Assignment 4

Group Members

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What is NAS ?

> 💡 Network Attached Storage (NAS) device is a storage device connected to a network that allows storage and retrieval of data from a central location for authorised network users and varied clients.

NAS devices contain a processor and operating system so it can run applications and provide the intelligence needed for files to be easily shared by authorized people. Each NAS resides on the LAN as an independent network node, defined by its own unique Internet Protocol (IP) address. Users on a local area network (LAN) access the shared storage via a standard Ethernet connection.

NAS stands out for its ease of access, high capacity and low cost. The devices consolidate storage in one place and support a cloud tier and tasks, such as archiving and backup.

Purpose of the tool

The purpose of NAS is to enable users to collaborate and share data more effectively. It is useful to distributed teams that need remote access or work in different time zones. NAS connects to a wireless router, making it easy for distributed workers to access files from any desktop or mobile device with a network connection. Organizations commonly deploy a NAS environment as the foundation for a personal or private cloud.

The path for software download

The FreeNAS operating system has to be installed on a separate device from the drives which hold the storage data. With only one disk drive, the FreeNAS web interface is available, but there is no place to store any data. And storing data is, after all, the whole point of a NAS system.

> 💡 The latest STABLE version of FreeNAS 11.2 is available for download from https://download.freenas.org/11.2/STABLE/latest/.

Note FreeNAS requires 64-bit hardware.

The download page contains an *.iso* file. This is a bootable installer that can be written to either a CD or USB flash.

The *.iso* file has an associated `sha256.txt` file which is used to verify the integrity of the downloaded file. The command to verify the checksum varies by operating system:

- on a BSD system use the command `sha256` *`name_of_file`*
- on a Linux system use the command `sha256sum` *`name_of_file`*
- on a Mac system use the command `shasum -a 256` *`name_of_file`*
- Windows or Mac users can install additional utilities like HashCalc or HashTab.

The value produced by running the command must match the value shown in the `sha256.txt` file. Checksum values that do not match indicate a corrupted installer file that should not be used.

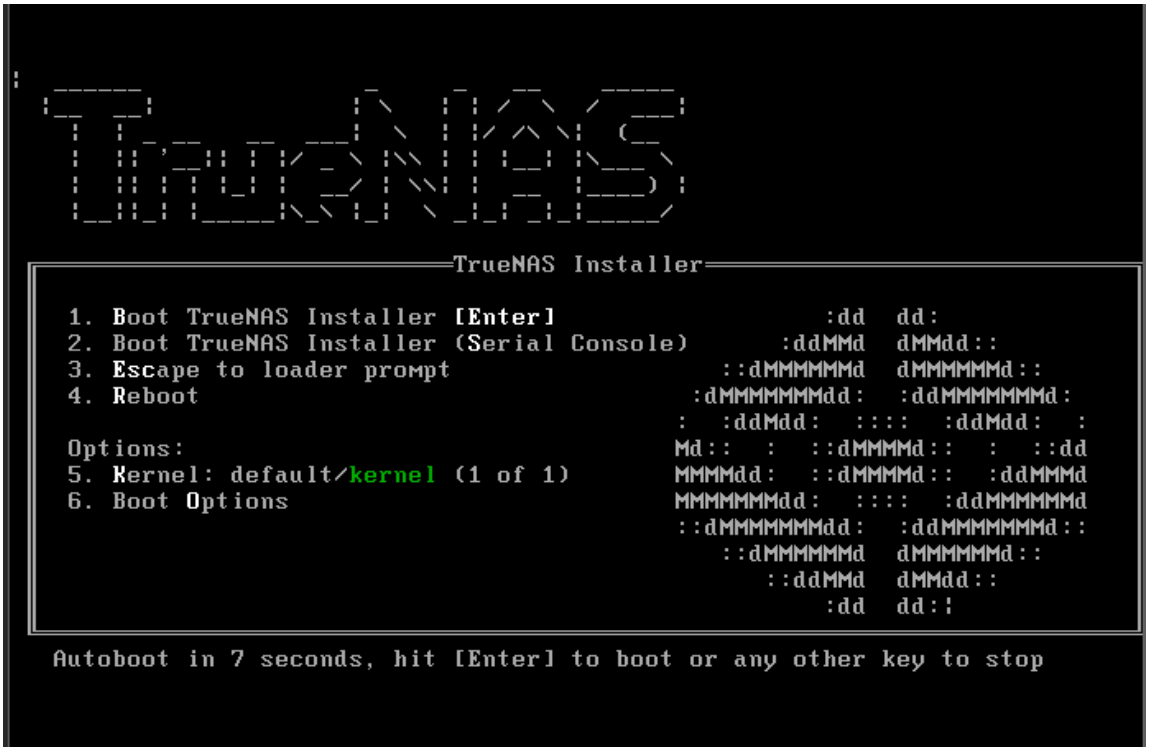
Target platform and installation procedure + Commands to configure and run the tool

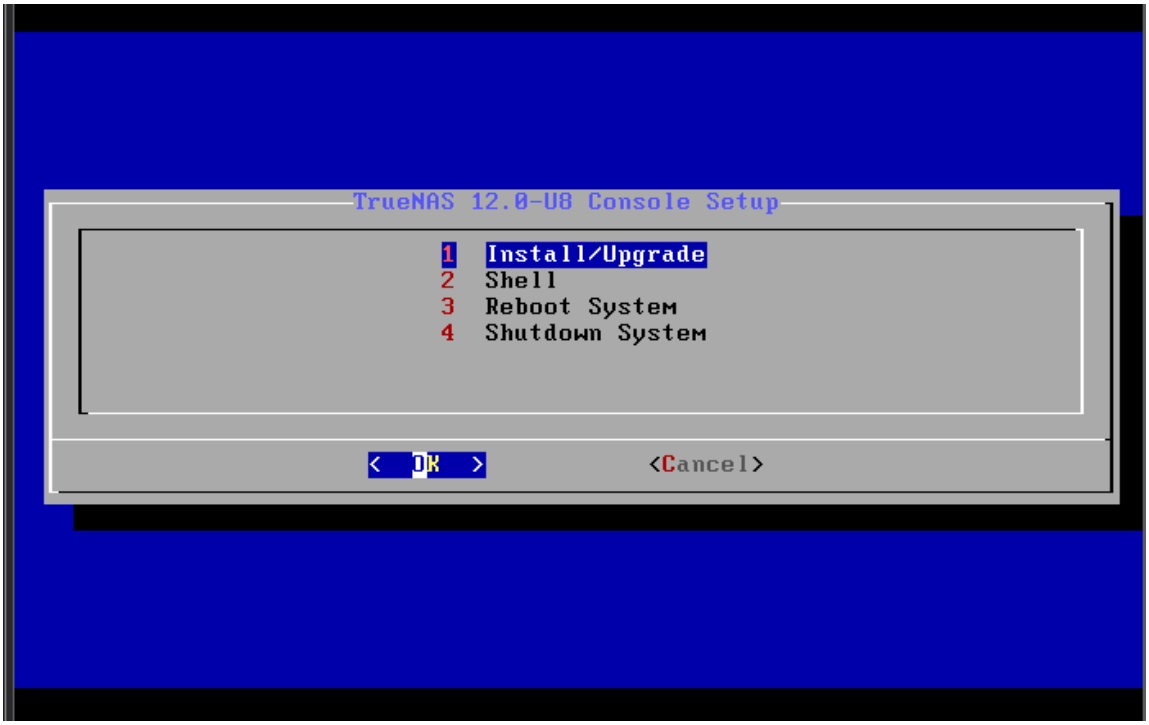
1. Make a VM complying with minimum system requirements
    a. 64-bit CPU (better if it supports ECC Memory). ECC (Error Checking and Correcting) Memory is a special type of memory which has the capability to fix any bit error which might come up in the memory. CPU also requires a special capability to manage this special type of memory
    b. 8 GB Memory (better if it’s ECC Memory)

c. 8 GB Minimum Storage for boot drive

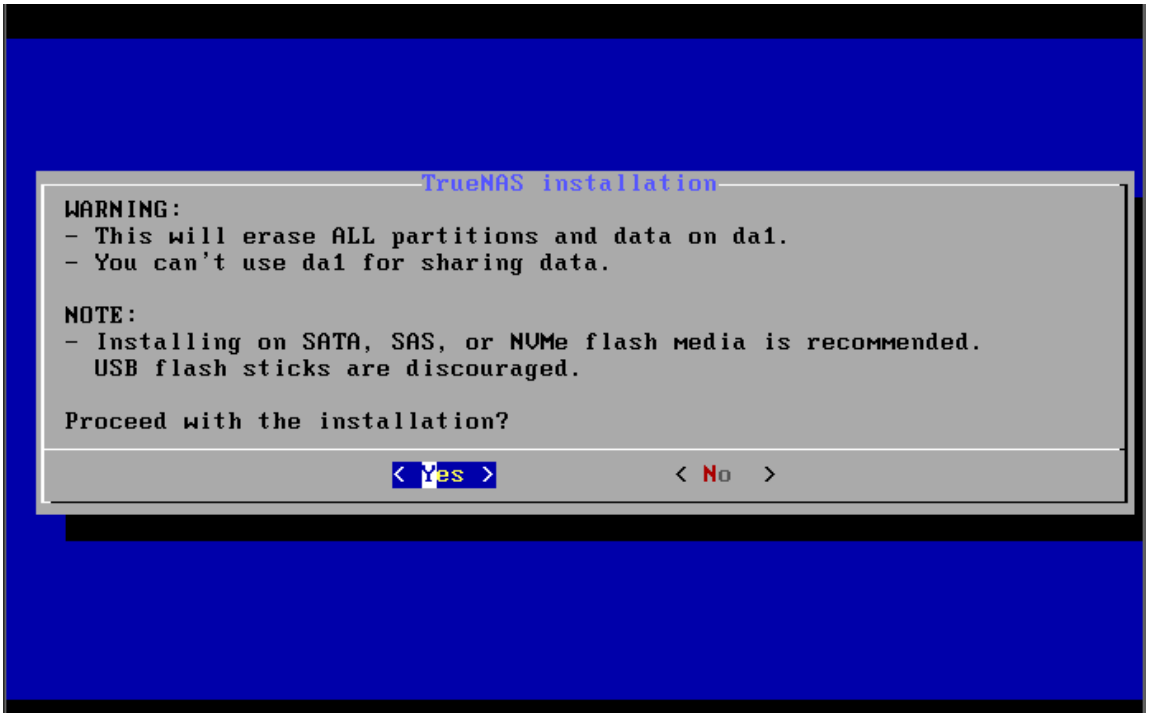
d. One or more drives for the storage pool of the Network Attached Storage

