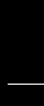


Homeserver using Proxmox and TrueNAS Scale

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BLU – March 2024



I needed a new server ...



For what?

- NAS
- NextCloud
- Host VMs
 - Home Assistant
 - Unifi controller
 - Testing

Hypervisor choices

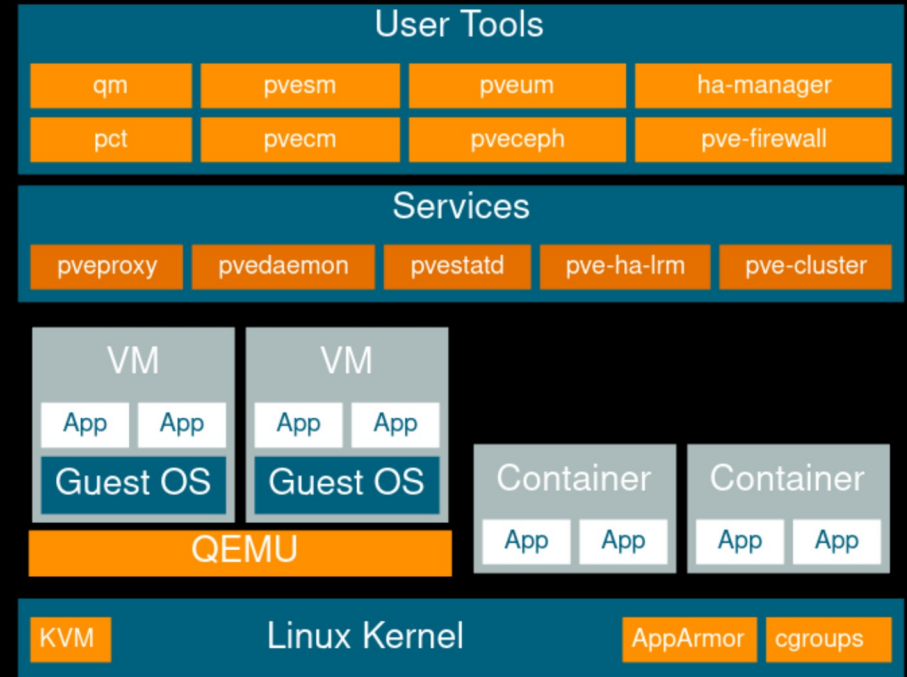
- Proxmox VE
- VMWare ESXi
- Xen
- DIY: Debian + KVM + virt-manager

Proxmox VE

- Based on Debian with a custom Linux kernel and a web interface
- Maintained by Austria based company
- All code is under GNU AGPLv3 license
- Enterprise support available with a subscription
 - Also gives access to extra repositories
- Active development and community support

Proxmox VE structure

- Uses KVM for full virtualization (Type1 hypervisor)
- Can also host containers using LXC



Major Proxmox VE features

- Both web-based and CLI control interface
- Allows clustering of nodes as well as live migration of VMs from one node to another
- Advanced network configurations, including bridged network, per VM VLANs, more advanced routing
- Flexible storage options: LVM, SMB/CIFS, Ceph etc.

Web GUI

PROXMOX Virtual Environment 8.1.3

Server View: Node 'pve-demo5'

Package versions

Summary: pve-demo5 (Uptime: 20:25:38)

- CPU usage: 8.90% of 2 CPU(s)
- IO delay: 0.19%
- Load average: 0.01, 0.18, 0.26
- RAM usage: 30.13% (2.91 GiB of 9.67 GiB)
- KSM sharing: 0 B
- / HD space: 22.08% (5.59 GiB of 25.33 GiB)
- SWAP usage: 0.00% (0 B of 7.87 GiB)

CPU(s): 2 x AMD Ryzen 7 2700X Eight-Core Processor (1 Socket)
Kernel Version: Linux 6.5.11-4-pve (2023-11-20T10:19Z)
Boot Mode: EFI (Secure Boot)
Manager Version: pve-manager/8.1.3/b46aac3b42da5d15
Repository Status: Proxmox VE updates, Production-ready Enterprise repository enabled

Server load: Load average graph showing peaks around 0.5-0.6.

