Hillingdon u3a Computer Club

An Introduction to Network Attached Storage

October 2026

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What is Network Attached Storage

A Network Attached Storage or NAS

- File storage server connected to a computer network
- Typically, a mini computer that also runs applications
- Provides data access to any type of computer on that Network
- NAS therefore refers to both the technology and systems involved.

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What is Network Attached Storage

A Network Attached Storage or NAS

- Storage systems comprise multiple storage devices such as
  - Hard Disk Drives
  - Tape drives
  - With layers of software

All to create a reliable, high-performance system to dynamically share stored data among independent networked computers.

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What is Network Attached Storage











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History of Network Attached Storage

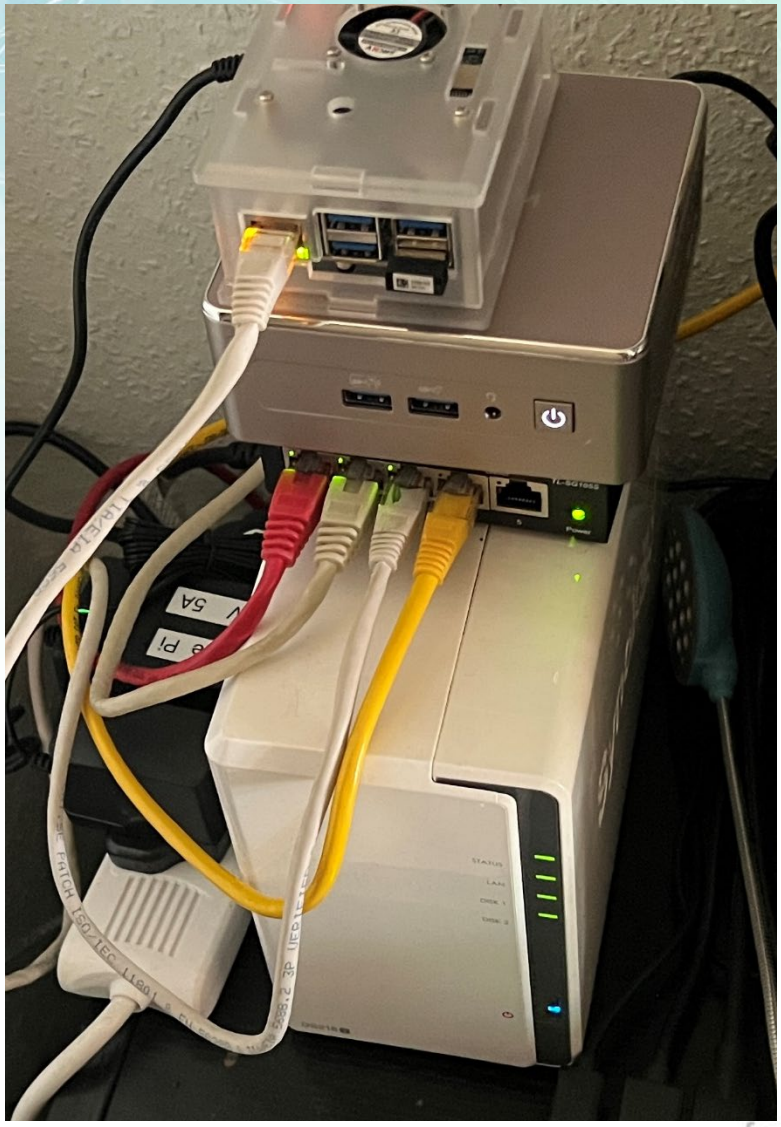
- Early 1980s saw Newcastle University demo a remote file access across a set of UNIX machines.
- Network companies saw the benefits and the NCP protocol was released in 1983.
- The NFS protocol was released in 1984
- 1990's saw the first Windows SMB & Unix NFS system
- 2000 saw the rise of NAS OS's
- 2009 saw integrated online backups
- 2021 saw hybrid cloud models



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A NAS in Real Life

My Synology 2-bay NAS

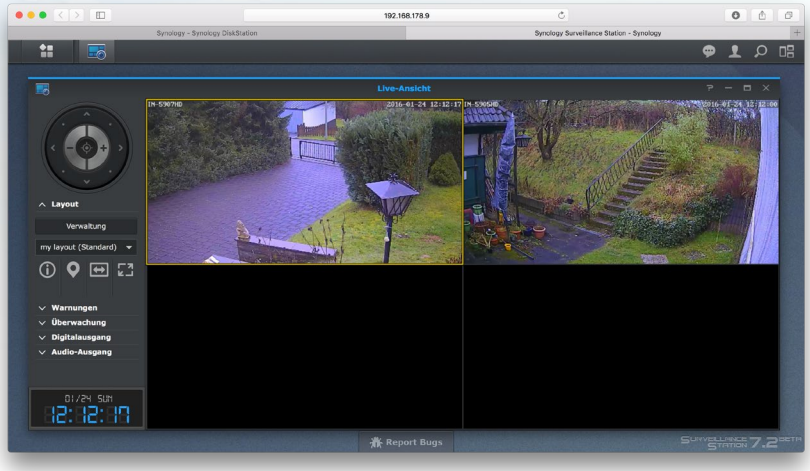


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Why did I need a NAS



- Front Door Security Camera
- Subscription
- Company folded
- Research led me to a NAS
- With a built-in application



