.3
- Memory usage: 54.0 %
- Temp: 51.0 °C

MAIN NAVIGATION

Total queries (27 clients)
40,261

Queries Blocked
263

Percentage Blocked
0.7%

Domains on Adlists
184,035

Future Homelab Projects

- Configure caching on TrueNAS using Intel Optane
- Move containers to Portainer
- Build Kubernetes (k8s) cluster
- Set up Nextcloud, HomeAssistant
- Upgrade OpenVPN and add support for WireGuard
- Set up Jenkins CI/CD for local development pipelines
- Build Proxmox Infrastructure as Code using Terraform and Packer
- Add Observability Tools - Grafana, Prometheus, Loki, Graylog, etc

Project Ideas and Suggestions Welcome!
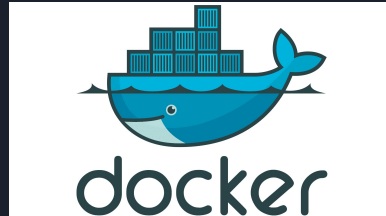
Advice & Recommendations

- Before buying hardware, plan out what you really need it for
- Think about where your bottlenecks will be
- Ask yourself if you really need to run this at home
- Dedicated cooling and power may be needed
- Plan for increased noise, power usage, and heat
- Experiment in the cloud if possible
- Consumer grade hardware may sometimes be a reasonable tradeoff
- Make sure to have a backup plan. RAID is not a backup!

RIP
PERC H730 MINI

Resources

- The Homelab Show   https://thehomelab.show/
- Lawrence Systems   https://lawrencesystems.com/
- Level 1 Techs   https://level1techs.com/
- Crosstalk Solutions   https://www.crosstalksolutions.com/
- Serve The Home   https://www.servethehome.com/
- Reddit: /r/selfhosting, /r/datahoarder, /r/homelab, /r/homelabsales