Memory usage: Total memory usage graph showing approximately 3.5 GiB used.

Network traffic: netin, netout graph showing 3.5 M.

Tasks Cluster log

Start Time	End Time	Node	User name	Description	Status
Nov 23 11:36:01		pve-demo5	root@pam	Shell	
Nov 23 11:38:45	Nov 23 11:38:46	pve-demo1	root@pam	VM 100 - Start	Error: start failed: QEMU exit...
Nov 23 11:38:33	Nov 23 11:38:35	pve-demo5	root@pam	VM 100 - Migrate	OK
Nov 23 11:38:20	Nov 23 11:38:22	pve-demo1	root@pam	VM 108 - Migrate	OK
Nov 23 11:38:04	Nov 23 11:38:04	pve-demo1	root@pam	VM 108 - Start	Error: cannot prepare PCI pa...

My machine

PROXMOX Virtual Environment 8.1.4 Search

Documentation Create VM Create CT root@pam

Server View Node 'pmax'

Reboot Shutdown Shell Bulk Actions Help

Datacenter (moxie)

- pmax
 - 100 (TrueNAS)
 - 101 (unifi)
 - 102 (tbox)
 - 103 (HomeA)
 - localnetwork (pmax)
 - local (pmax)
 - local-lvm (pmax)

Search

Package versions

Hour (average)

Summary

Notes

Shell

System

Network

Certificates

DNS

Hosts

Options

Time

Syslog

Updates

Repositories

Firewall

Disks

- LVM
- LVM-Thin
- Directory
- ZFS

Ceph

Replication

Task History

Subscription

Summary

pmax (Uptime: 19 days 07:41:17)

CPU usage	1.94% of 12 CPU(s)	IO delay	0.00%
Load average	0.30,0.38,0.41		
RAM usage	74.78% (46.64 GiB of 62.37 GiB)	KSM sharing	717.51 MiB
/ HD space	34.39% (32.30 GiB of 93.93 GiB)	SWAP usage	0.00% (0 B of 8.00 GiB)

CPU(s) 12 x Intel(R) Xeon(R) W-2135 CPU @ 3.70GHz (1 Socket)

Kernel Version Linux 6.5.13-1-pve (2024-02-05T13:50Z)

Boot Mode EFI

Manager Version pve-manager/8.1.4/ec5a1fc9e41f1d79

Repository Status ✔ Proxmox VE updates ⚠ Non production-ready repository enabled! ▶

Server load

Load average

Memory usage

Total RAM usage

NAS choices

- TrueNAS Scale or Core
- Open Media Vault (OMV)
- Unraid
-

TrueNAS



- Maintained by iX Systems
 - Interesting history behind the company
- There are two main products
 - TrueNAS Core: from original FreeNAS, based on FreeBSD
 - TrueNAS Scale: based on Debian, announced in 2020 and was in beta till 2022

