napp-it

napp-it cs
Client Server Edition

ZFS Storageserver GUI
for (m)any ZFS server

Windows All in One
Barebone NAS and VM server

unique selling points:
- Usability
- Storage Spaces (pool disks of any size)
- OpenZFS (nearly ready)
- Fine granular ntfs ACL + inheritance
- SMB groups (groups in groups)
- Storage web-gui napp-it cs (opt)

Windows Server (Essentials):
- SMB Direct (SMB with 3-10Gbyte/s)
- Active Directory

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Howto

other manuals
https://www.napp-it.org/doc/downloads/napp-it_cs.pdf

https://www.napp-it.org/doc/downloads/freebsd-aio.pdf
https://www.napp-it.org/doc/downloads/osx-aio.pdf
https://www.napp-it.org/doc/downloads/proxmox-aio.pdf
https://www.napp-it.org/doc/downloads/windows-aio.pdf

TL;DR

too long; didn't read

ZFS Server with web-gui on Windows in 3 steps

Step1: Download napp-it cs web-gui with xampp

http://www.napp-it.org/doc/downloads/xampp.zip

- unzip and copy folder xampp to c:\ (c:\xampp, initial setup or update)

- install Smartmontools (Windows installer)
  with an optional gui https://gsmartcontrol.shaduri.dev/

Step 2: Start web-gui as administrator

„C:\xampp__start_zfs-gui_as_admin.bat"

Step 3: Web manage your server

Open a browser with url http(s)://ip (ip or dns name of Windows)
and select „localhost" to manage Windows or any other server in a group.

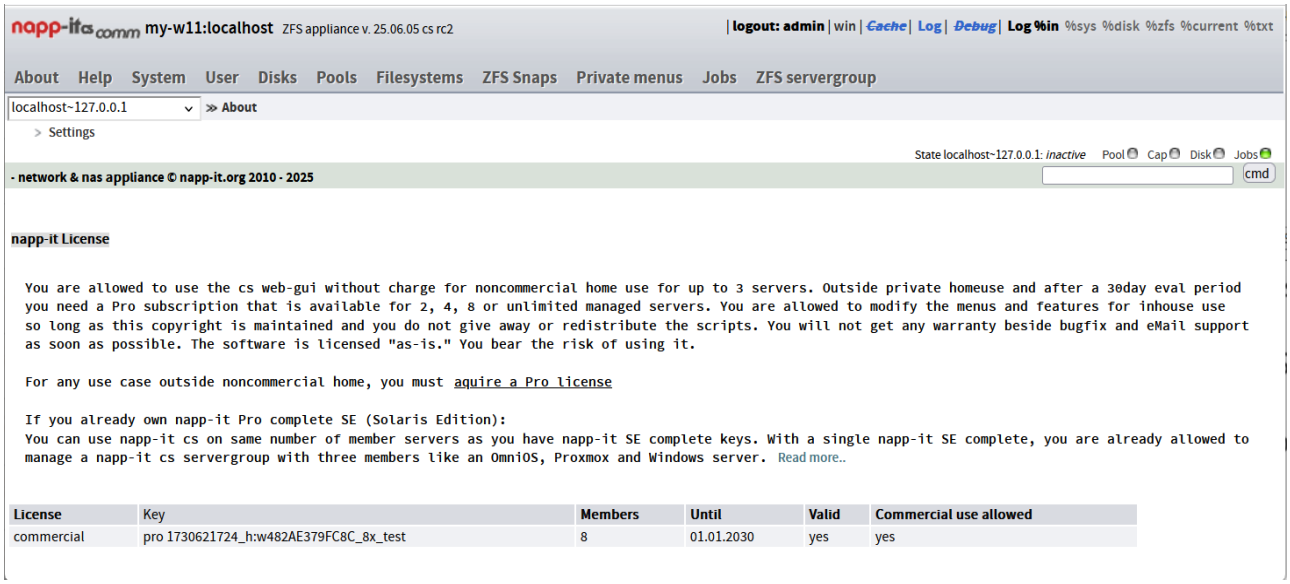
optionally

If you get „auth error":
./csweb-gui/cfg/server.auth (backend server) must be identical to
./csweb-gui/_log/group/groupmember.txt (localhost~ip.txt) on frontend.

