WHY I NEED A NAS?

What is a NAS? What are the Benefits? What do I use mine for?

Welcome

- Who am I?
  - Jonathan A Burt BSc Cert Mgmt HND FIAP IEng MBCS CITP
    - Batchelor of Science Degree (Open)
    - Professional Certificate in Management
    - Higher National Diploma in Computing
    - Fellow of the Institute of Analysts and Programmers
    - Incorporated Engineer with the Engineering Council
    - Member of the British Computer Society
    - Charted IT Professional
    - PRINCE2 Practitioner
    - Certified Novell Administrator (v5.x)
  - 25+ years experience of working in IT, now retired.
  - Long time member of the Isle of Wight PC User Group!


Warning!

- As with all my talks, I recommend that you do you own research before making any changes to your PC.

- Also, please ensure you have backed up all of your data before you make changes to your PC.

What is a NAS?

- Network Attached Storage (NAS) is dedicated file storage that enables multiple users and devices to retrieve data from a centralised disk capacity.
- Users on a local area network (LAN) access the shared storage via a standard Ethernet (or wireless) connection.
- NAS devices typically are headless, i.e. they do not have a keyboard or monitor, and are configured and managed via browsers or a bespoke utility.
- Each NAS resides on the LAN as an independent network node, defined by its own unique Internet Protocol (IP) address.

So what did that mean?

- Basically a NAS is a server with a motherboard, processor, RAM and a lot of hard drives!

Not Just Storage Anymore!

- However, things have moved on and NAS boxes can now offer extra features.
- Generally, for large businesses, a NAS is just a plain simple NAS, i.e. just storage. This is because they often have the infrastructure to have separate servers for each business requirement.
- However, for small businesses and home users a NAS can offer a whole lot more.

Not Just Storage Anymore!

- For example FreeNAS (which I use) supports:
  - SSH access
  - S.M.A.R.T. management
  - Data Compression, Encryption, Deduplication
  - Snapshots
  - User Quotas
  - Login Account management
  - Replication with fallover/failover protection
  - Multiple network protocols: Samba/SMB/CIFS (for Microsoft and other networks), AFP (Apple), NFS (UNIX/Linux), FTP
  - UPS support
  - Jail and Virtual Machine technology (to run what you like)
  - as well as over 20,000 packages and ports available and able to be installed from FreeBSD repositories (within Jails)
  - Plugins (pre-configured Jails)
  - and more….

So why do I have a NAS?

- I wanted a central place to store documents, thus offering protection form PC failures, viruses and other malware.
- An easy way to backup all data from all PCs, Laptops and Mobile Phones whether at home or elsewhere.
- A way for my brother and sister to backup their computers to my NAS for off-site backup of their data.
- To have a Media Server.
- To run other server “toys” from home.

My First NAS

- My first NAS (in 2015/16) was a Netgear ReadyNAS 210, which was a simple small NAS, with the following specification:
  - 2GB RAM
  - Supported up-to 4 hard-disks
  - ARM processor
  - 1GB network port
  - Built-in Bespoke Virus Protection
  - User Account Management

NAS Solutions - Hardware

- There are various hardware and software solutions for a NAS. The following are all hardware based NAS solutions with their own NAS operating software:
  - Netgear
  - QNAP
  - Synology
  - Buffalo
  - Seagate
  - Western Digital

You can just buy their “NAS box” and plug-in your hard-drives.

NAS Solutions - Hardware

- However, these can have limitations, for example:
  - Low amount of RAM
  - Non ECC-RAM
  - Low Powered Processors
  - Limited “NAS” functionality
  - Limited “add-on” functionality
  - Non-NAS specific hard-drives
  - “cheap” build

NAS Solutions - Software

- There are also a selection of Software based NAS solutions, which you can install onto your own hardware, for example:
  - FreeNAS
  - XigmaNAS (previously NAS4Free)
  - OpenMediaVault
  - Openfiler
  - Rockstor
  - Nexenta Community Edition

Why did I choose FreeNAS?

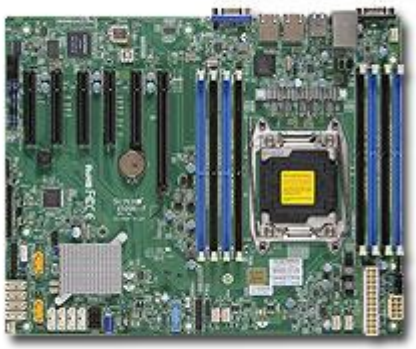
- FreeNAS is the most popular free and open source NAS operating system that has enterprise-class features and enterprise-ready ZFS (OpenZFS) open source file system.
- Backed and mainly developed by a well-known NAS provider iXsystems.
- It can be installed virtually (on VMware ESXi) as well as on hardware to create a centralized data environment.
- The interface it provides is very intuitive (web interface).
- Besides this, it has various options for installing additional software packages, i.e. plugins, Jails, Virtual machines.