- Both use ZFS as primary filesystem



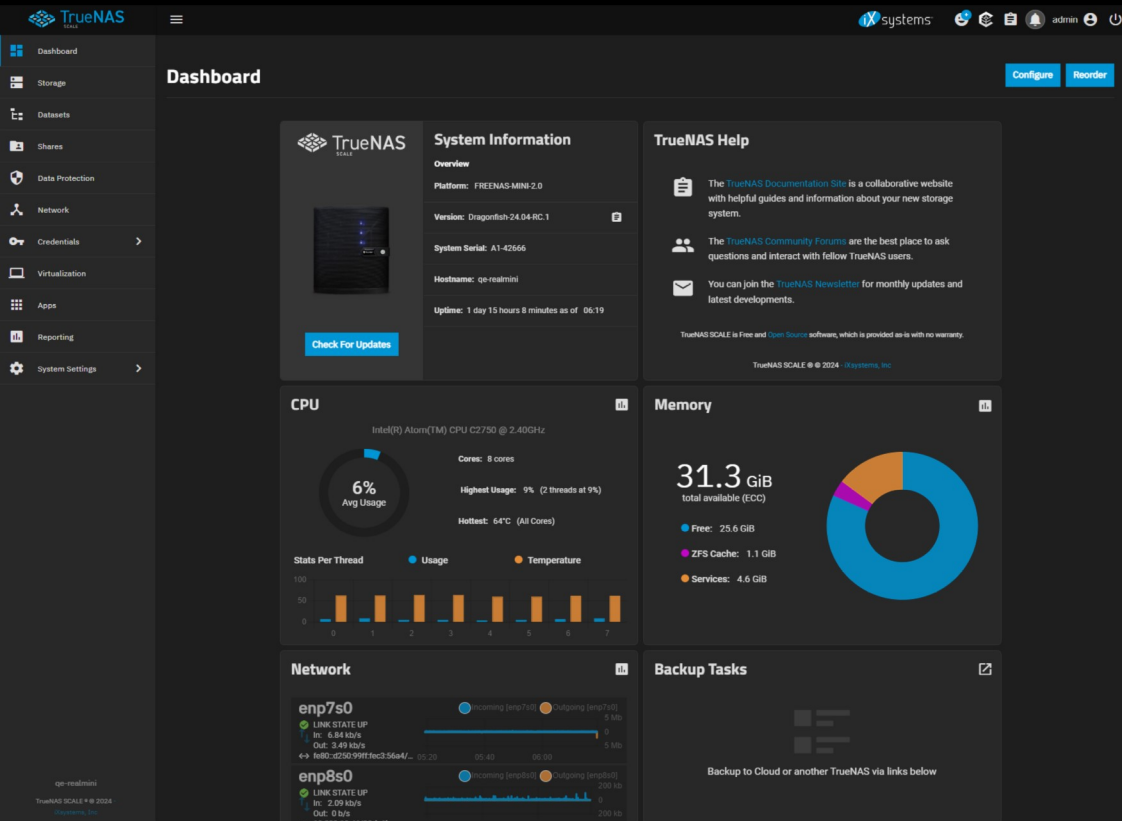
Feature comparison

	Enterprise	CORE	SCALE
Virtualization	Citrix, Veeam, vCenter Plugin, Built-in KVM / Kubernetes	bhyve	Built-in KVM, Kubernetes
GPUs for VMs & Apps	On Request	No	Yes
File Protocols	SMB v1/v2/v3, NFS v3/v4, AFP, FTP, WebDAV, rsync, GlusterFS	SMB v1/v2/v3, NFS v3/v4, FTP, WebDAV, rsync	SMB v2/v3, NFS v3/v4, FTP, rsync, GlusterFS
Multi-Channel SMB	Yes (23.10)	No	Yes
Block Protocols	iSCSI with VAAI support, Fibre Channel	iSCSI with VAAI support	iSCSI with VAAI support
Object Protocols	S3-Compliant API, Minio clustering, Multitenancy, Cloud Sync	S3-Compliant API, Minio single node, Cloud Sync	S3-Compliant API, Minio clustering, Multitenancy, Cloud Sync
Base OS	FreeBSD (13.0) or Linux (23.10)	FreeBSD	Debian Linux
FIPS 140-2 Security	Yes, with KMIP management	No	No
Deployment Services	Deployment Assistance & Performance Tuning + Proactive Monitoring option	Self-deployment	Self-deployment

TrueNAS SCALE

Filesystem	Open ZFS
Configurations	Single disk, Stripe, Mirror, RAIDZ1/Z2/Z3
Snapshots	Incremental (uses Copy-on-Write)
Replication	ZFS replication, rsync, Syncthing
Reduction	Inline compression, Deduplication
Acceleration	ZFS Caching (ARC, L2ARC)
Data protection	Checksum allows detection and repair of data corruption
Encryption	Optional, at disk, pool, or dataset level