- start on bootup: add startscript as planned task when computer starts
- check menu About > Update for newest release

Open firewall for client - server socket connection on port 63000
Discuss: https://forums.servethehome.com/index.php?forums/solaris-nexenta-openindiana-and-napp-it.26/

Windows as an AiO Server



1. Pre Considerations

1.1 Which Windows OS.

Windows 10 and earlier
Avoid, End of Life, no security updates and fixes

Windows 11
For a home/soho SMB NAS, a Windows 11 Pro 64 bit is perfect for a Storage Spaces and ZFS NAS.
I would prefer a current release ex 24H2 or newer mainly for security reasons

Windows Server 2022+
Windows Server allows more concurrently active users with additional services like Active Directotry, NFS Server or SMB Direct that allows a superiour SMB performance with RDMA capable nics (host to host or host to Win11 clients) and 3-10 Gbyte/s (20-100G nics) with lowest latency and CPU load even in a multiuser environment ex for 4/8k video editing.

If you can accept the restriction of 1 server, 1 cpu/10 cores and max 25 users you can use the cheap Server Essentials edition.
For a high performance video editing workgroup with say up to 8 Windows 11 clients, you can use DAC connections with 2x/4x 25G nics in the NAS to avoid the expensive and loud 25/100G switch.

Additional Features
Enable Hyper-V with Hyper-V additions for Powershell (needed for VMs and disk based virtual harddisks)
Add newest OpenZFS for Windows, check issues and discuss at https://github.com/openzfsonwindows/openzfs/releases
Add napp-it cs web-gui (download http://napp-it.org/doc/downloads/xampp.zip, unzip to c:/xampp and start as admin):
„C:\xampp\csweb-gui\data__start_zfs-gui_as_admin.bat"

When using Windows 11 Pro
- install with a local user/admin account
- use a minimalistic setup iso with a local user or debloat Windows (https://christitus.com/windows-tool/)

1.2 Setup napp-it cs Web-gui for storage management

Windows offers GUI tools for disk, pool, volume and partition management. This covers basic software raid options and Storage Spaces where you can define redundancy per Space (virtual disk). If you download the copy and run napp-it web-gui, you can manage storage per browser that includes ZFS management. Setup is easy:

- Download https://www.napp-it.de/doc/downloads/xampp.zip and unzip xampp folder to c:\xampp
- Download and install smartmontools (or Crystaldiskinfo) for disk health checks (optional)
- Start web-gui as admin: „C:\xampp__start_zfs-gui_as_admin.bat **(all default scripts in \xampp\csweb-gui\startup)**"
- Open browser at adress https://localhost (or remote via https://ip)

1.3 Which Pooling or Raid method
You have 3 options on Windows

– No disk pooling
Use a classic hardware raid or Windows software raid ex a mirror and ntfs or ReFS volumes.
Avoid this method with ZFS

- Storage Spaces Pool

This is a method to pool disks of any size or type. A Storage Spaces pool is not a raid array but a basket of disks without a diskbased redundancy. When you create a Space (virtual disk), you can define redundancy (by data copies on other disks), location (ssd/hd) or hot/cold auto tiering (hd <-> ssd <-> nvme) per space. A space can be formatted in ntfs or ReFS (called dev drive in current Windows 11)

- ZFS Pool

This is a realtime raid method with redundancy over disks organized in vdevs like mirror or Raid-Z. If you have more than one vdev, data is striped over vdevs to increase performance and capacity. ZFS allows hybrid pools like storage spaces but data is tiered not based on use patterns (hot/cold) but data structures (metadata and small files) that can be stored in a special vdev mirror. ZFS can protect its rambased write cache with sync write that offers a security level better than a hardware raid with BBU protection. Additionally ZFS offers snaps, encryption, compress, realtime dedup and fast filesystem sync even over lan with open files included

You can mix all three methods ex a hardware raid-1 for OS and disk pooling for data disks based on needs. If you care about ZFS bugs (OpenZFS or Windows file system driver), use a Storage Space for backup of data on ZFS via a robocopy planned task (to ntfs or ReFS). Performance my be another criteria as ntfs is faster than ZFS. From a security view, ReFS and especially ZFS are more secure than ntfs due Copy on Write (crash resistent, snap data versioning) and checksums on data/metadata (bitrot protection, self healing) . Sync data from ntfs to ZFS as backup with snap versioning is it then.