Hardware – Case & PSU

- I went for a known supplier of quality server cases, and purchased a SuperMicro SuperChassis 745TQ-R920B.
- This server supported hot-swap on the Fans, Data Hard-Disks and PSUs.
- It also has a 920W Redundant Platinum Level Certified High-Efficiency Power Supply.

Hardware – Motherboard

- I also went for a known supplier of quality server motherboards, and purchased a SuperMicro X10SRi-F.
- This motherboard supported the Xeon processor and up-to 1TB of ECC-RAM, it also had two 1GB network ports, a dedicated IPMI port, and 10 SATA3 (6Gbps) connections for the hard-drives.
- The motherboard was also one the server case supported.

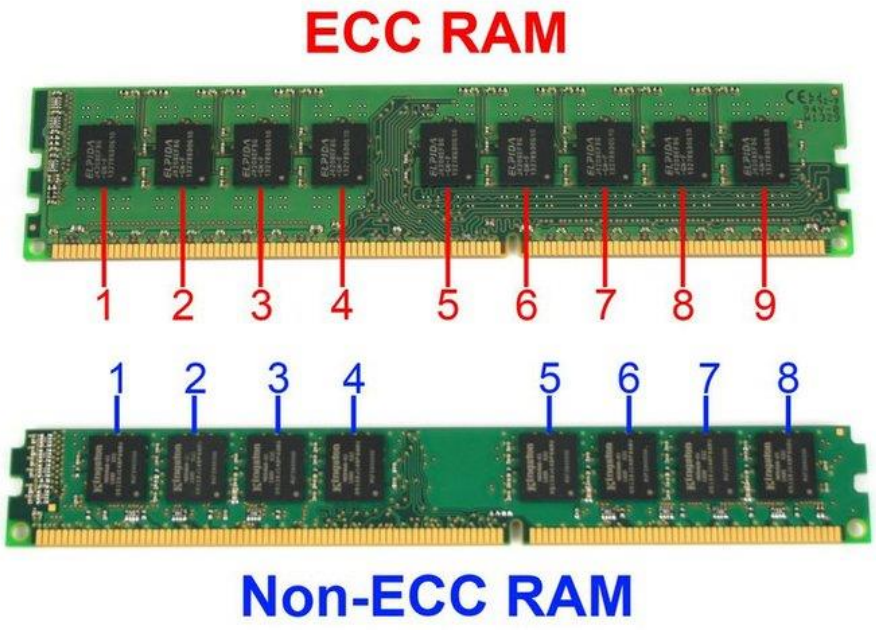


Hardware – CPU

- I wanted a powerful dedicated server processor and went for the Intel Xeon E5-1650 v4.
- This 64bit processor has 6 cores and 12 threads running at 3.6GHz, and it supports ECC RAM and has a large 15MB cache (which is built with ECC RAM).

Hardware – RAM

- I wanted to ensure I have a lot of fast RAM, and wanted to utilise ECC RAM – which the motherboard and processor supported. I opted for four Supermicro 32GB DDR4 2400MHz ECC chips.

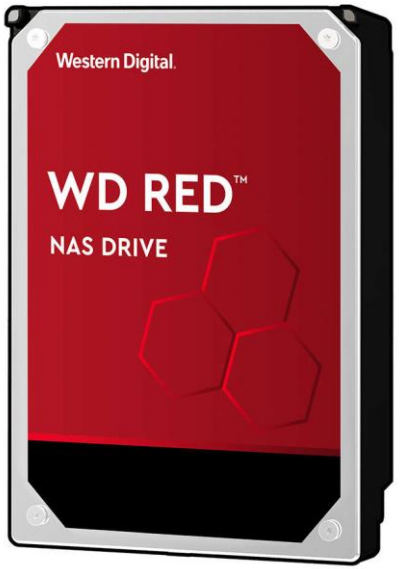


Hardware – Boot Drive

- FreeNAS works by having the operating system on one drive(s) and the data on another – thus keeping the data safe from any issues with the boot drive(s). Very useful when you get errors during an upgrade process.
- I wanted a fast boot drive which was at a server level performance and reliability specification, and went for a Micron M510DC SATA 120GB Enterprise SSD.