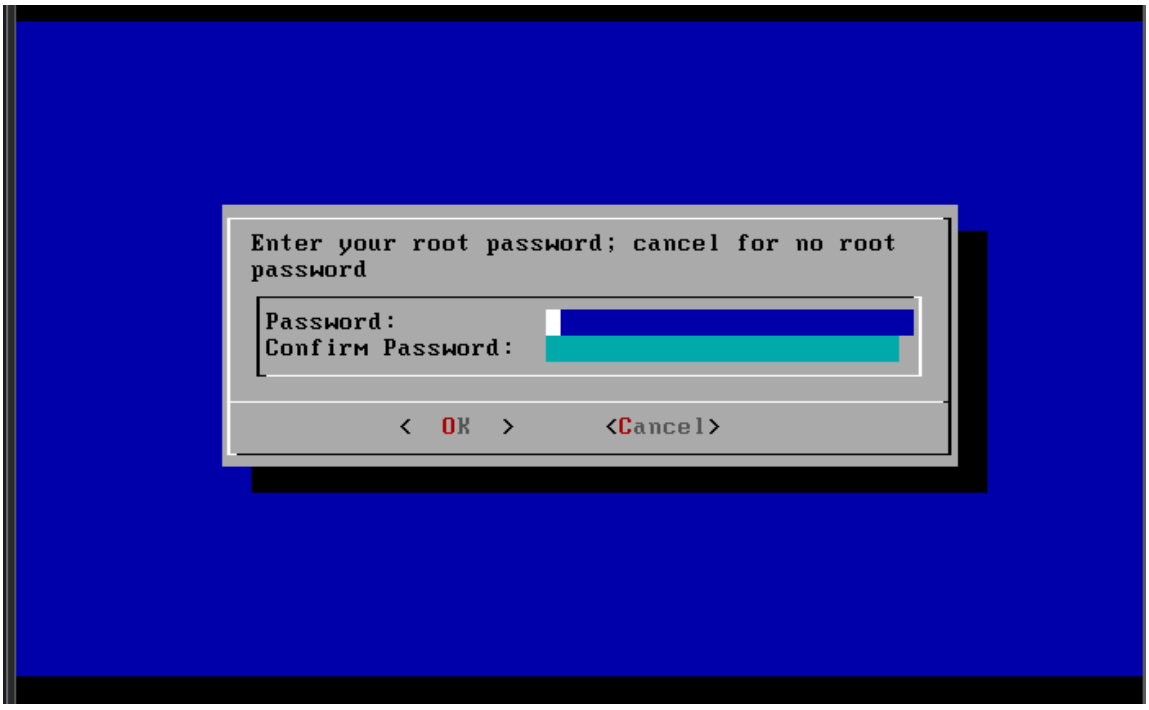
2. VM status → 8 GB RAM and two storage media, 20GB for OS and 30GB for storage