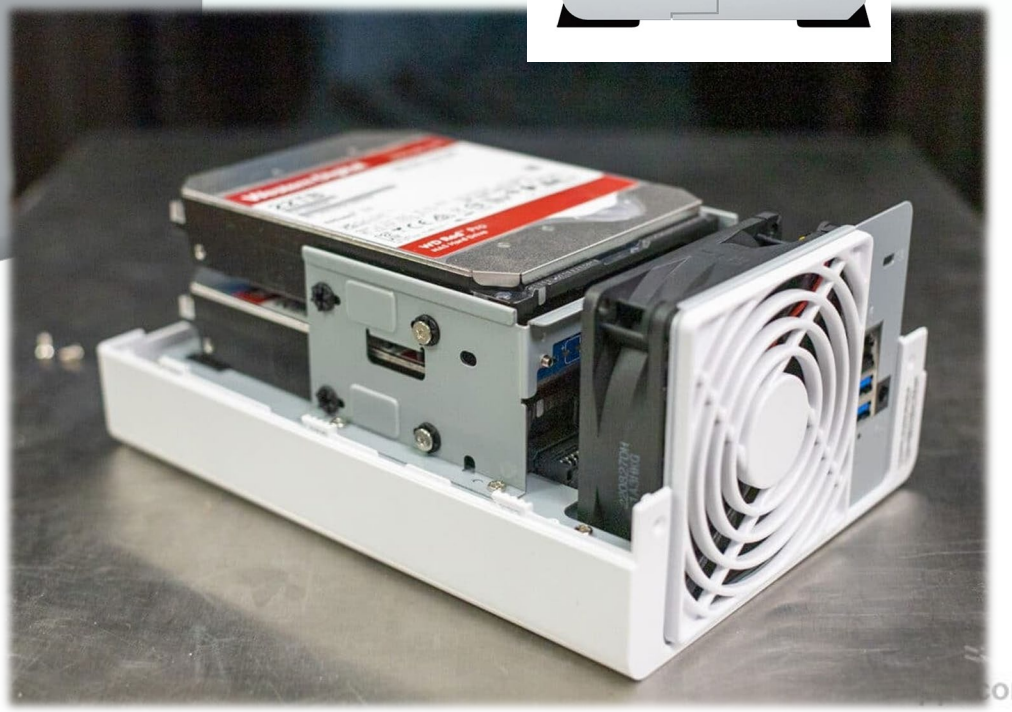


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Why did I need a NAS

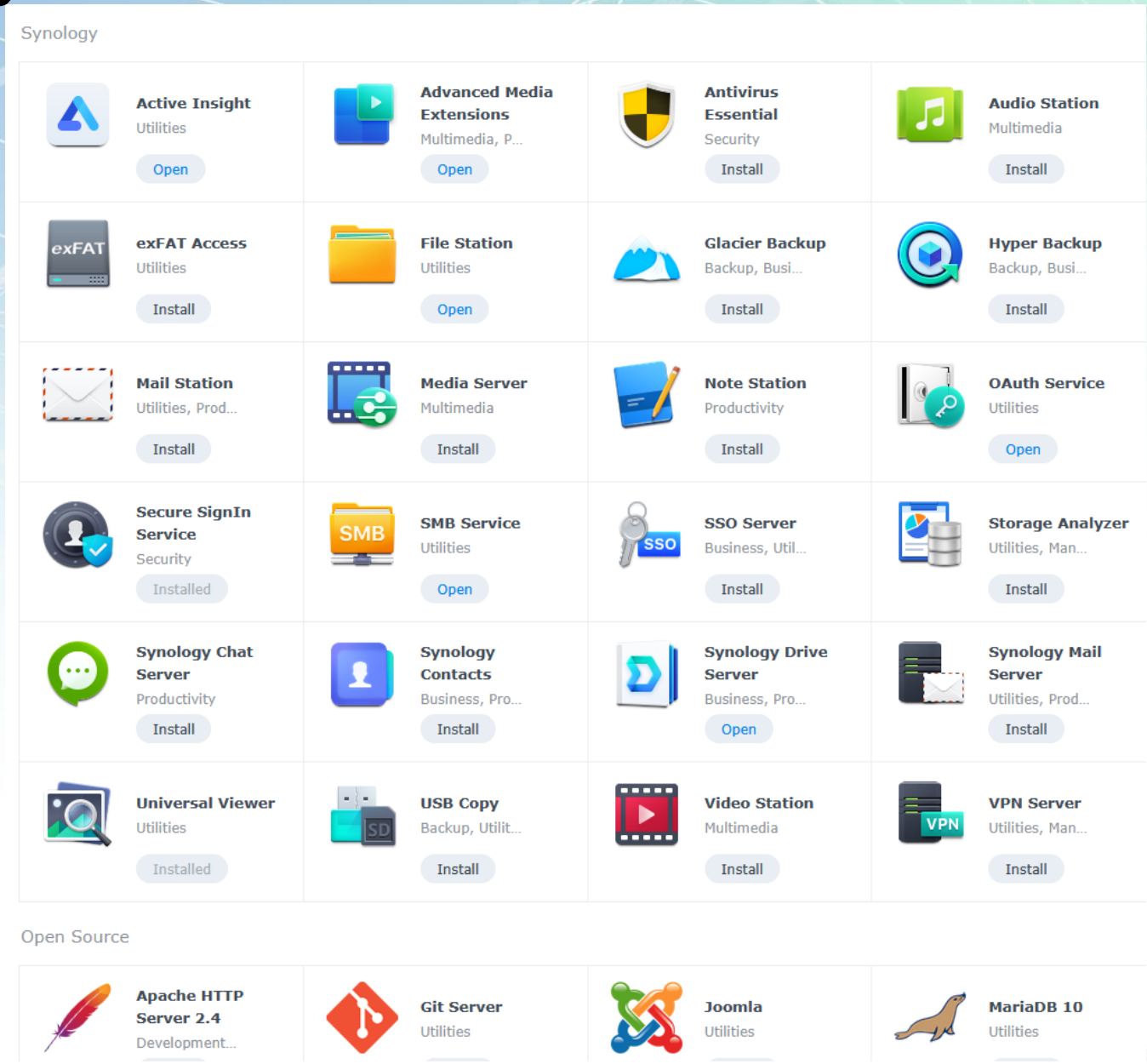