TrueNAS Web & CLI interface



Enter an option from 1-9:

- 1) Configure network interfaces
- 2) Configure network settings
- 3) Configure static routes
- 4) Reset root password
- 5) Reset configuration to defaults
- 6) Open TrueNAS CLI Shell
- 7) Open Linux Shell
- 8) Reboot
- 9) Shutdown

Enter an option from 1-9: 6

Type "ls" (followed by Enter) to list available configuration options

```
[truenas]>
```

Why not TrueNAS Scale as host?

- VM management not as streamlined as Proxmox
- Uses up all of boot disk for itself – no easy way to use that disk space for guest VM images
- Setting up NAS on different VLAN was easier with Proxmox as host

What hardware?

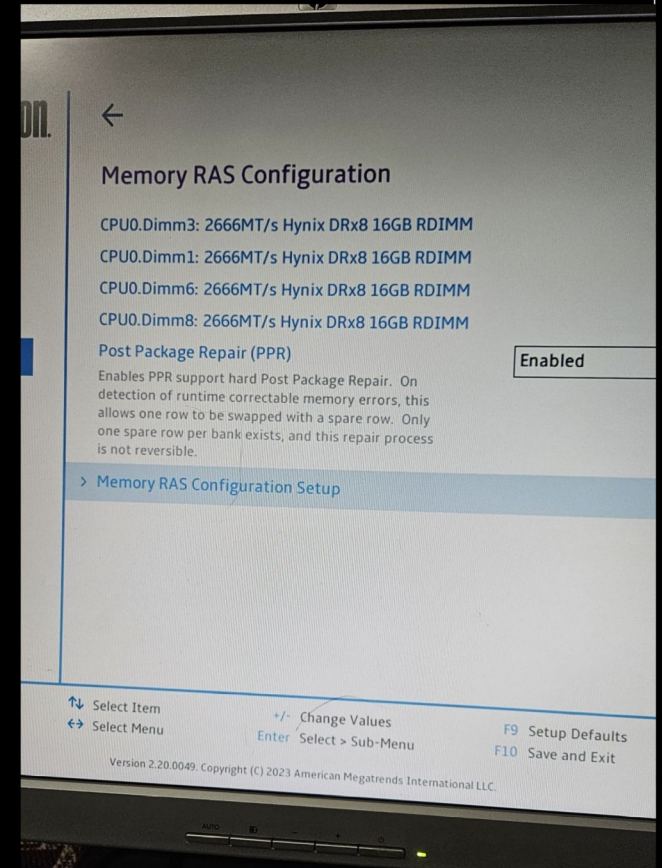
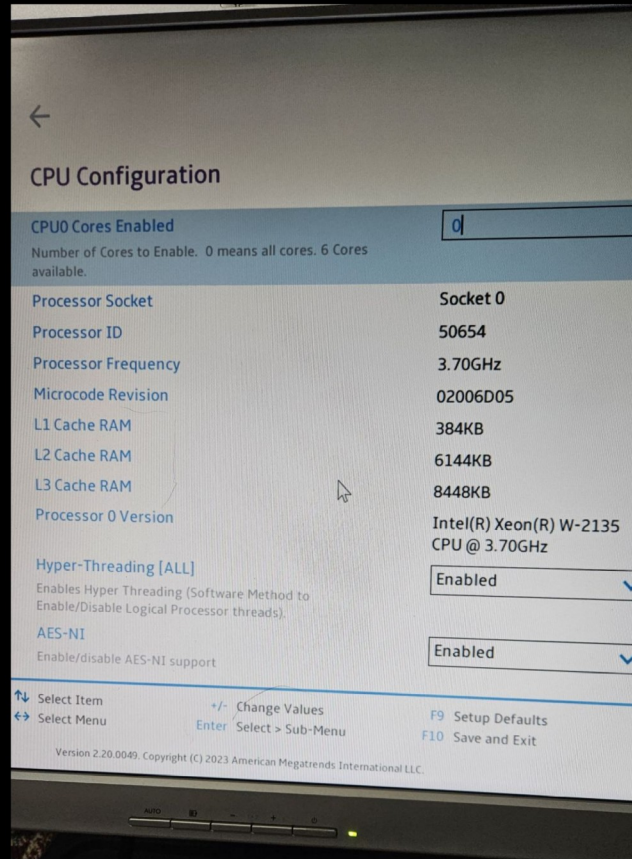
HW Requirements