Hardware – Data Drives

- In my old NAS I had just stuck in some of my old desktop hard-drives. For this one though I wanted NAS specific hard-drives (due to better performance and reliability).
- As such I went for the Western Digital “Red” drives, as these are built specifically for NAS use. I use eight 8TB drives.



Hardware – UPS

- To protect my server I wanted an Uninterruptable Power Supply (UPS), and purchased the APC Smart-UPS 1500VA LCD 230V. This protects the server from power failures and power spikes.
- I have also connected my network switch and broadband router to the UPS – this ensures that the server can still email me an alert in the event of power outages.

How much did it cost?

CASE & PSU: SuperMicro SuperChassis 745TQ-R920B	692.90
MOBO: SuperMicro X10SRi-F	288.52
CPU: Intel® Xeon® Processor E5-1650 v4 3.60GHz	769.28
CPU FAN: Supermicro 2U Passive CPU Heat Sink Socket LGA2011	20.32
RAM: 4* Supermicro 32GB DDR4 2400MHz ECC (£360.46 ea.)	1,441.84
BOOT DRIVE: Micron M510DC SATA 120GB Enterprise SSD	120.00
DATA DRIVE: 8* WD Red 8TB SATA III harddrives (£259.80 ea.)	2,078.40
UPS: APC Smart-UPS 1500VA LCD 230V	447.26
Build (inc. 3-year warranty) & Delivery	253.94
	£6,112.46

Testing Hardware

- Once the server arrived, I didn't just install FreeNAS and go-live. First I had to test the hardware and ensure everything worked as expected. I ran the following Tests:
  - Power-Up
  - Smoke Test
  - FAN Test
  - Redundant PSU tests
  - Boot Test
  - IPMI Port test
  - BIOS/IPMI Upgrades
  - UPS Test
  - RAM Stress Test (MemTest 86+)
  - CPU Stress Test (Mersenne Prime Test v28.5)
  - S.M.A.R.T. Tests
  - Destructive Data Test (Linux badblocks command)
  - FreeNAS Install (to test configuration and hardware)

My Setup – Hard-drives

- I mentioned earlier that I had eight 8TB data drives, which equates to 64TB of storage. However, one of the reasons of using a NAS is to protect your data in the event of a hard-disk failure.
- You do this by implementing RAID storage, and FreeNAS supports 5 types:
  - Stripe (RAID 0) – requires at least one disk
  - Mirror (RAID 1) – requires at least two disks
  - Raid-Z1 (RAID 5) – requires at least three disks
  - Raid-Z2 (RAID 6) – requires at least four disks
  - Raid-Z3 – requires at least five disks

Hard-Drive Storage Configuration

	Storage Available*	Configuration	Notes
Stripe	64TB	A group of 8 drives.	Most storage space, no data redundancy. A single drive failure will lead to complete data loss.
Mirror	32TB	4 pairs of drives (limited to 8TB storage per pair).	1 drive in each pair could fail before you lose your data (in that pair).
Raid-Z1	56TB	A group of 8 drives.	1 drive can fail before you lose your data.
Raid-Z2	48TB	A group of 8 drives.	2 drives can fail before you lose your data.
Raid-Z3	40TB	A group of 8 drives.	3 drives can fail before you lose your data. Least storage space, most data redundancy

*Storage Available is approximate as there is still some overhead which is used by the OS, for example SWAP space.

My Setup - Software

- I currently run the additional software on my NAS:
  - Windows 10 Pro (Virtual Machine)
  - Rclone (package)
  - ClamAV (Jail)
  - Syncthing (Jail)
  - Plex Media Server (Jail)
  - Rsync (on PC - .BAT backup)
  - Various shell scripts

The Future

- There are still a few things which I want to do, both to save money (i.e. hosting charges) and to make things easier for the family.

- The will either be Jails or Virtual Machines, depending on the requirements, and the things I'm looking at include:

  - Dynamic DNS
  - Web Server (for www.jaburt.com)
  - Email Server (for @jaburt.com)
  - FTP Server
  - Mine O/S (Minecraft Server)

A Final Word of Advice

- A NAS is very useful if you have many devices at home and wish to centralise your data storage (which in turn makes backup's easier).
- They have a steep learning curve, but in my view, well worth it once you have figured it out.
- Finally, I would strongly recommend you only use NAS specific disk-drives and ECC RAM.

Further Information

- Wikipedia
  - https://en.wikipedia.org/
- Lots of useful tutorials
  - http://www.howtogeek.com/
- TechRadar has a good selection of reviews.
  - http://www.techradar.com/
- FreeNAS
  - https://freenas.org/

Questions?

Does anyone have any questions?