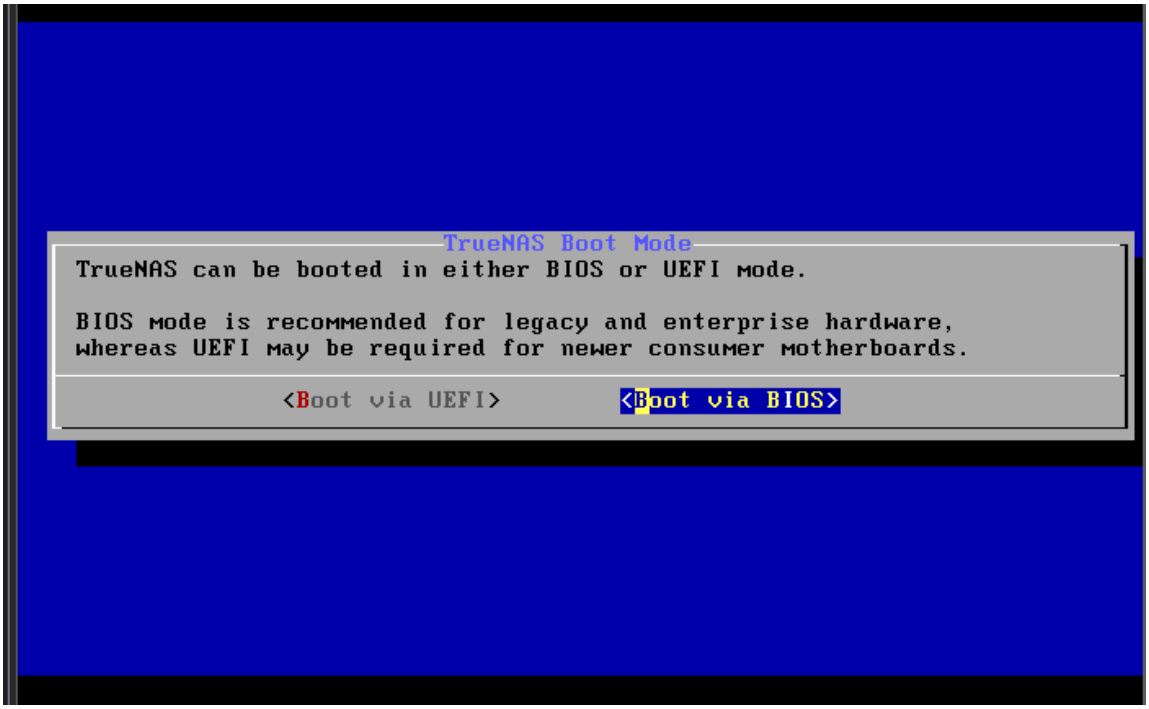


3. select da1 to be boot drive

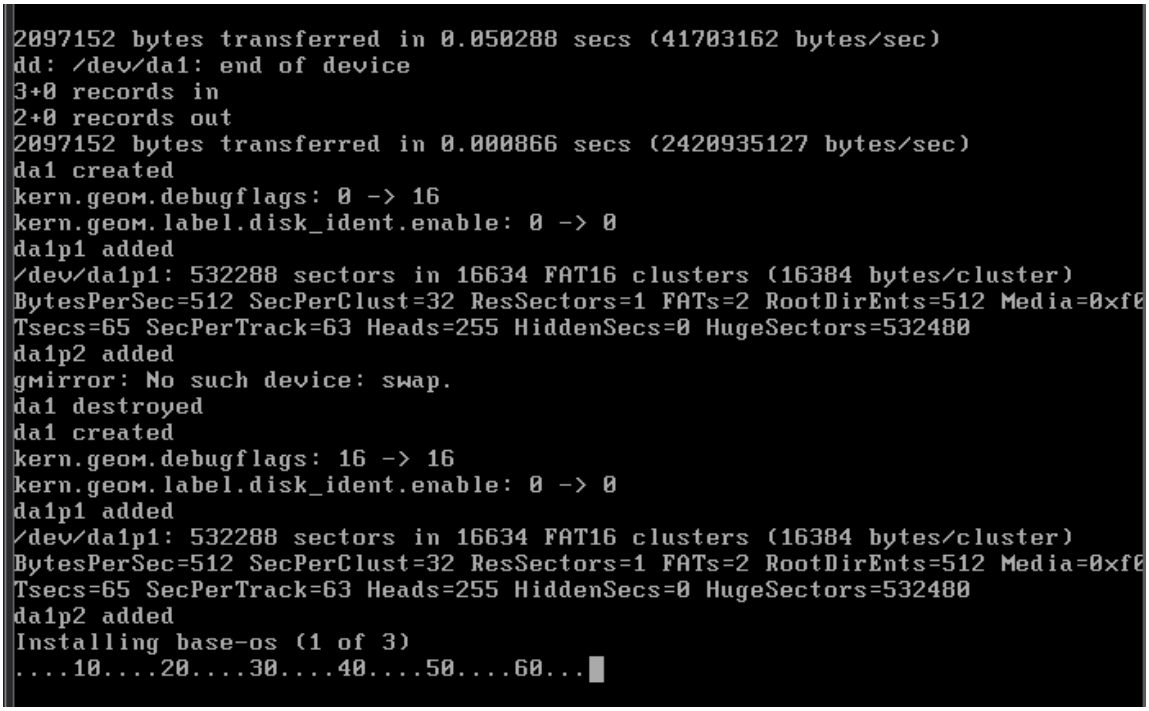


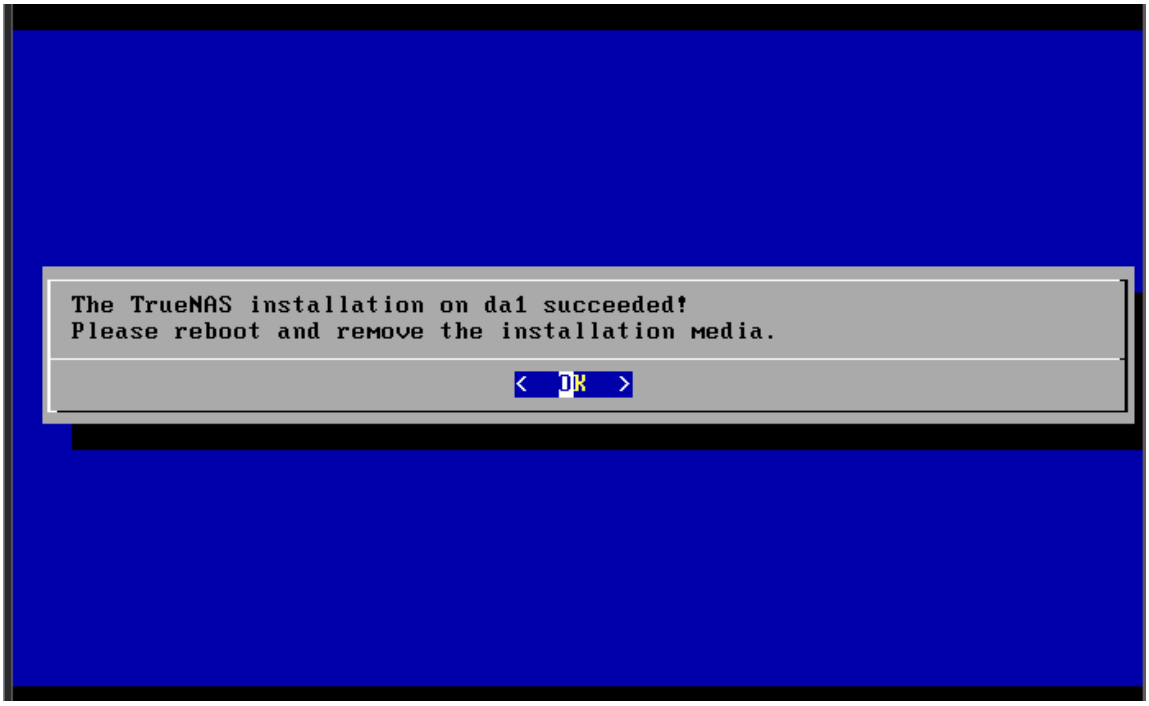


4. password: qwerty

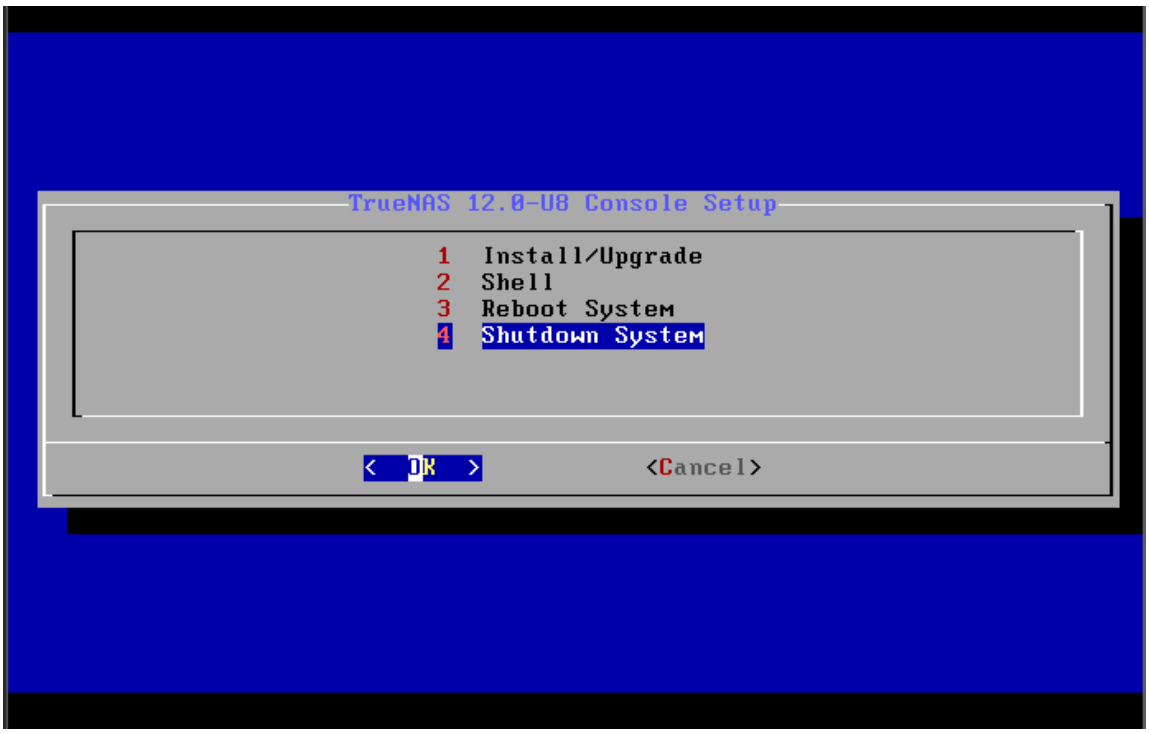


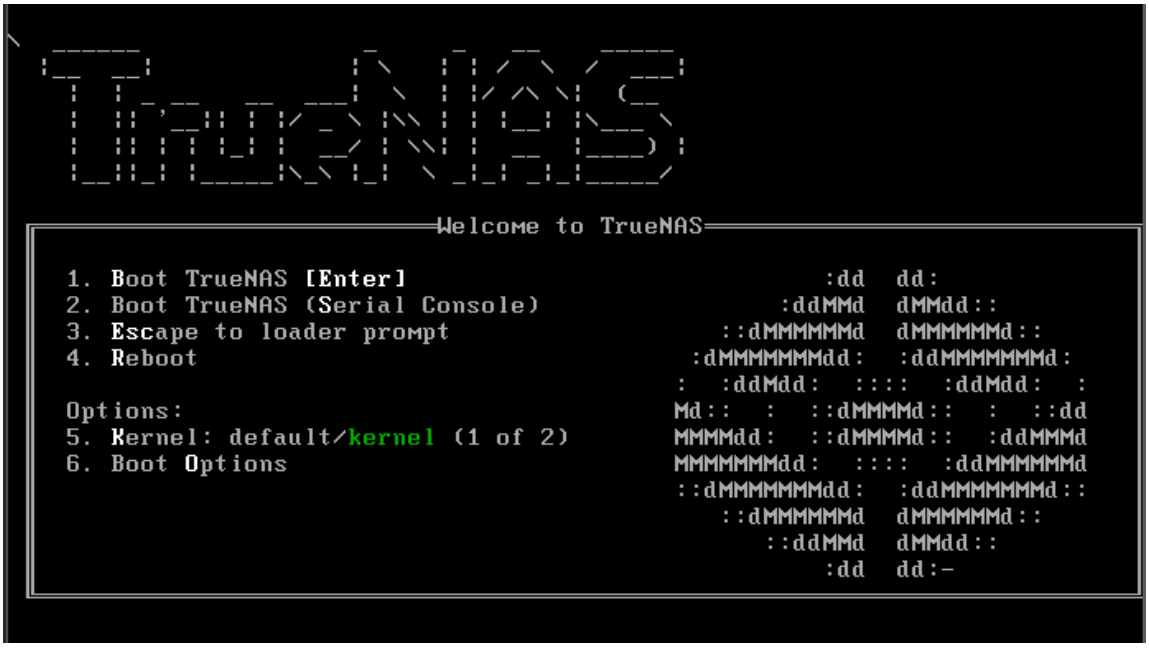
5. Go with the bios option as VM works with BIOS rather than UEFI, now installation is starting