2. Why to prefer Windows over Linux?
Beside personal preferences, reasons are

- SMB Direct (available on Linux with ksmbd but only really stable and usable out of the box with a Windows Server)
- you need the centralized user database Active Directory and want the real one
- you need fine granular Windows ntfs ACL with inheritance, groups in groups based on worldwide unique AD SID
(this is the point where Linux + SAMBA with Posix ACL is a pain compared to Windows or Solaris with ntfs or nfsv4 ACL)
- flexible pooling method Storage Spaces with tiering

- Windows is the company platform or you know how to manage
usability with GUI tools vs cli management

3. Setup and configure a Windows NAS from scratch

- Download a Windows .iso ex Windows 11 from Microsoft'
- Create a bootable USB stick (use the free Rufus tool. You can modify the iso for old hardware.
- Boot the installer. Enter your key or select „I have no key" with a version ex Win 11 Pro

- During setup, you need a Microsoft account. You can use your email ex xx@google.com.
After setup, create a local (admin) account.

- Update Windows to newest

- Install the OpenZFS filesystem driver for Windows from openzfsonwindows.org

- Add the Hyper-V feature (Settings > System > optional features >more Windows functions: enable Hyper-V
This includes the Hypervisor and the Powershell add on for filebased .vhdx virtual haddisks

- download the storage web-gui napp-it cs https://www.napp-it.de/doc/downloads/xampp.zip, unzip xammp folder to c:\xampp and (re)start the web-gui (manually or via planned task). Use startscript as admin from the xampp folder

Sync auth (same auth string) on the web server frontend in ./csweb-gui/log/group/freebsd~ip.txt
with backend server auth file ./csweb-gui/cfg/server.auth (same content)

optional:
If you get a message about missing msvcp140.dll files, install the Microsoft Visual C++ Redistributable package.
https://learn.microsoft.com/en-us/cpp/windows/latest-supported-vc-redist?view=msvc-170

- add an addition antivirus app as an alternative to the build in Defender
- create a disaster recovery image
I use Aomei backupper that can create system images from a running Windows to external usb disks or SMB shares,
After a disaster (example os disk dead), you can replace the bootdisk, boot Aomei from an usb stick (WinPE or Linux) and restore the configured OS from the usb disk or SMB share

Disable secure boot (bios setting) to boot Aomei from stick

Configure a Windows NAS

- Create a pool from your disks
(Storage Spaces Pool and/or ZFS Pool)

- create Spaces (with redundancy, location and tiering as option, formatted as ntfs or ReFS)
enable shadow copies for critical data folders

and/or
- Create ZFS filesystems with encryption or dedup as option,
enable ZFS autosnap ex a snap per day, hold last 30

- Create SMB shares for ZFS filesystems or a folder, create users, set ACL permissions ex

allow readx for everyone and this folder only (shared folder to make it visible as a share)
allow folder create for this folder only (shared folder
allow folder/file create for subfolders only (shared folder)
A user can now create a folder and folders/files within with full permissions (via owner, others no access)
Create a public subfolder (as admin) with everyone read/write permissions for this folder
Everyone can read/write

remember:
- ntfs ACL are fine granular with inheritance and much more advanced than Linux permissions or Posix ACL
- you can stop inheriance in a path tree with a new set of acl
- inheritance can be set to this folder only, subfolders only or files and folders
- ntfs (and Solaris) ACL are based on Windows SID. They are worldwide unique and remain valid after a pool move/restore
Windows (and Solaris) can group SMB groups and users within SMB groups