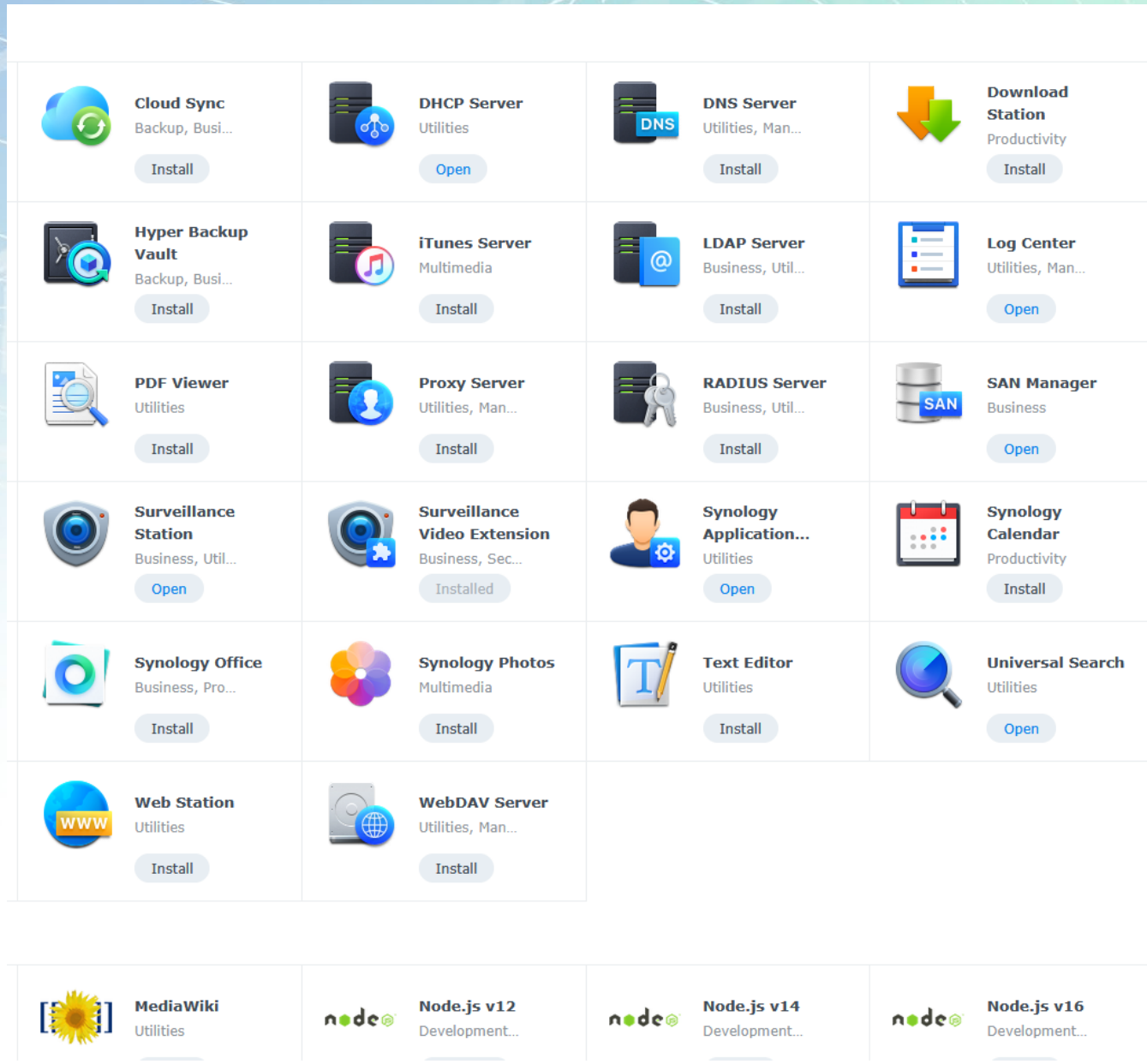
Why did I need a NAS

Built in Apps 1



Why did I need a NAS

Built in Apps 2