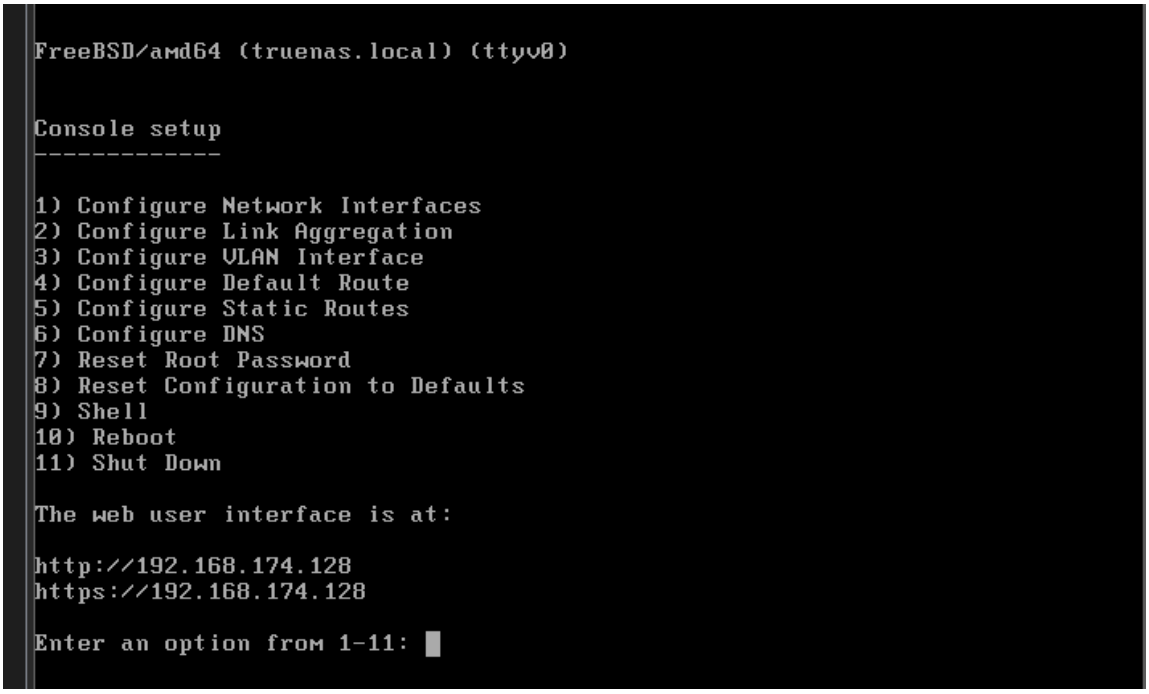


6. you will be again sent to the starting screen, now shutdown and remove iso

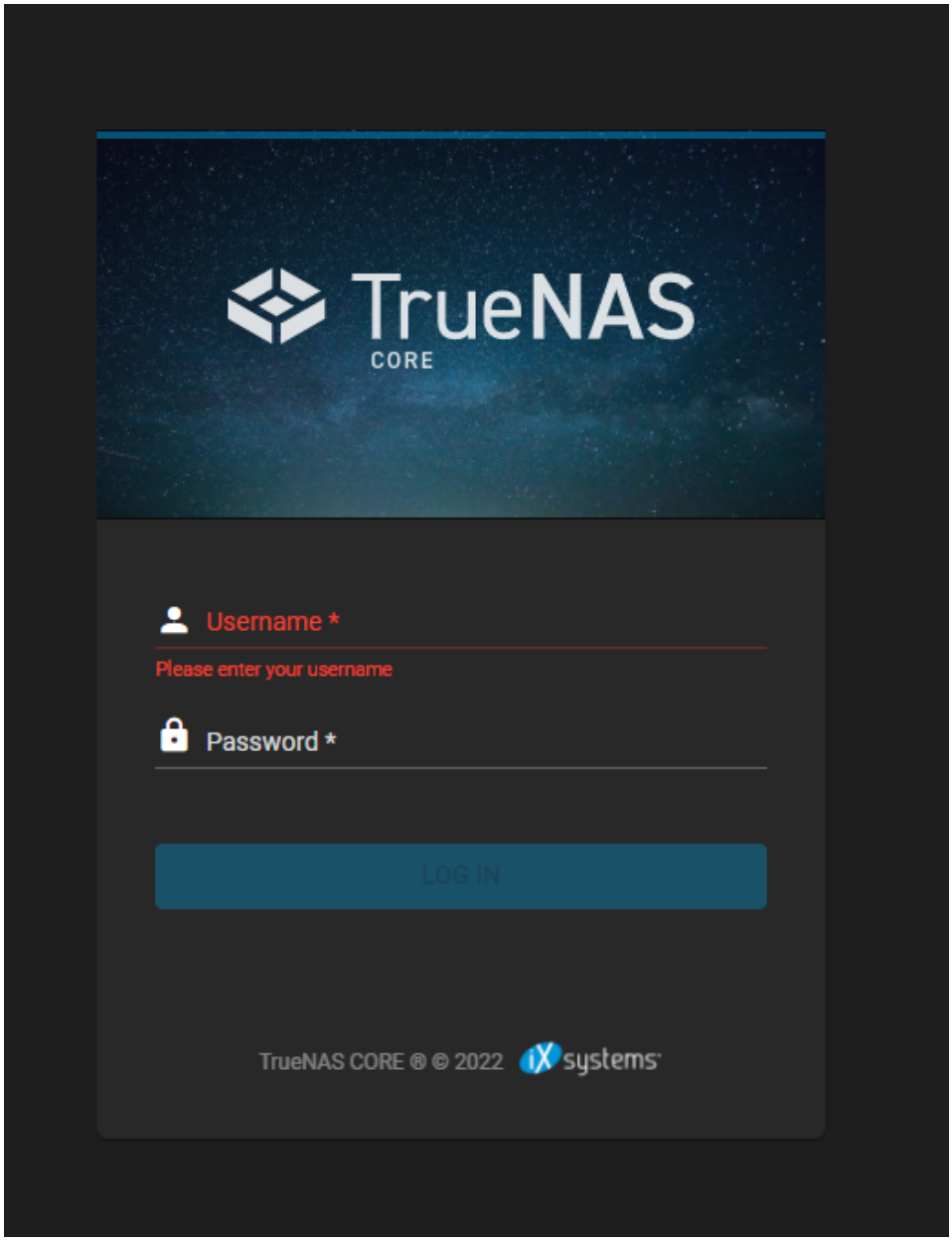




7. OS Welcome screen, we see an IP address here for the interface



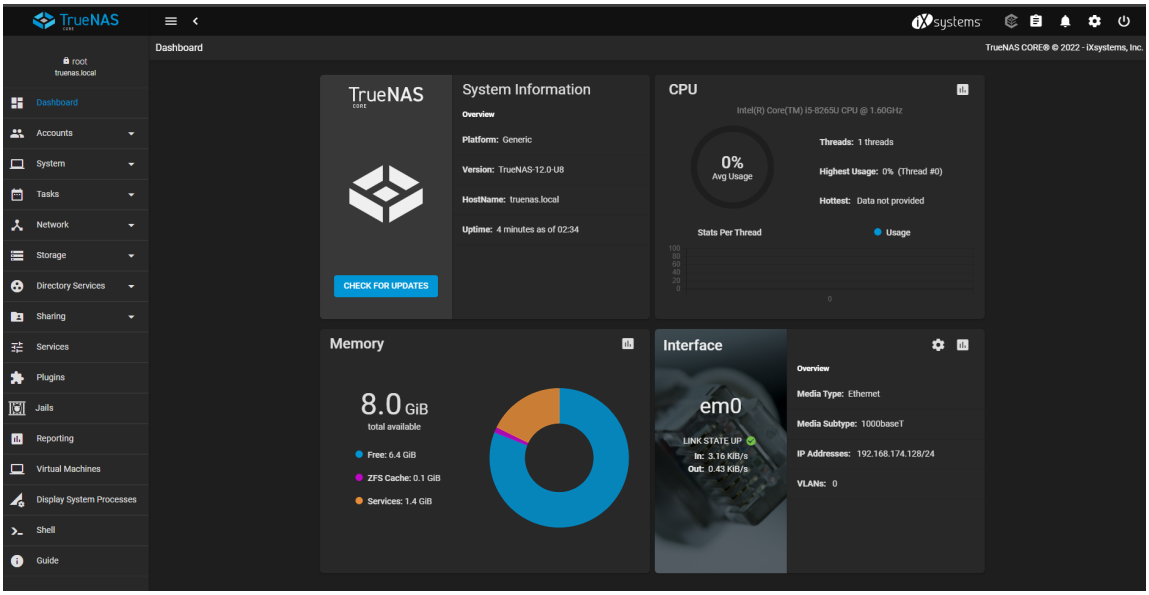
8. Now enter the URL in the Browser



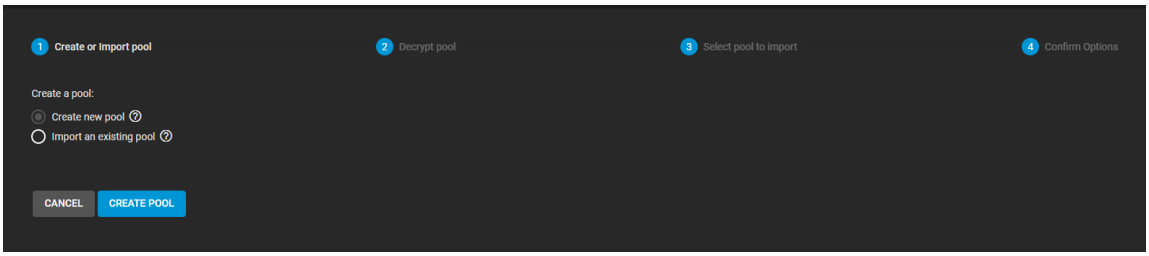
username: root

password: qwerty

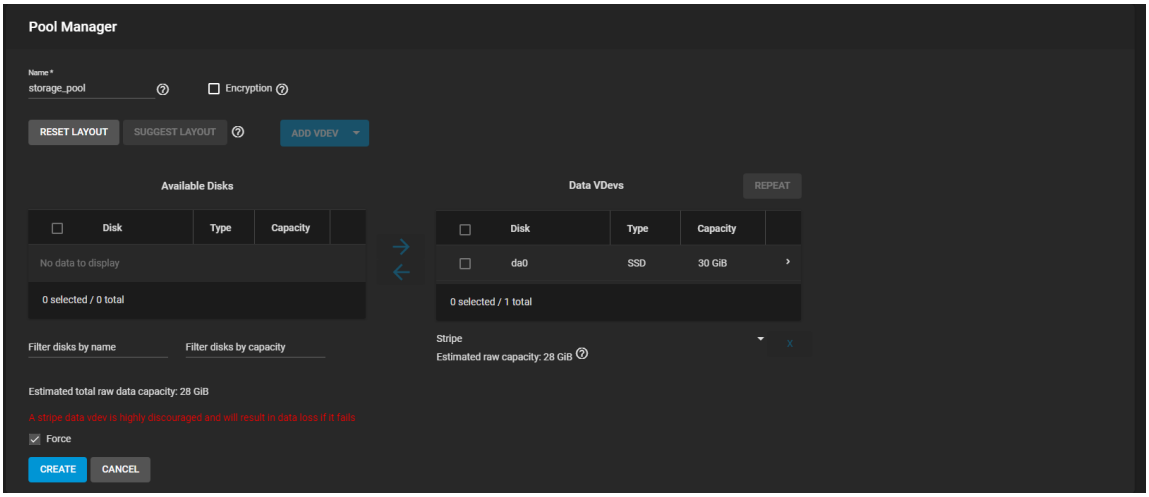
9. now we see the TrueNAS dashboard



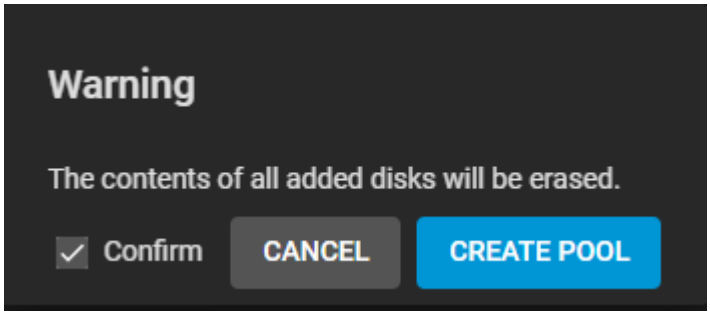
10. Let’s make a Storage pool to make a storage container for me; Storage → Pool → Add



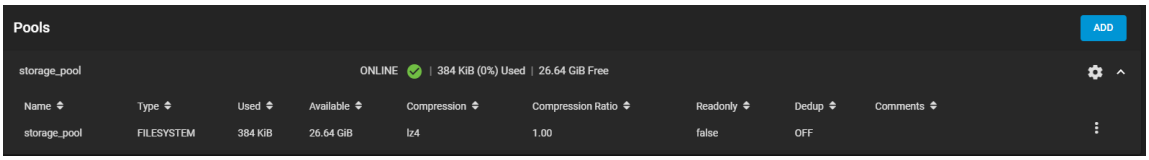
11. create new pool, add da0 to a storage pool