- Need x86-64 chip with 4 to 8 cores
- Intel VT-d/AMD-IOMMU support for PCIe passthrough
- \geq 48GB of ECC RAM
- 2 or 3 open PCIe slots, at least one x16 slot
 - Support for PCIe bifurcation (preferably)
- M.2 NVMe and SATA ports
- Used HW for lower cost, help environment

The machine: ThinkStation P520



Machine (contd.)



Storage

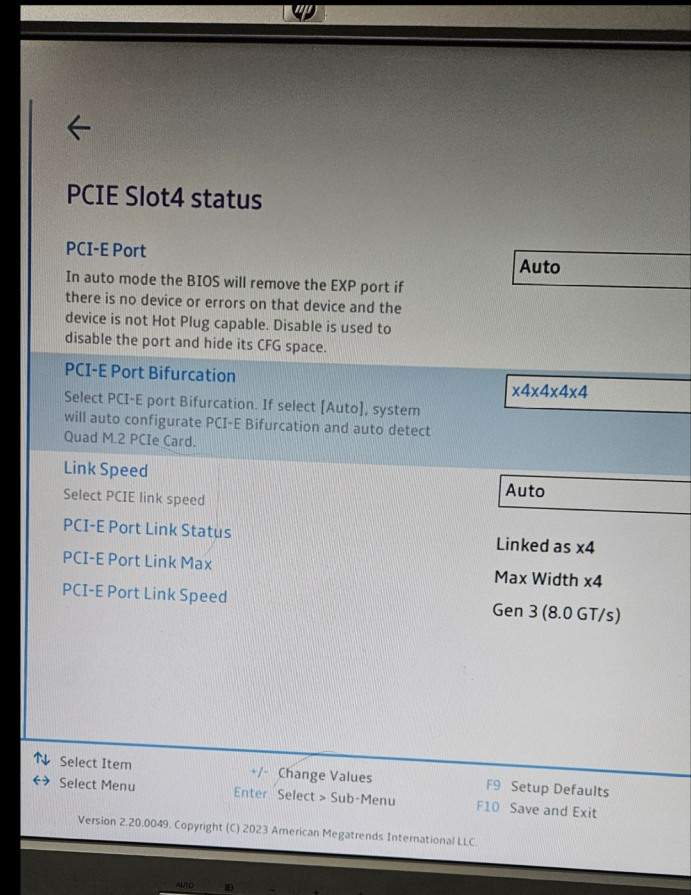


All additional parts



PCIe bifurcation

- Allows division of a single PCIe slot into multiple links
 - e.g. x16 slot into four x4 links
- Enables multiple M.2 drives to connect via independent x4 links
- Needs support in the motherboard and BIOS



M.2 to PCIe adapter



Usage

- NextCloud running in a container within TrueNAS VM
 - Syncs files to laptops/desktops and pictures/videos from phones (about 8 clients, not all on simultaneously)
- Some directories NFS mounted to desktop
- HomeAssistant continuously logging data from solar inverter, “smart plugs”, other sensors
- Test VMs fired up as needed

Power & Performance

- Large file transfers from the NAS VM limited by Gbe rate
 - No complaints from family
- Can switch to 10Gbe when need arises and budget allows
- Power draw is about 65W on average, varying between 50W and 150W
 - Approx. 50c a day at current rates

Thank you!