Why did I need a NAS

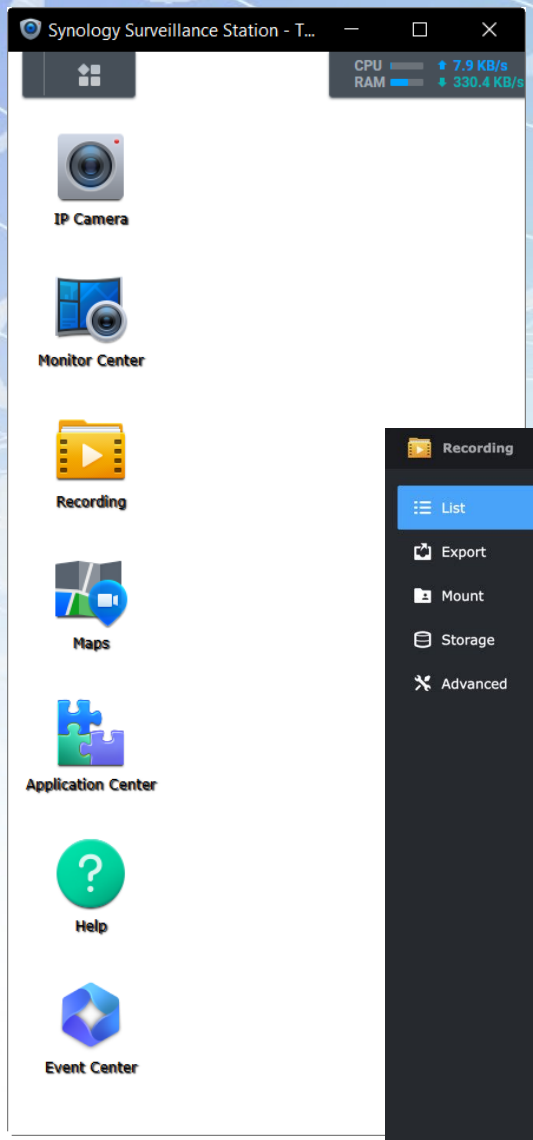


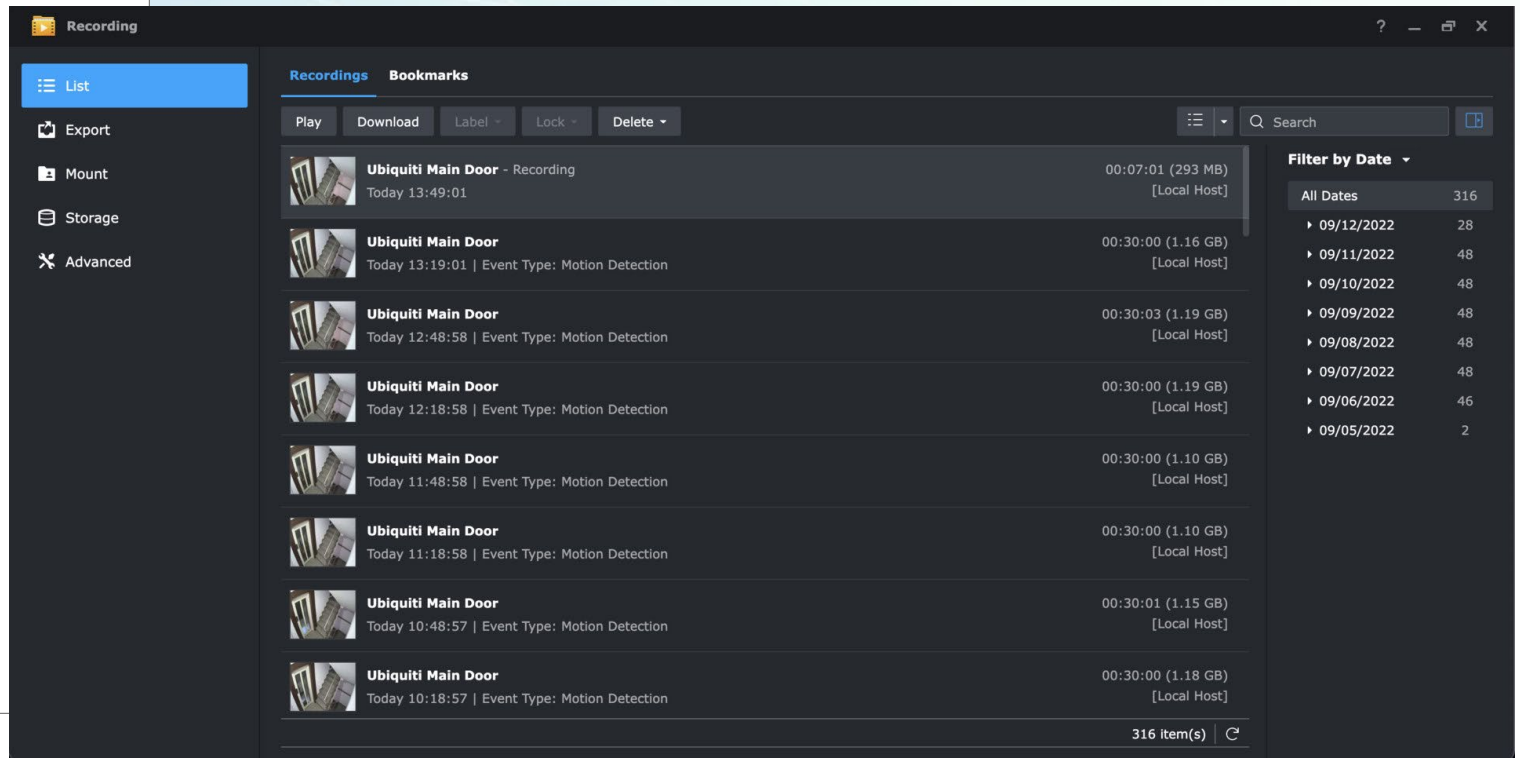
Front Door



Road View

Why did I need a NAS