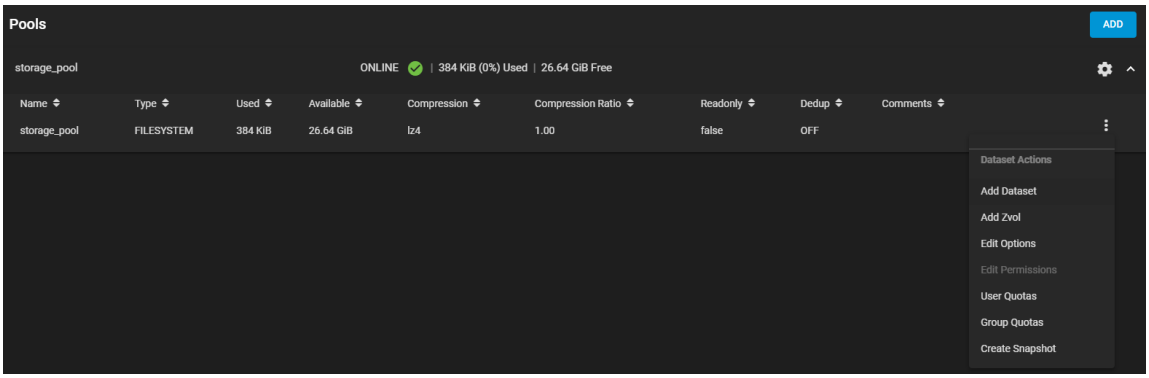
confirm create pool

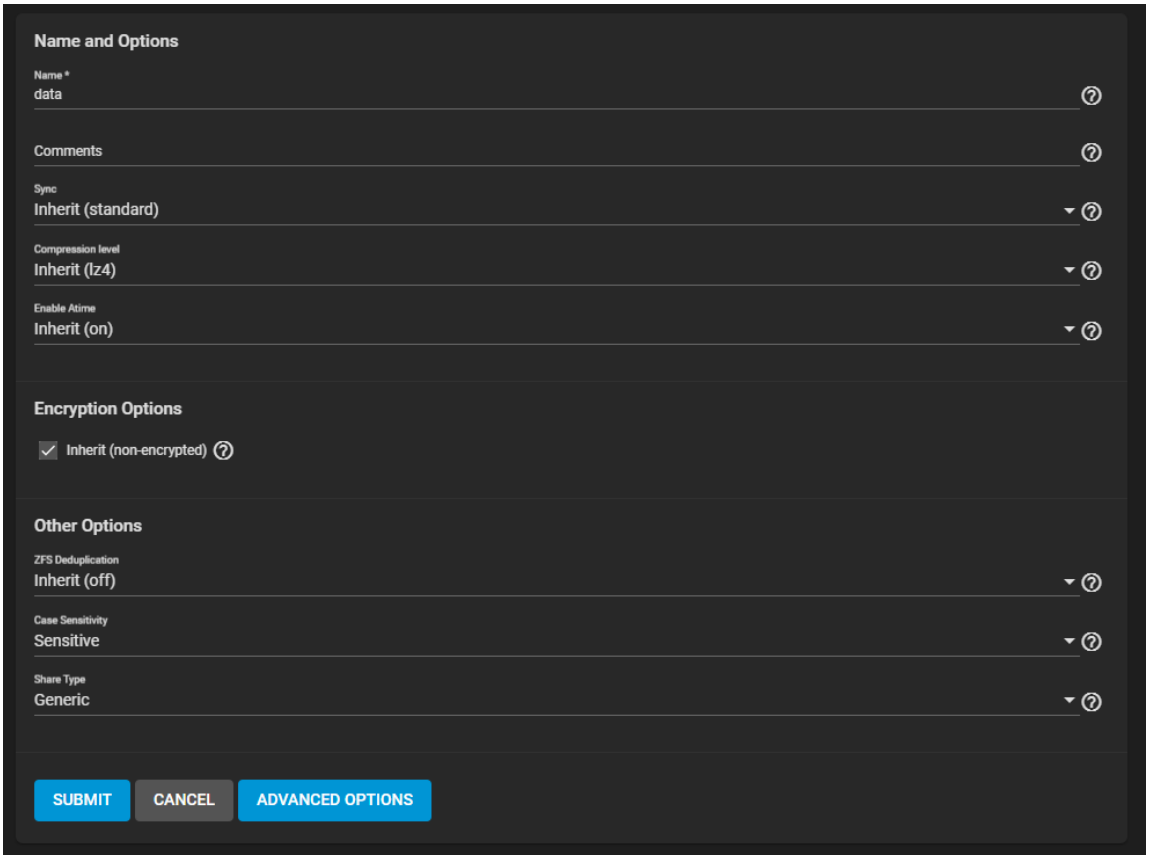


Now the storage pool is created

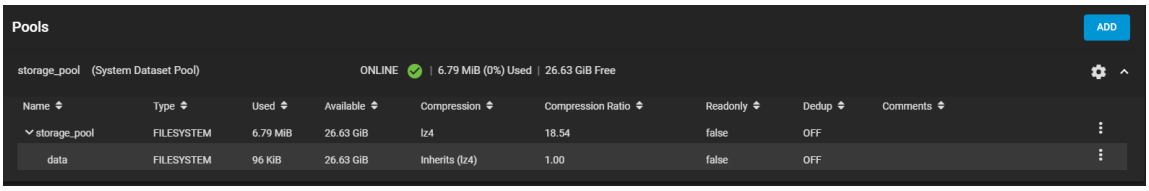


12. Now let's add a global dataset for all users; click the three triple dots → add dataset

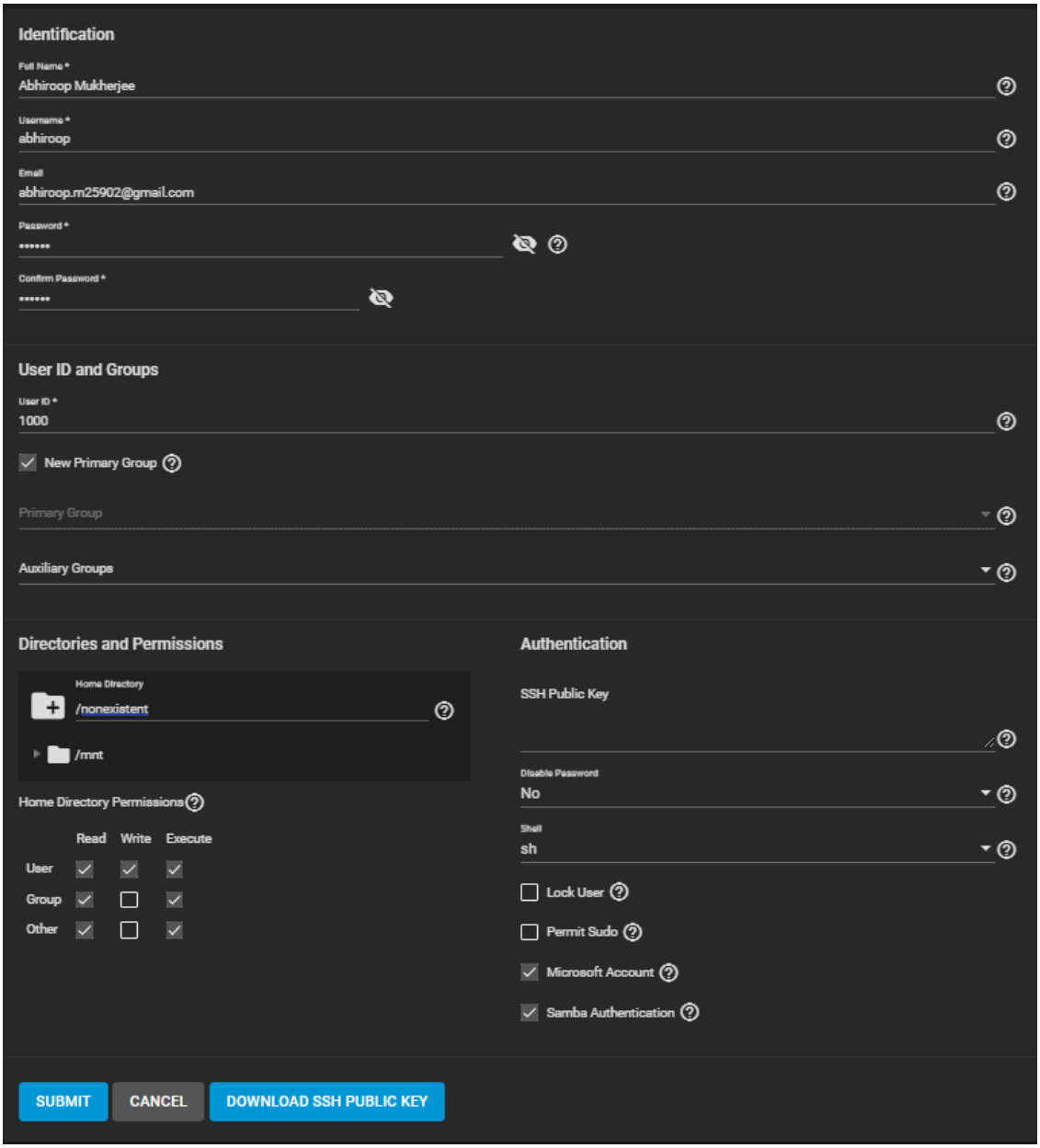




click the submit button, now dataset has been created

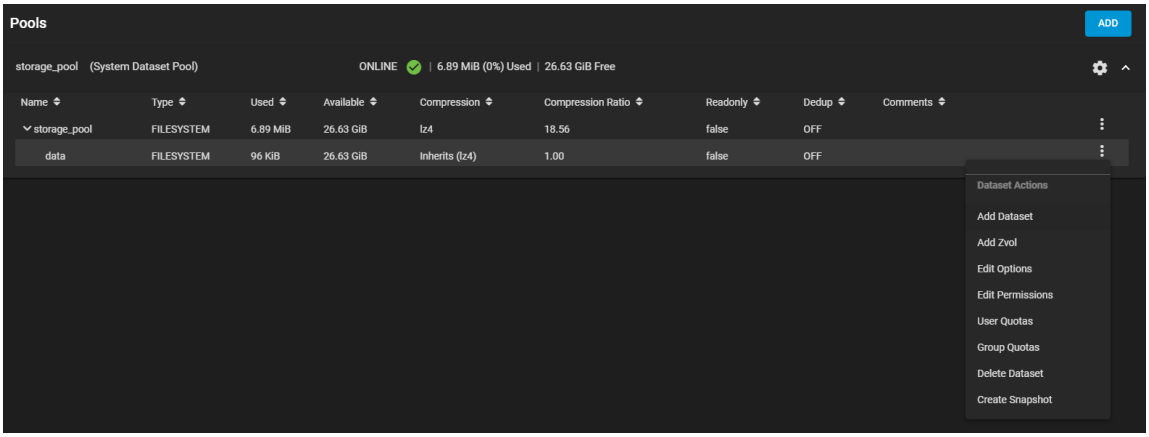


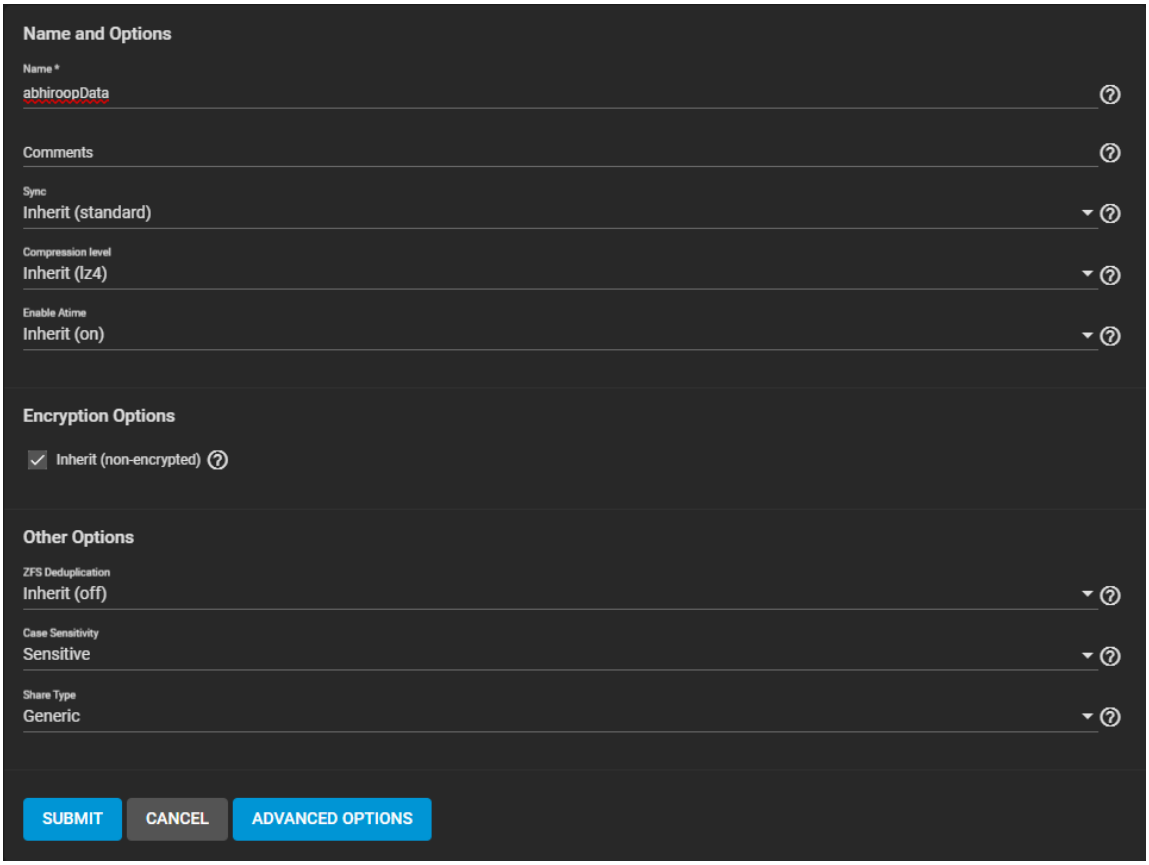
13. Now let's make a user access this data; account → users → add