4. Run a Windows NAS
Think about OS disaster recovery, data recovery and backup

OS recovery
You need a method to reinstall the configured OS from scratch to same or new disk from an external USB disk or SMB share

My preferred method is Aomei backupper that can
- create a bootable USB stick for disaster recovery (Linux or WinPE)
- create system images for recovery on an external USB disk or SMB share
on Problems: boot USB stick (secure boot off) and restore OS image

Data recovery
You need data recovery when you accidentally deleted something or a ransomware attacked you with data on snaps available

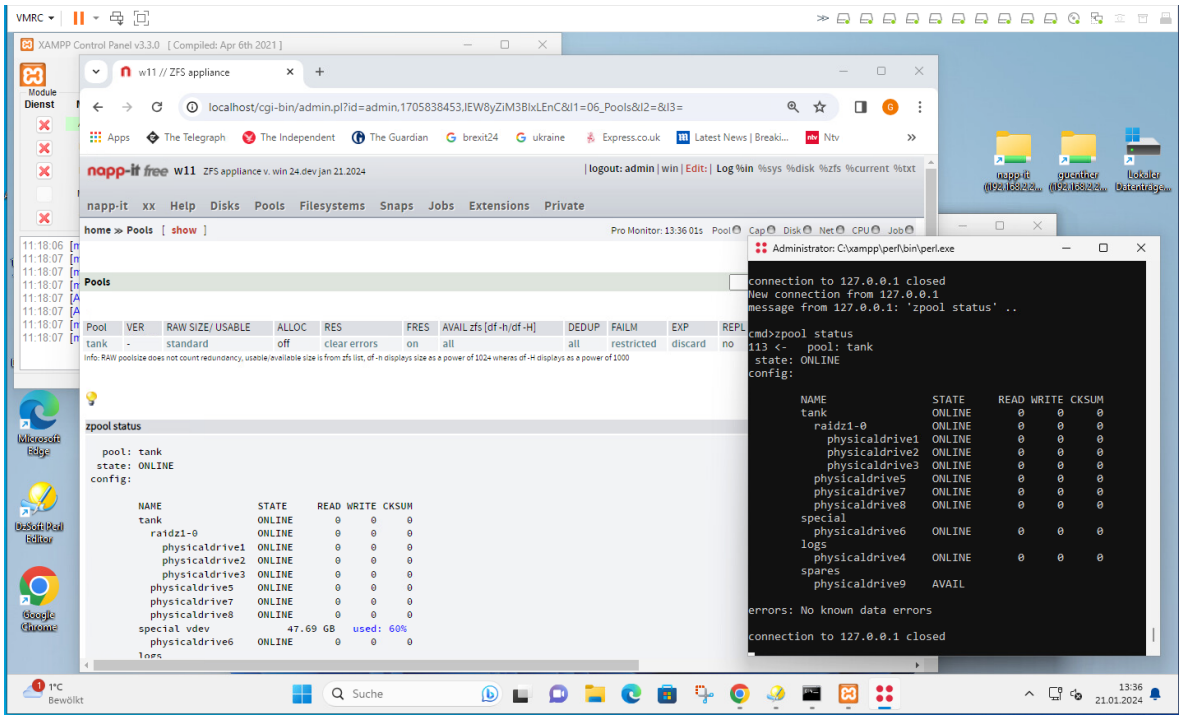
Use Windows „previous versions" or ZFS snaps in folder /pool/filesystem/.zfs/snapshot to access snaps.
Copy wanted data back !! Have as many snap versions as possible.!!

ZFS snaps are created without delay or initial space consumption. They only block space of datablocks that are modified after snap creation, no data copy involved.