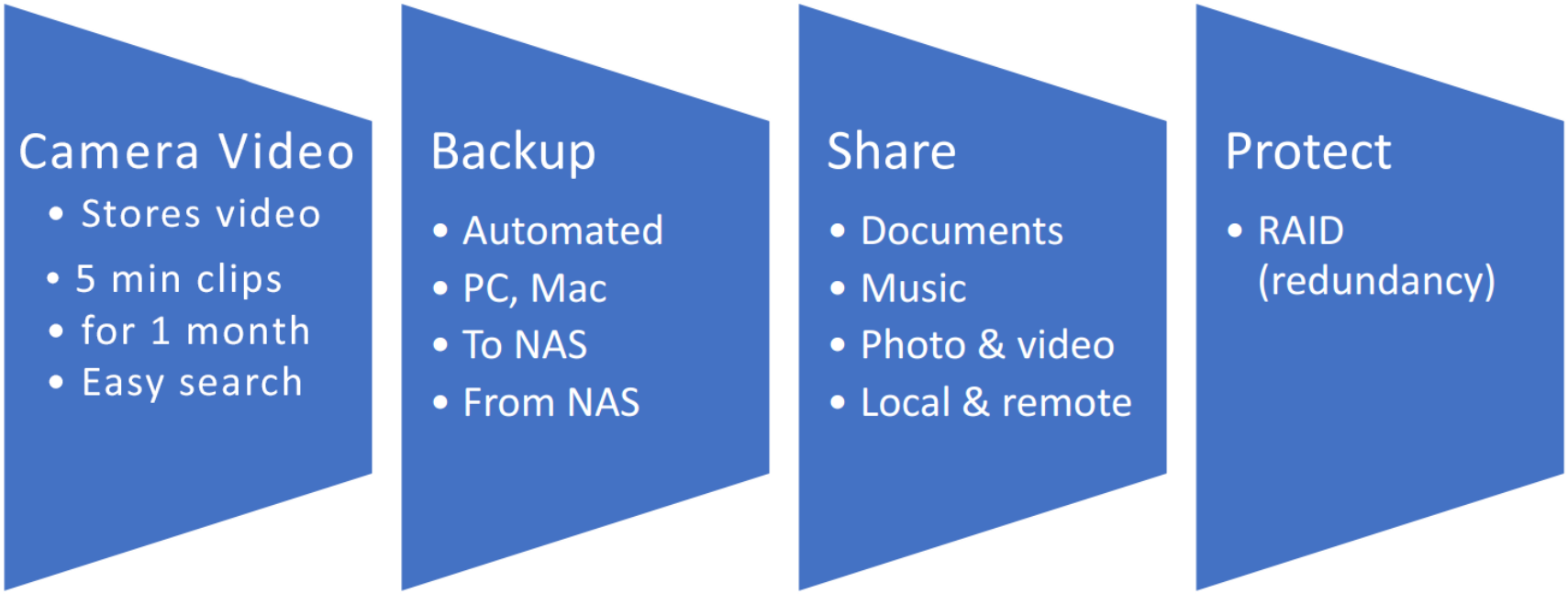




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Why did I need a NAS

What does it do for me?