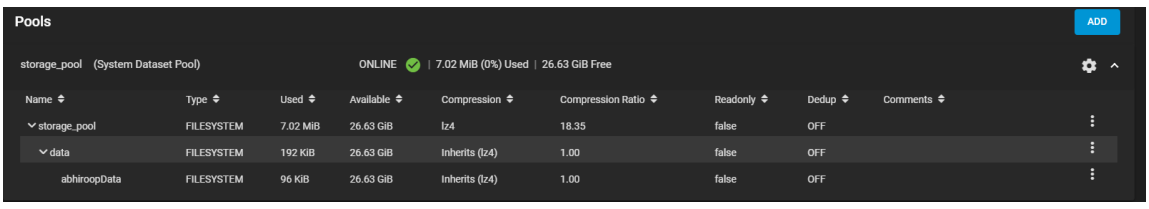


press submit, account will be created

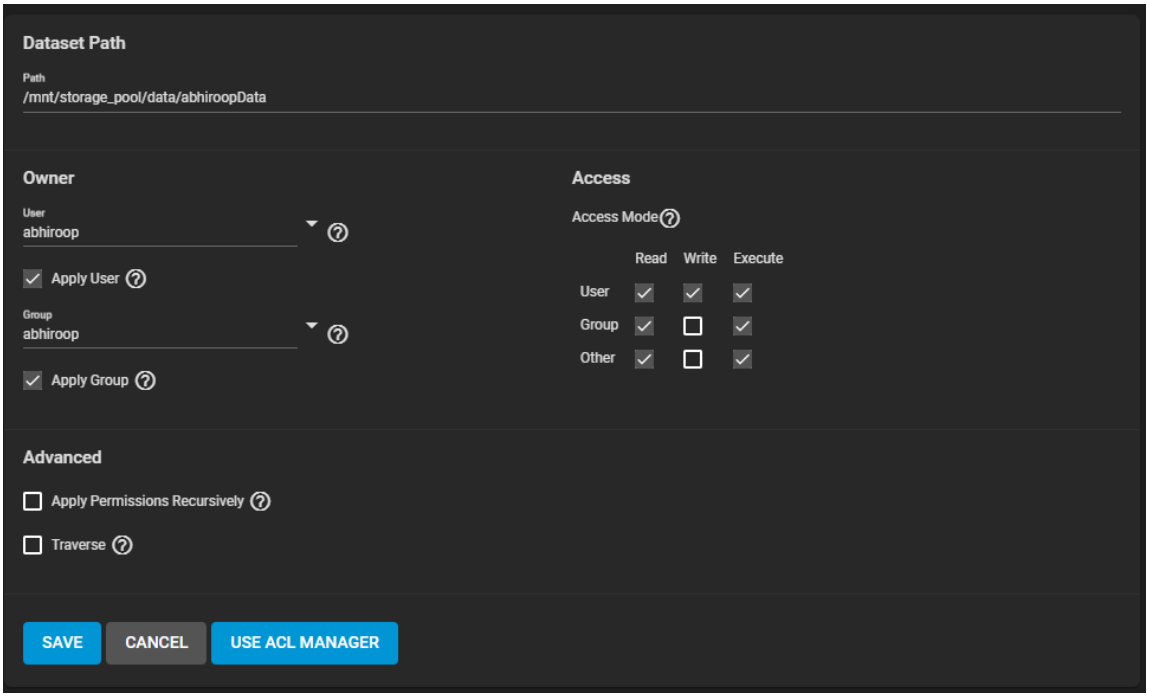
14. Now let's allocate a dataset for the user created; storage → pools → triple dot of data → add dataset





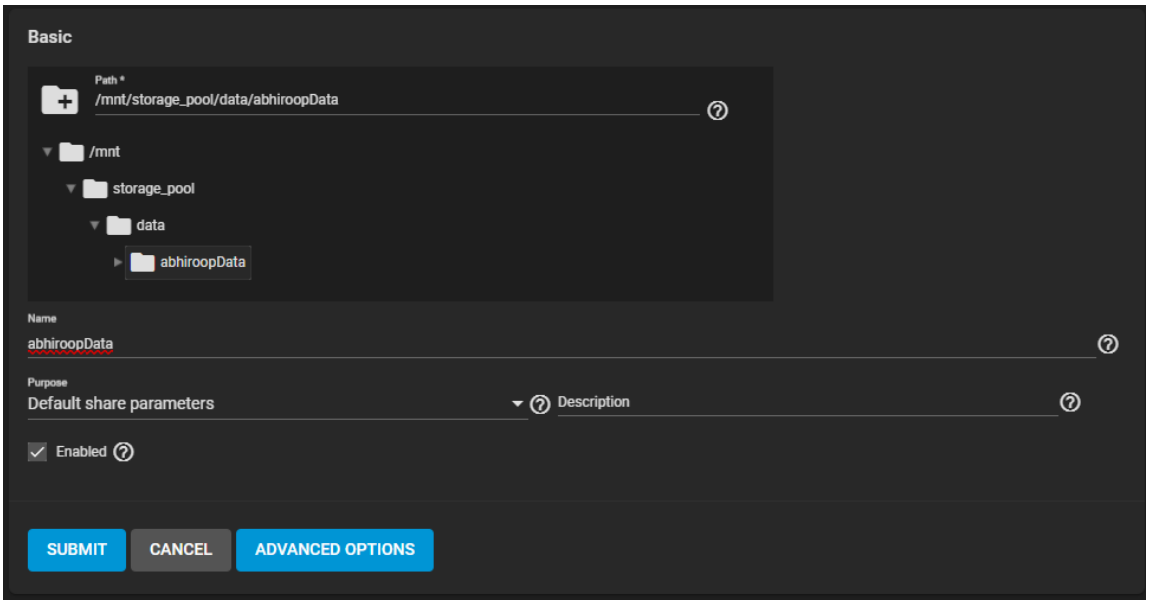


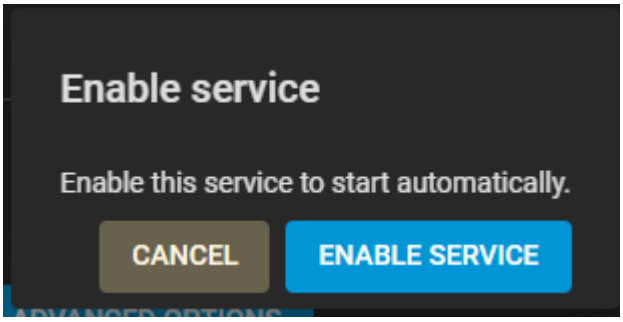
triple dot of abhiroopData → edit permissions → change owner and group to “abhiroop” and also setup read, write and execute permissions → save



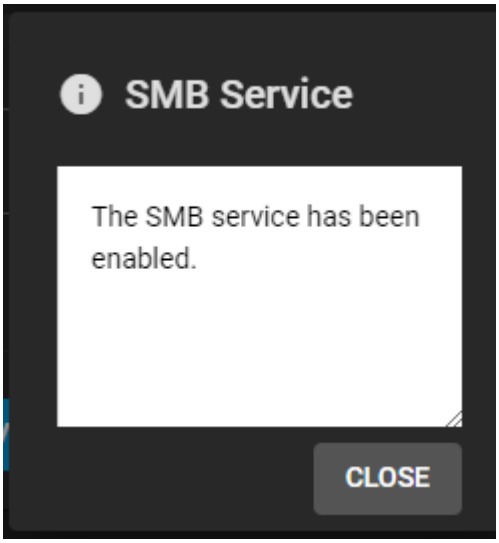
15. Now as I am using windows, I need to share this data with my local PC

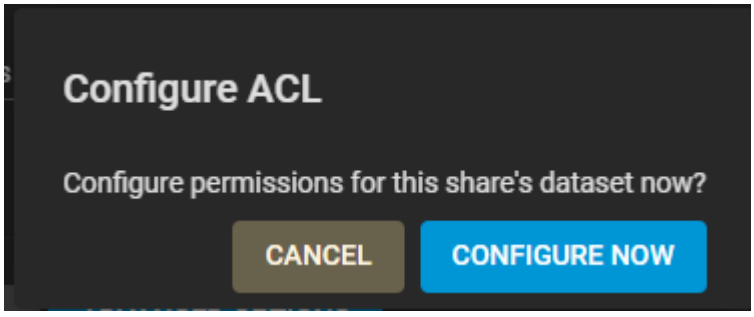
    Sharing → Windows Share (SMB) → add → select the dataset created (abhiroopData) → submit



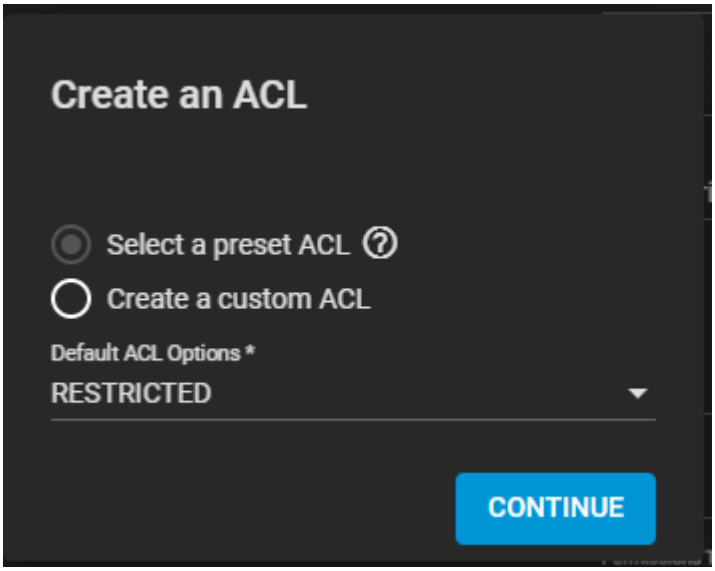


Enable Service

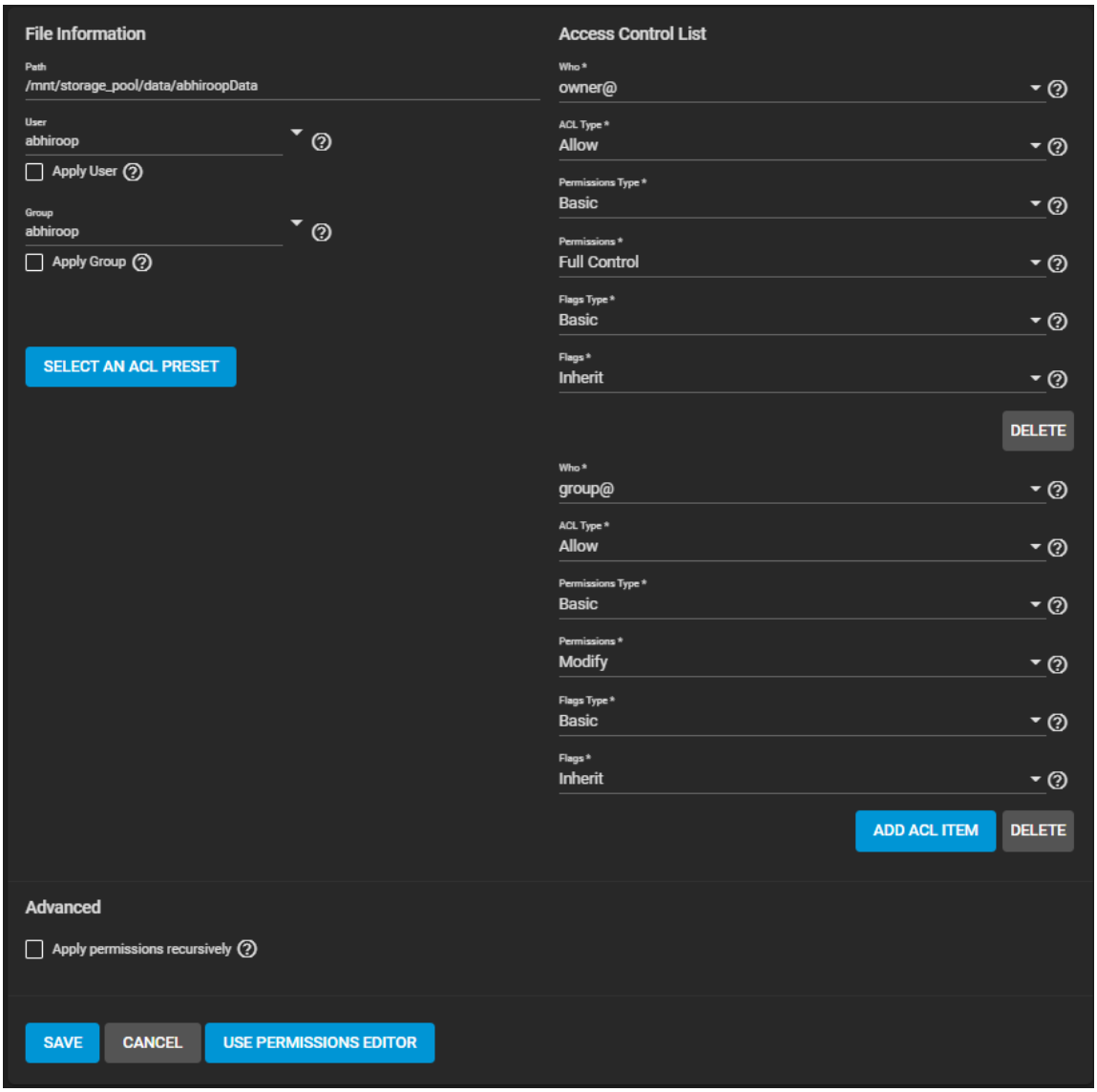




configure now (ACL → Access Control List, a list which is used to deny/allow access to the dataset)