Data backup

If your NAS is stolen or lost ex due amok hardware, flash or fire, you need external backups
This can be cloud based (encrypted), based on a second remote NAS or based on removeable USB disks.
If you use a ZFS backup pool on a USB disk do not forget to export prior unplug or you must reboot to regain access to the **USB backup pools.**

For critical data, consider two external or offline backups. WithZFS you can set copies=2 to allow a repair from bad blocks
set autosnap jobs (as many as possible if you have the capacity)
set autoscrub jobs (check checkums and repair to be informed on problems early)
set autoalert (email warnings on problems)
prefer setups where any two disks can fail and you will sleep better when a disk fails

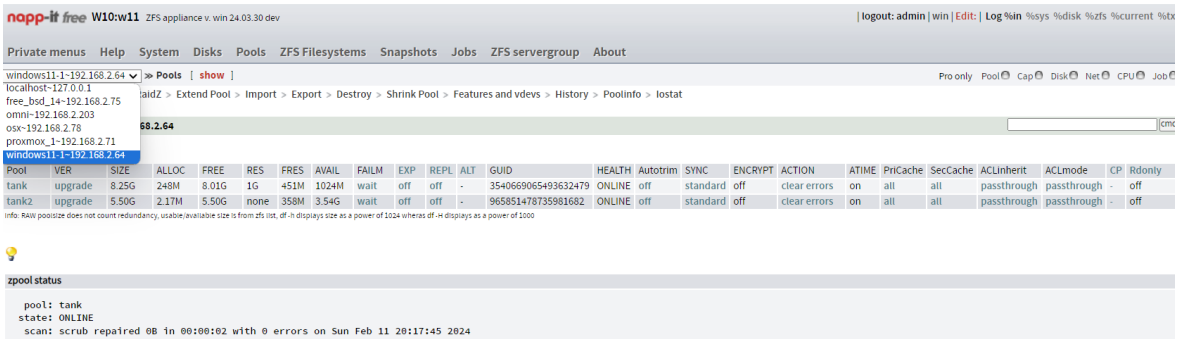


5. NAS Servergroups

If you have another OpenZFS servers (Free-BSD, Illumos, Linux, OSX, Windows)

- you can remotely manage them just like the local server
- you can replicate ZFS filesystems any OS to any OS with napp-it cs

In a servergroup you can switch to another server and manage in the web-gui just like the local one
Start the backend services server.pl and monitor.pl on a remote server (any OS with Perl installed) and add the remote server in menu ZFS Servergroup. Only manual action is to sync the memberfile ./csweb-gui/_log/group/memberfile.txt with ./csweb-gui/cfg/server.auth on the remote server (same auth string, use WinSCP).



ZFS servergroup managemant, select a server and all menus are for this server

6. Flavours of ZFS with independent development

Solaris ZFS

Sun developped ZFS as part of its commercial Solaris Unix with ZFS as the main filesystem with a deep integration into the OS and sharing services like iSCSI, NFS and SMB.. To be more competitive against Windows NT, Sun offered the OpenSource option OpenSolaris. Solaris is still available as a commercial option with ZFS v 53+ and developped by Oracle but their new focus are cloud services, not a server OS. For noncommercial homeuse, there is Solaris 11.4 cbe (currently SRU81) that you can download for free. Current Solaris ZFS is incompatible with OpenZFS. (last cross compatible version is ZFS 28v.5). Use rsync to sync data between Solaris ZFS and OpenZFS. Napp-it SE is a web-gui for a Solaris NAS.

Illumos ZFS

When Oracle bought Sun they ended OpenSolaris. Illumos was the project to continue OpenSolaris and ZFS as Opensource with distributions like the minimalistic OmniOS for server use or OpenIndiana with an additional destop option. Illumos introduced ZFS features with pool version 5000 to differ from Solaris ZFS versions. Illumos is parent of OpenZFS with a strong focus on stability and easy maintenance. Not all newest OpenZFS features are already integrated. You can move an Illumos pool to OpenZFS and back if features like draid, raid-z expansion or fast dedup are not activated. Alternatively replicate a pool what you should also do with encrypted filesystems. that you want to move to/from OpenZFS. You can use napp-it se and napp-it cs as a nas web-gui on Illumos.

OpenZFS

OpenZFS was initially the name of the common roof for all opensource ZFS efforts with OpenZFS a downstream of Illumos. Now it means more the current state of ZFS on Free-BSD and Linux as there are new features added. On OSX and Windows there is a filesystem driver for current OpenZFS so ZFS is available now on any OS.