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Why did I need a NAS

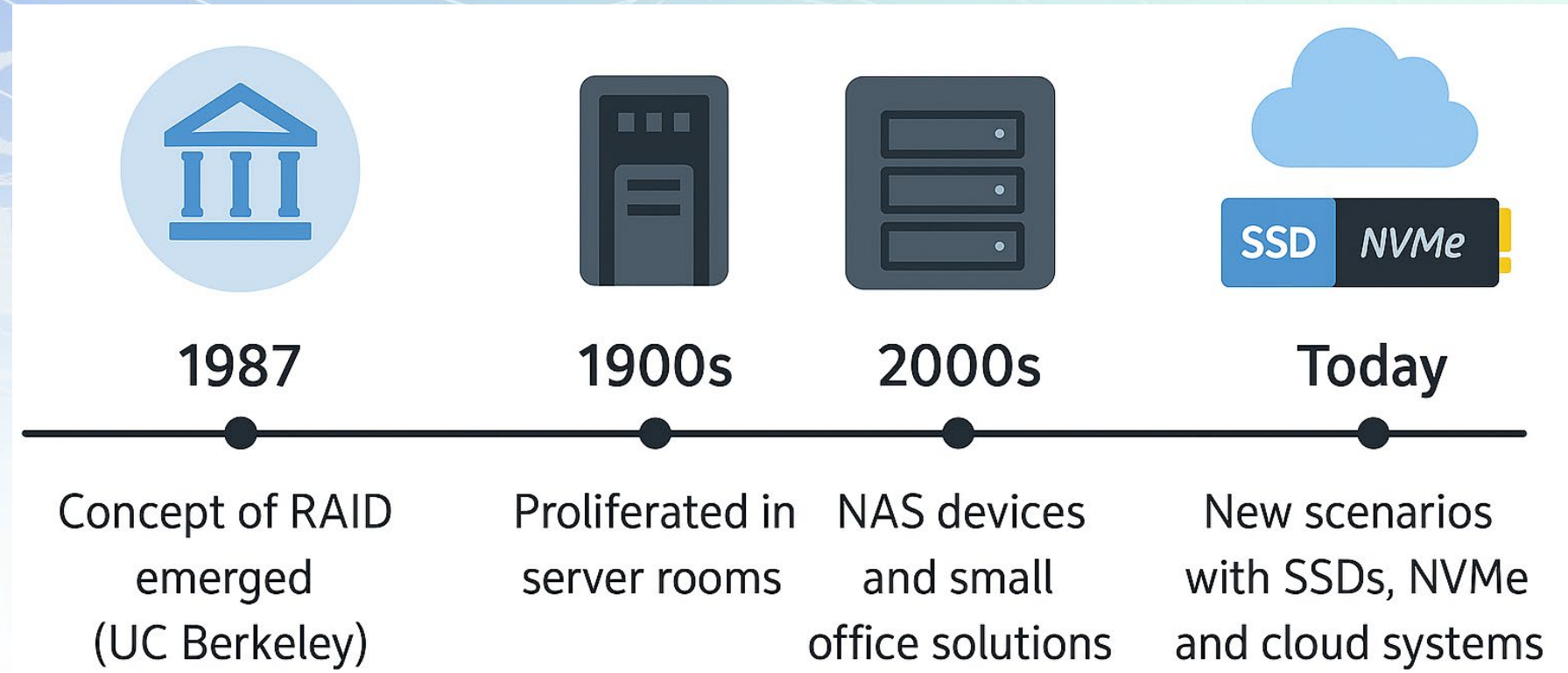
Best Synology Apps

- DS Video – Streams a video collection to Android or iOS
- Synology MailPlus – Run your own Mail Server
- DS Finder – Manage your NAS from a phone
- Synology Photos – Your own Google Photos
- Synology Notes Station – Create & sync notes to devices
- Synology Hyper Backup – Comprehensive Back Up App
- Virtual Machine Manager – Create Virtual Machines
- VPN Server – Have your own Virtual Private Network
- Surveillance Station – Manage security cameras
- Synology Drive – Your own Cloud Storage

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What is Raid

Redundant Array of Independent/Inexpensive Disks



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What is Raid

A method of combining more than one disk to get the benefit of redundancy and or speed

RAID 0: Data is **Striped** across disks. It's fantastic for speed. For example, video editing studios that handle large files often use it. But if even one disk fails, all data is lost. Risky but fast.

RAID 1: Data is **Mirrored** to two disks simultaneously. If one fails, the other continues. The downside is inefficient capacity: two disks give you the storage of just one.

RAID 5: Requires at least three disks. Data is **Striped,** and **parity** information is stored across disks. If one disk fails, parity can rebuild the missing data. It balances capacity and redundancy but can impact write performance.

RAID 6: Requires at least four disks and similar to RAID 5, but with double parity. Two disks can fail simultaneously without data loss. Popular in enterprise environments where resilience is critical.

RAID 10 (1+0): Requires at least four disks and combines RAID 1's redundancy with RAID 0's performance. Among professionals this is "the best if budget allows,".

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WHAT IS RAID?



REDUNDANT ARRAY OF INDEPENDENT DISKS

RAID 0

STRIPING





MAX SPEED

NO REDUNDANCY

RAID 1

MIRRORING





DATA PROTECTION

1 DISK FAILURE OK

RAID 5

STRIPING WITH PARITY



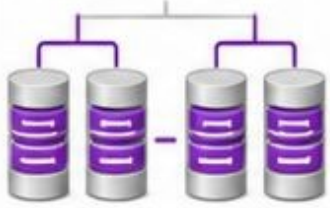


BALANCED

1 DISK FAILURE OK

RAID 10

STRIPED MIRRORS





HIGH PERFORMANCE

MULTIPLE FAILURES OK



NVMe SSD



HIGH PERFORMANCE



LARGE CAPACITY



DATA PROTECTION



99.9% UPTIME

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NAS for File Management

The main benefit of a NAS is a centralised file structure for storing, sharing and organising files over your network for multiple users to access.

These are managed with permissions and user management

Files can be easily backed-up.