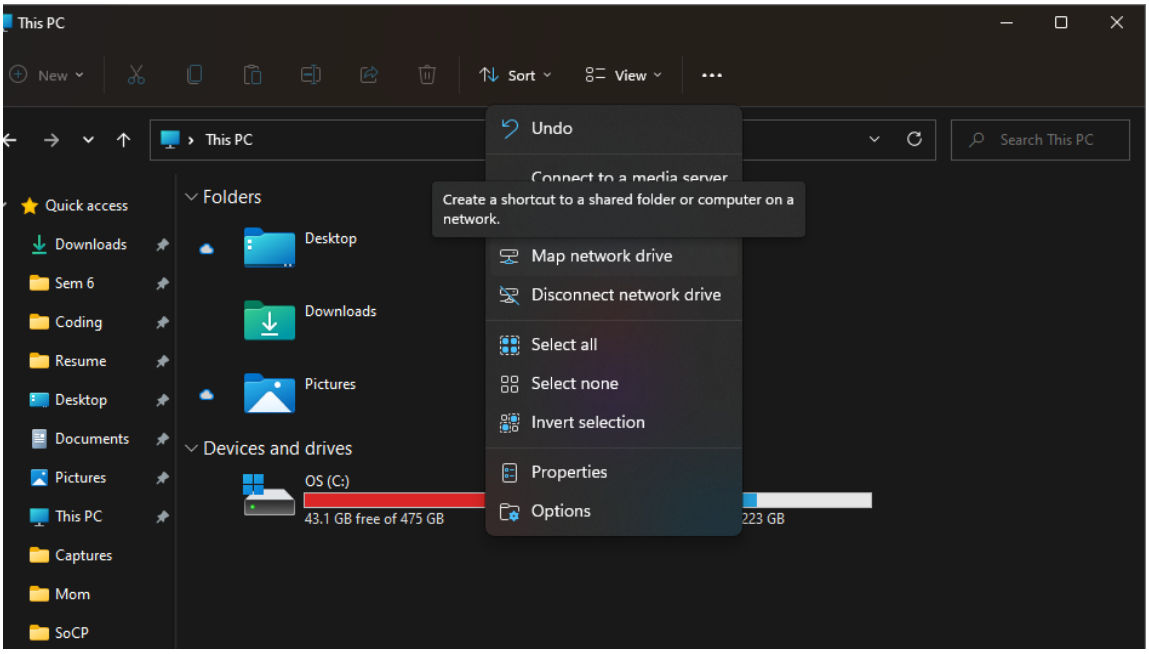


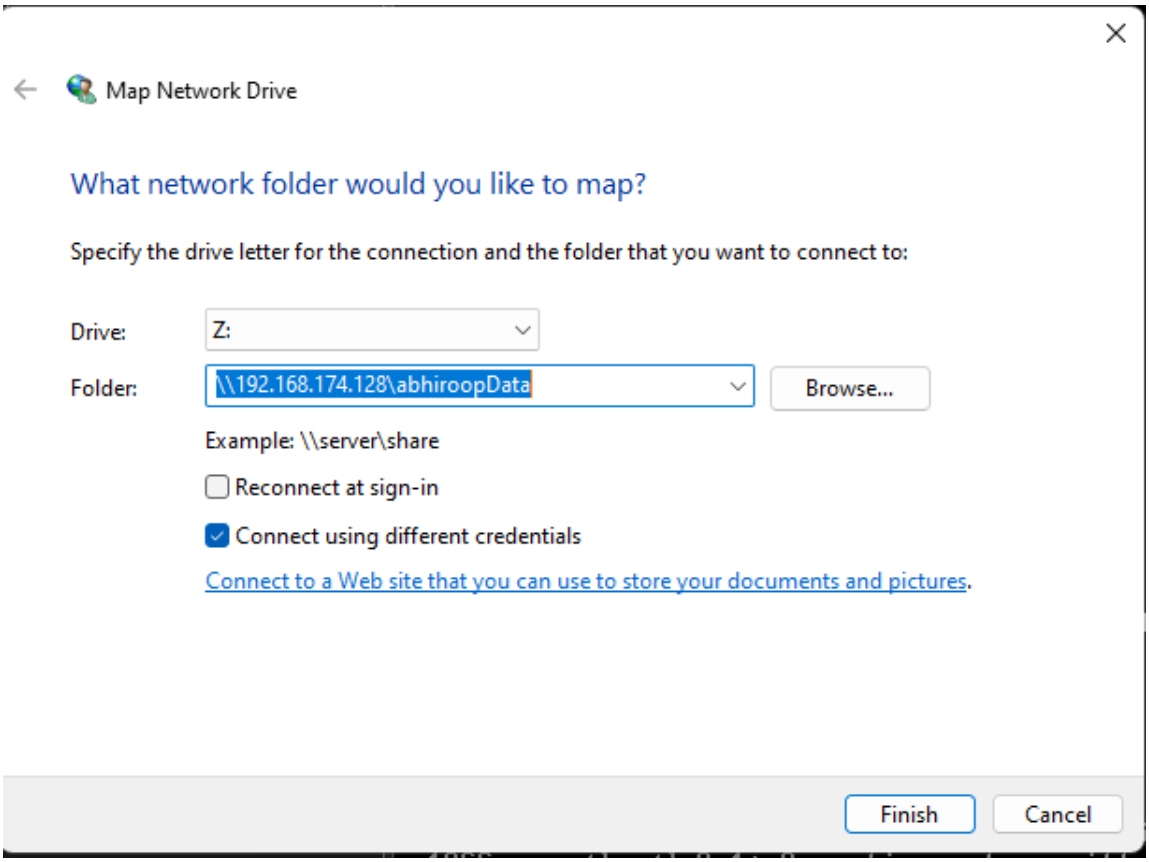
RESTRICTED → I want only me to access this dataset; press continue → save



16. now let's see if all this config works or not

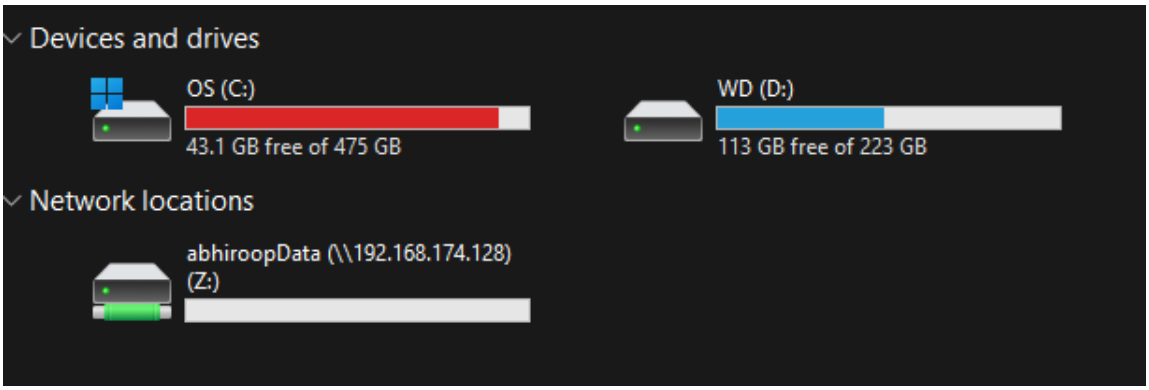
    Go to the windows explorer → three dot → map network drive

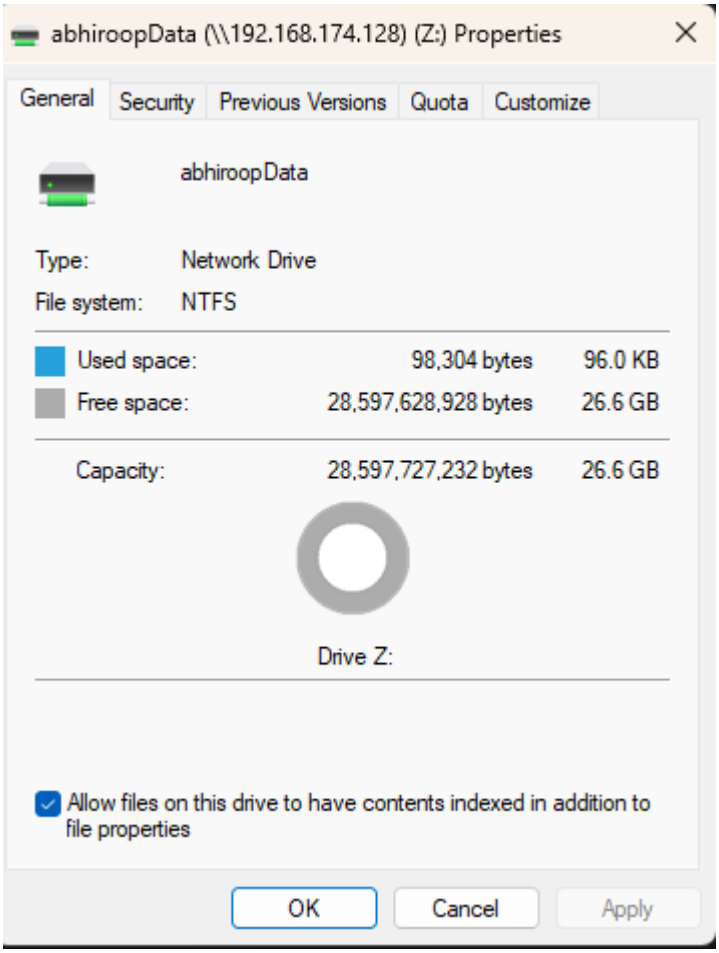




add credentials of the user created

17. Now we have network storage attached to our windows





because of the ACL added, only my account and my group can access this, we can add more users by adding them to the ACL

Case studies – the kind of experiments done using this tool

1 . TENNESSEE COUNTY SCHOOL SYSTEM

ISSUES

1. A County School System in Tennessee serves the needs of multiple K-12 schools with tens of thousands of students and thousands of staff members, requiring substantial hardware to maintain school district records and databases.