On Linux I would prefer a distribution with OpenZFS included out of the box. This is mainly the case with TrueNAS (for a NAS system but with limited CLI options), Proxmox when you want a commercially maintained general use Debian with strong virtualisation options and Ubuntu when you additionally want a desktop and office system. Proxmox comes with a web-gui for VM and system managent on port 8006. For storage and ZFS management you can use napp-it cs..

Qnap ZFS

Qnap ZFS is based on an older OpenZFS. Due some Qnap specials you cannot move pools to/from OpenZFS. Newer OpenZFS features are not available and propably never will be.

Napp-it web-gui for servers, Storage Spaces and ZFS

Napp-it se (Solaris Edition) is a web-gui for Solaris and OmniOS/OpenIndiana. Napp-it cs (client/server) is a web-gui that runs on any system with a cgi capable webserver and Perl. Napp-it cs can manage ZFS server or servergroups on Free-BSD, Illumos, Linux, OSX, Solaris and Windows (there also Storage Spaces Pools) with the restriction that you cannot replicate OpenZFS from/to Solaris ZFS. On TrueNAS or Qnap options are limited as theiy do not want or allow actions outside their web-gui with a special api or database for management.

7. Tipps

Windows includes Hyper-V, a premium class type-1 hypervisor.
Enable the Hyper-V feature together with Powershell extensions that are needed for virtual harddisks
(filebased virtual disks, thin provisioned, very fast even over SMB)

For a superiour SMB performance ex multiuser 4k video editing, use Windows Server (Essentials) with Windows 11 Pro clients and 25-100G RDMA capable nics. For a workgroup you can use 4x25G nics and DAC cabling without switch.

Avoid:

- Vendor or OS lockin (BroadCom. Oracle, Synology, Qnap)

Prefer
- All in One systems: Storage + virtualisation
- Mainstream Solutions with ZFS: Proxmox, Windows (opt. ESXi/OmniOS)
- single or multiple server management

With napp-it cs you can manage single or multiple servers with X86/X64 or ARM architecture
on Free-BSD, Linux, OSX, Illumos and Windows

Define your system

mini NAS	(4x NVME, 2,5G, max 8TB, non ECC)
SoHo	(uATX Sata HD, 10G, ECC opt)
Mediacreator	(uATX 2/4 x 25G RDMA nic, ECC, Windows Server + Windows Client with SMB Direct)
Enterprise	(SAS/Sata HD,NVMe, ECC, 10G+, 19" backplane)

Smartmontools is an important tool to check disk health
with an optional gui https://gsmartcontrol.shaduri.dev/

1. scan disks in an admin terminal

smartctl -d pd --scan
/dev/pd0 -d nvme # /dev/pd0, NVMe device
/dev/pd1 -d scsi # /dev/pd1, SCSI device

pd0 is physicaldrive0

To check disk health of pd0=physicaldrive0

```
smartctl -HA /dev/pd0
smartctl 7.5 2025-04-30 r5714 [x86_64-w64-mingw32-w11-24H2] (AppVeyor)
Copyright (C) 2002-25, Bruce Allen, Christian Franke, www.smartmontools.org

=== START OF SMART DATA SECTION ===
SMART overall-health self-assessment test result: PASSED

SMART/Health Information (NVMe Log 0x02, NSID 0xffffff)
Critical Warning:                   0x00
Temperature:                        40 Celsius
Available Spare:                    100%
Available Spare Threshold:          10%
Percentage Used:                    4%
Data Units Read:                    83,124,394 [42.5 TB]
Data Units Written:                 75,628,566 [38.7 TB]
Host Read Commands:                 920,399,201
Host Write Commands:                1,219,291,056
Controller Busy Time:               3,870
Power Cycles:                       2,624
Power On Hours:                     9,416
Unsafe Shutdowns:                   177
Media and Data Integrity Errors:    0
Error Information Log Entries:      10,634
Warning  Comp. Temperature Time:    0
Critical Comp. Temperature Time:    0
Temperature Sensor 1:               40 Celsius
Temperature Sensor 2:               50 Celsius
```