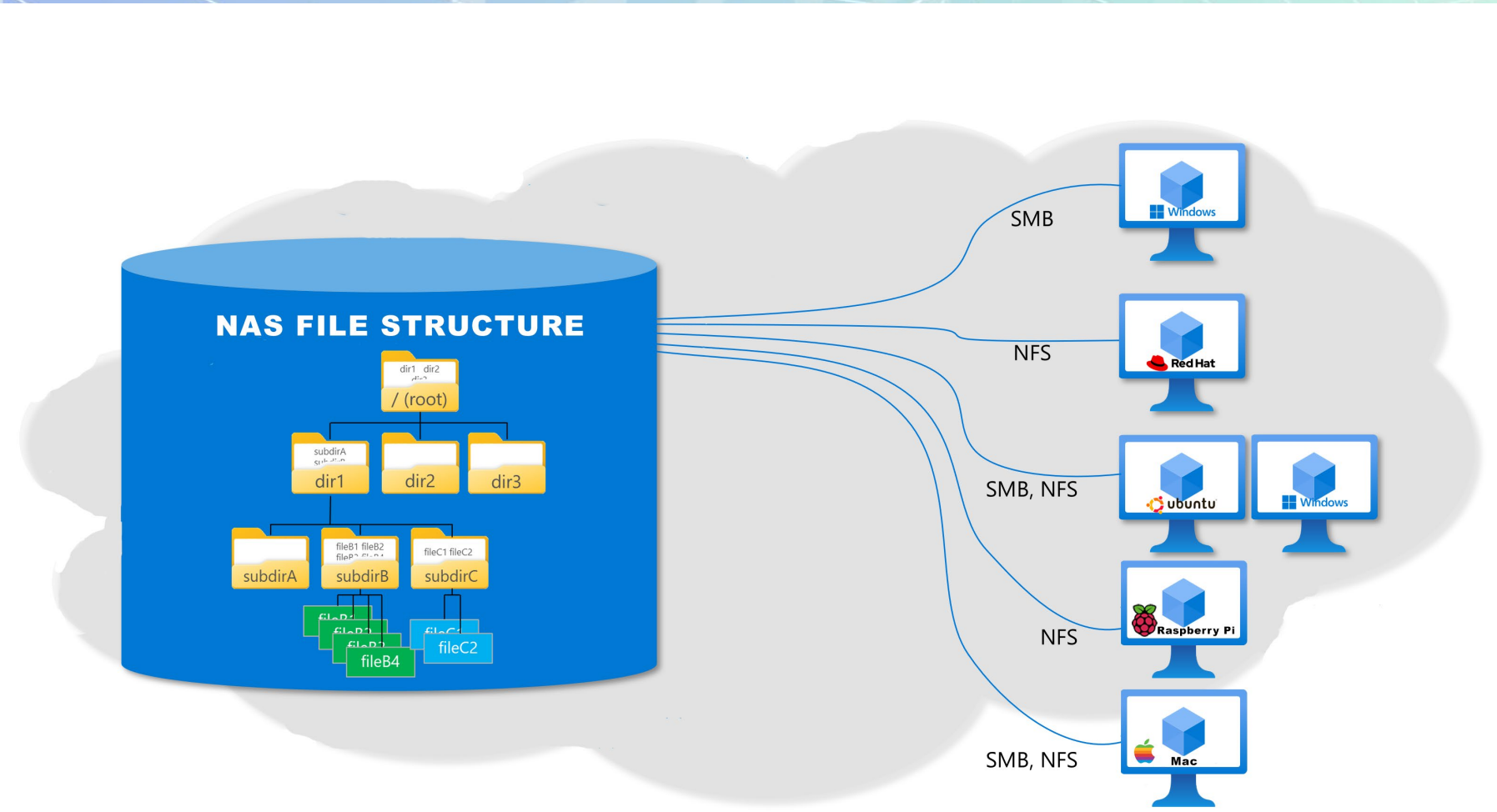
Typically accessed via a browser-based interface

Access is device transparent and by using protocols like NFS, SMB, gives compatibility across different operating systems.

Provides/ helps with storage space management

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NAS for File Management



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NAS Security

- NAS system uses strong cryptography to keep data secure
- NAS provides Physical security (it's in your house)
- NAS provides Network security (you control access on your network)
- NAS uses Access control Lists which should have strong passwords

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What's it Cost ?

My setup	NAS Options Today	Disks
• Synology DS218J • 2 x 2TB disks • RAID 1 =2TB usable • No paid-for software	• 2 Disk › DS223J £175 › £542 with 2 x 2TB • 4 Disk › DS423 £364 › £1,124 with 4 x 4TB	› £90 for 1 TB HDD › £130 for 2TB HDD › £170 for 4TB HDD › £313 for 8TB HDD