1. Previously, the School System had been using Dell EqualLogic servers for their SAN storage, but they could not handle the load and would get daily timeouts,

resulting in their virtual servers going down on a weekly basis.

2. This left important services and information unavailable to students and faculty until IT staff could reboot the servers.
3. This is were NAS comes in

CONCLUSION

1. TrueNAS won out because of its ability to provide superior performance with low-latency, solid state storage, all for fewer dollars per gigabyte than the competition.

> *"What we were looking for is something that had solid state performance. We looked at several vendors, but TrueNAS came with a lower acquisition cost, more storage, and better performance."*
>
> **- Preston Fisher**

- After evaluating all their options, the County School System decided to replace their EqualLogic servers with the all-flash TrueNAS Z50 TrueFlash High Availability (HA) Storage Appliance for their most performance intensive virtual servers.
- They also purchased a second, hybrid storage TrueNAS HA solution for additional VMware hosting.
- The TrueNAS was pre-configured for the school system with 5TB of usable storage in a
  RAID 10 configuration.

IMPROVED PERFORMANCE WITH TRUENAS

- Since implementing TrueNAS, the School System has had none of the outages they experienced with their EqualLogic solutions.

- Having High availability ensures they can do system maintenance with no downtime.
- Restore times for their PowerSchool database using an Equallogic solution used to take nearly 5 hours. Now, with TrueNAS a restore takes about 1 hour 45 minutes, nearly **tripling performance**
- Backup times for Windows VMs are nearly twice as fast, taking 30-50% less time. The IT staff for CMCSS also saved time on administration compared to their EqualLogic solution.

QUALITY CUSTOMER EXPERIENCE WITH IXSYSTEMS

- The sales staff at iXsystems are knowledgeable about the customer's environment, and provided a solution that meets the specific needs of the School System rather than pushing one size fits all configurations
- Having the development team for TrueNAS in-house also means that sales and support have more direct lines of communication with the development team than they have found with other storage vendors

CONCLUSION

- Serving the storage needs of tens of thousands of students and staff requires a high performing and reliable solution
- When the County School System's EqualLogic storage solution was not living up to their needs, they turned to iXsystems and TrueNAS.
- The All-Flash TrueNAS storage array with TrueFlash technology handles their heavy workload without missing a beat, and provides additional VM storage at near all-flash performance.
- TrueNAS not only meets their needs, but greatly improves upon their previous solution's performance at lower acquisition costs.

2 . TECHSOFT SYSTEMS

As an IT company offering cloud based services Techsoft system hosts and manages a considerable amount of data and hundreds of virtual machines .Techsoft has worked with a number of large number of vendors for their storage requirements over the years.

Issues

- Vendors were not as concerned with meeting the individualized needs as they would like.
- The high cost of other solution impacted their operation and constraint their growth and return on investment.
- Some of the applications being used in the environment had limitations which caused decrease in the performance.
- As the system was subjected to greater and greater loads both performance and stability were a concern.

Solution

- After few investigation it was found that TrueNas was a flexible platform based on open standards offering a high storage solution.
- The IXsystem worked with Techsoft to review their technical requirements make the solution that was best fit for their needs testing specific configuration to ensure functionality and performance.
- Techsoft implemented a TrueNas appliance a high performance SSD ZFS device to write 10 Gbe e disk pool configured with Raid-Z2.

3 . CalTech

California Institute of Technology Leverages Open Storage for Seismic Research

ISSUE

The California Institute of Technology (CalTech) and the City of Pasadena were trying to understand the extent to which even minor earthquakes impact and affect the city and surrounding areas.
Given ***fiscal constraints***, CalTech and the city had to leverage technology in the most ***efficient and cost effective*** manner. In addition, modern seismic sensor technology is able to capture ***large amounts of data***, so ***storage*** remains both a cost and performance challenge.

- Need to improve analysis of earthquake impact
- Financial limitations for local government solutions
- Data solutions must be **cost effective**
- Earthquakes happen 24x7, so need **high availability**

SOLUTION

Since data storage required was large and data had to be accessible fast and on demand, NAS was chosen as a suitable solution. The solution offered was TrueNAS M40. It managed cost by using open source software, OpenZFS, as well as a Two-tier cache for faster data access. It is also an easily scalable storage device offering Enterprise grade reliability at a low cost. Effectively CalTech was able to conduct it's research on the earthquakes despite budget constraints.

> 💡 **OpenZFS** is an open-source storage platform. It includes the functionality of both traditional file systems and volume manager.

4 . DeepDyve

Protecting data with ZFS Snapshots & Replication on TrueNAS

ISSUE

DeepDyve serves up millions of documents from scholarly and professional publishers to its worldwide user base on a ***24/7 basis***. DeepDyve needed a solution that would be able to store the data and keep up with their ever-increasing publication archives for over 50 million published documents. *Putting together new NFS servers every time storage needs expanded was a costly solution which also required valuable time from IT administration.* A solution that was ***easy to scale*** and that ***didn't require dedicated IT staff*** to maintain would be a substantial improvement and a considerably better investment over time.

SOLUTION

Data needed to be stored securely due to critical nature of their business. They also needed a fast restoration from their older servers to the newer solution as they couldn't halt business. Using FreeBSD as the OS on previous NFS(Network File System) storage servers meant they needed a FreeBSD/ZFS expert on site which is costly. The solution — TrueNAS

It came with all the storage functionality of FreeBSD and data integrity features of ZFS, all administered from a comprehensive Web Interface. It also meant that hardware was supported, qualified, and guaranteed to be compatible with the operating system, eliminating trial and error in builds and substantially ***reducing any***

hardware-based issues that needed to be dealt with. They didn't need specialized IT personnel to handle software. TrueNAS storage expansion shelves also made upgrading their storage painless.

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5 . iostudio

Topic: High Throughput Storage for Media Producion

Challenges

(i) iostudio wanted to consolidate their storage solutions into a single manageable solution that could be scaled easily and used by their many applications. They had diverse storage solutions, including Apple Xserve servers, some direct attached storage (DAS), and GraniteStor servers.

(ii) These solutions were aging and required a significant amount of time to manage, increasing their storage costs. These solutions also didn't have much in the way of data protection, so they needed storage with the kind of data integrity checks that a next generation file system has to offer.

Solutions

(i) TrueNAS provided high quality, scalable hardware with professional support. TrueNAS provides them with primary storage for about 50 users, and shared data using AFP and NFS over a dual port
10GbE network card. One port runs on a 1GB network fabric and serves as a storage repository and the other port runs over a 10GbE Brocade Fastiron Switch to serve as primary data storage for video editing.

(ii) TrueNAS provides iostudio with hundreds of megabytes of throughput and low latency storage necessary for creating multiple 4K video files without performance degradation. TrueNAS helped iostudio reduce their storage costs, which was a major component of their video production budget. In addition to providing responsive data storage to support their move to 4K images, TrueNAS provides multiple data integrity safeguards that provide data redundancy.

6 . University Of Cambridge

Topic: Data-Intensive University Research Finds Value with Open Storage

Challenges

The data storage requirement is increasing day by day in University Research. The example of experiments related to *fluorescence microscopy* was given which requires terabytes of data storage due to the increasing number of labs, good technologies available etc. They complain about lagging data storage available.

While the cloud option is available, It is not fit for this application because of :

1. Cloud provider pricing structures do not typically meet the budgetary requirements of most universities because pricing scales too linearly.
2. As usage levels increase, bulk storage discounts do not deliver the promised savings.
3. There are significant data movement charges that add up on large data volumes moved to and from the cloud.
4. Services typically lack the latency and bandwidth necessary for rapid access to data.

Solutions

Open Storage has evolved over the past decade becoming a viable option to tame ‘data explosion’
challenges. The capabilities and maturity of Open Storage have advanced quickly over the past several years. Features previously only available at a premium with proprietary and cloud storage solutions, such as snapshots, replication, advanced compression, access to APIs, etc., have now become standard items in Open Storage.

Why TrueNAS?

It incorporates all of the features of the OpenZFS filesystem while adding a user-friendly web interface for storage configuration and management. It also features a data protection suite that
provides the ability to combine RAID protection, replication, snapshots, automatic corruption repair, and optional high availability, to deliver enterprise-class data center protection to satisfy mission-critical research environments. The TrueNAS solution has open and clear pricing that scales in a linear fashion.

REFERENCES

FreeNAS Requirements | How to Install FreeNAS

We've all been on the wrong end of a solution that was sold as inexpensive, free, time-saving, energy saving or one that offered a quick return on investment only to end up spending more on that alternative solution than a mainstream one.

https://www.serverwatch.com/guides/freenas-free-and-snazzy-storage-solution/

What is a NAS device and how does it work?

A network-attached storage (NAS) device is a data storage device that connects to and is accessed through a network, instead of connecting directly to a computer. NAS devices

https://iosafe.com/data-protection-topics/what-is-a-nas-device/

What is Network-Attached Storage (NAS) and How Does it Work?

Network-attached storage (NAS) is dedicated file storage that enables multiple users and heterogeneous client devices to retrieve data from centralized disk capacity. Users on a local area network (LAN) access the

https://www.techtarget.com/searchstorage/definition/network-attached-storage

What is NAS (Network Attached Storage) and Why is NAS Important for Small Businesses? | Sea

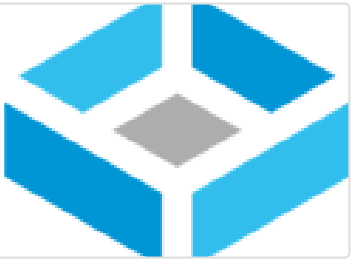
Each of these issues contributes to lack of efficiency and potential loss of income if customers must wait for a c outage to be corrected.

https://www.seagate.com/in/en/tech-insights/what-is-nas-master-ti/

Help Me Choose Between TrueNAS CORE, SCALE, or Enterprise

TrueNAS has three editions to choose from. Let us help you choose which edition of TrueNAS is right for you.

https://www.truenas.com/compare-editions/



TrueNAS - Wikipedia

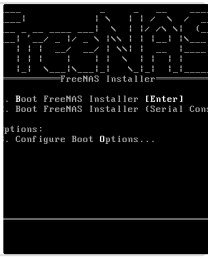
TrueNAS is the branding for a range of free and open-source network-attached storage (NAS) operating systems produced by iXsystems, and based on FreeBSD and Linux, using the OpenZFS file system. It is licensed under the terms of the BSD License and runs on commodity x86-64 hardware.

https://en.wikipedia.org/wiki/TrueNAS

2. Installing and Upgrading - FreeNAS®11.2-U3 User Guide Table of Contents

The FreeNAS ® operating system has to be installed on a separate device from the drives which hold the storage data. With only one disk drive, the FreeNAS ® web interface is available, but there is no place to store any data. And storing data is, after

https://www.ixsystems.com/documentation/freenas/11.2/install.html



Case Studies | Read How TrueNAS Revolutionizes Industry Storage Infrastructure

Learn how businesses and industries around the world have deployed TrueNAS to solve their storage problems.

https://www.truenas.com/case-studies/