Consider a Refurbished NAS box but always use New disks

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Retail Options



UGREEN 2 bay
£190



QNAP 2 bay
£238



Buffalo 2 bay + 4TB
£253



Asustor 2 bay
£188



Ubiquiti 2 bay
£234

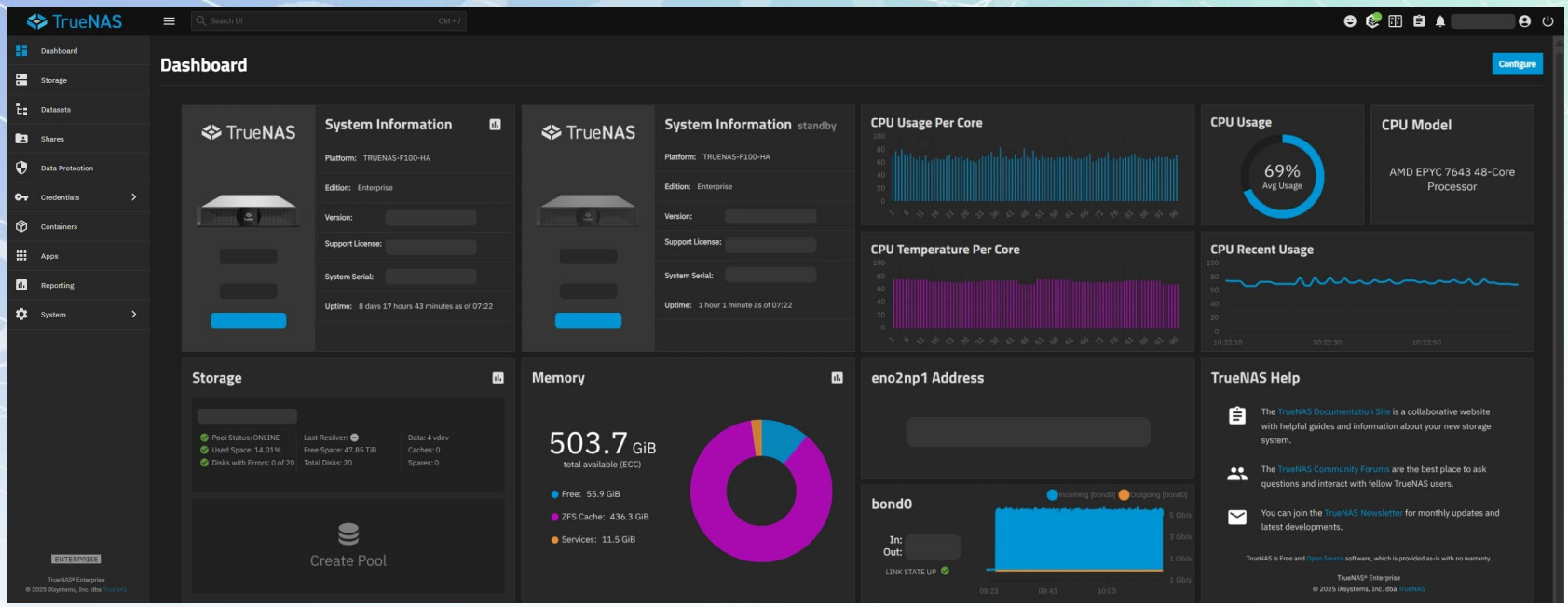
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Open Source (Free) Options

Feature	TrueNAS	XigmaNAS	OpenMediaVault	Rockstor	Amahi	TurnKey File Server	EasyNAS	ESOS
Base OS	FreeBSD/Linux	FreeBSD	Debian	CentOS/Alma Linux	Fedora	Debian	OpenSUSE	Linux (RAM-based)
File System	ZFS (CORE) / Btrfs (SCALE)	ZFS, UFS	EXT4, XFS, Btrfs	Btrfs	EXT4, XFS	EXT4, XFS	Btrfs	EXT4, XFS
Best For	Enterprise NAS & SAN	Advanced FreeBSD Users	Home & Small Business NAS	Linux & Docker Users	Home NAS & Media	Basic File Server	Simple Home NAS	Enterprise SAN (iSCSI, FC)
Web UI	✅ Yes	✅ Yes	✅ Yes	✅ Yes	✅ Yes	✅ Yes (Webmin)	✅ Yes	❌ No (CLI Only)
Docker Support	❌ (Only SCALE)	❌ No	✅ Yes	✅ Yes (Rock-ons)	✅ Yes	❌ No	❌ No	❌ No
RAID Support	✅ ZFS RAID	✅ ZFS RAID	✅ Software RAID	✅ Btrfs RAID	✅ Disk Pooling	✅ Software RAID	✅ Btrfs RAID	✅ Hardware & Software RAID
Snapshot Support	✅ Yes (ZFS/Btrfs)	✅ Yes (ZFS)	✅ Yes (Btrfs)	✅ Yes (Btrfs)	❌ No	✅ Yes (Duplicity)	✅ Yes (Btrfs)	❌ No
Ease of Use	⭐⭐⭐ (Medium)	⭐⭐⭐ (Medium)	⭐⭐⭐⭐ (Easy)	⭐⭐⭐ (Medium)	⭐⭐⭐⭐ (Easy)	⭐⭐⭐ (Medium)	⭐⭐⭐⭐ (Easy)	⭐ (Advanced – CLI Only)
Open-Source	✅ Yes	✅ Yes	✅ Yes	✅ Yes	✅ Yes	✅ Yes	✅ Yes	✅ Ye

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TrueNAS



Considered one of the best and been around as FreeNAS since 2009.

Runs on any 64 bit hardware as a Linux application

Runs on a Virtual Machine (VirtualBox or a Docker container)

Runs on a Raspberry Pi

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An Introduction to Network Attached Storage

The End

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