STUDY GUIDE FOR MODULE NO. LAB 11

NETWORK-ATTACHED STORAGE (NAS)

MODULE OVERVIEW

This module will guide you through setting up a primary NAS (Network Attached Storage) using a Raspberry Pi. You can store and view your files using a NAS from any device connected to your home network. This module aims to provide students with hands-on experience building a cost-effective and customizable NAS solution using Raspberry Pi and open-source software. Students will learn the necessary hardware and software components, network protocols, and storage management techniques for creating and managing a Raspberry Pi-based NAS.

MODULE LEARNING OUTCOMES

By the end of this module, "Building Network-Attached Storage (NAS) using Raspberry Pi," students will be able to:

- Understand the concept and benefits of network-attached storage (NAS) systems.
- Configure and set up a Raspberry Pi for NAS purposes.
- Install and configure open-source operating systems and software for NAS on Raspberry Pi.
- Manage storage devices, including disk partitioning, formatting, and file system selection.
- Configure and optimize network protocols for efficient file sharing in a NAS environment.
- Implement data backup and redundancy strategies in a Raspberry Pi-based NAS system.
- Enable remote access to NAS files and services, including media streaming capabilities.
- Monitor and maintain the performance of a Raspberry Pi-based NAS.
- Apply security measures and data protection techniques to ensure the integrity of NAS systems.
- Troubleshoot common issues and errors encountered in NAS setups.

LEARNING CONTENT

Name: Cerujano Erman Ace M. Due date: April 15, 2024

Introduction

Network-attached Storage (NAS) provides centralized file storage and sharing capabilities over a network. NAS systems offer several benefits, including centralized Storage, easy file sharing, data redundancy, scalability, accessibility, and cost-effectiveness. They can be compared to other storage solutions, such as Direct-Attached Storage (DAS) and Cloud Storage, highlighting the advantages of NAS regarding network-wide accessibility, centralized management, and local control over data.

NAS finds applications in various scenarios, including home storage for media files and backups, small businesses requiring centralized Storage and collaboration, media streaming, surveillance systems, remote access, and backup solutions. Understanding the definition, benefits, and use cases of NAS systems provides a solid foundation for delving into the technical aspects of building and configuring a NAS using Raspberry Pi.[21]

Raspberry Pi Setup

Install Raspberry Pi OS Lite

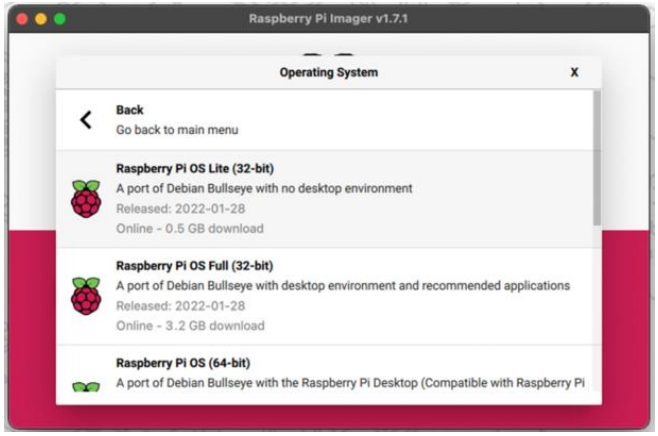
Utilize your microSD card to install Raspberry Pi OS Lite, and use Raspberry Pi Imager. It is possible to use Raspberry Pi Imager with Windows, macOS, Ubuntu for x86, and Raspberry Pi OS.[22]

Connect your microSD card to your computer, then launch the Imager software. Utilize an SD card adapter to link your microSD card to your computer. A minimum storage capacity of 16GB is advised.

On your microSD card, install Raspberry Pi OS.

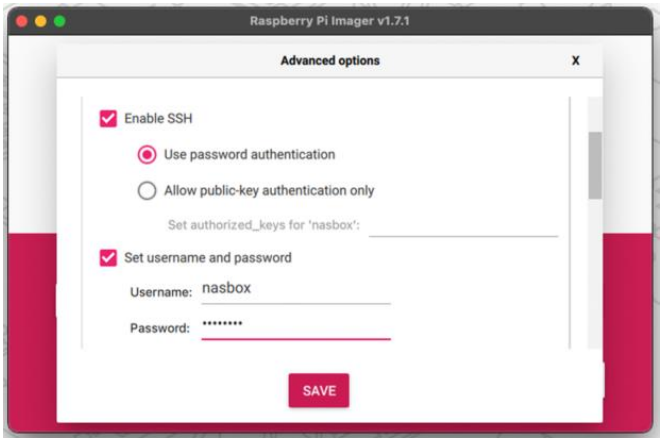
Using the Raspberry Pi Imager:

For example, pick your operating system from Raspberry Pi OS (other). Since our project's desktop environment is unnecessary, we employ the scaled-down Raspberry Pi OS Lite.



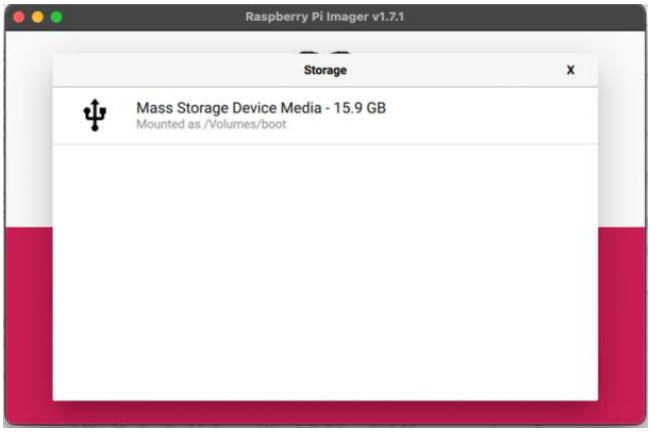
To access the advanced menu, select the Advanced Menu button or press Ctrl-Shift-X to display the Raspberry Pi Imager advanced menu.

Check the **Enable SSH** box, then provide a username and password to enable SSH. These credentials are required to access network storage and your Raspberry Pi.



To exit the advanced menu, select Save.

Select your microSD card under STORAGE.



Select **Write** to finish.

After completion, you can insert your microSD card into your Raspberry Pi by removing it from your computer.

Storage options

A portable USB and an internal hard drive with a SATA-to-USB adapter will be used for this lesson. You can also utilize a USB flash drive. We advise clearing your purpose of data because you might need to format it later. Connecting your Storage to your Raspberry Pi via a powered USB hub is advisable to ensure a steady power supply for your external hard drives.

Setting up your Raspberry Pi

An Ethernet cable must connect your Raspberry Pi to your Network. For most individuals, this entails directly connecting the gadget to your router. The powered USB hub should have your Storage attached before the Raspberry Pi. Connect your Raspberry Pi to the main power using a USB-C power supply unit.

Retrieving your IP address

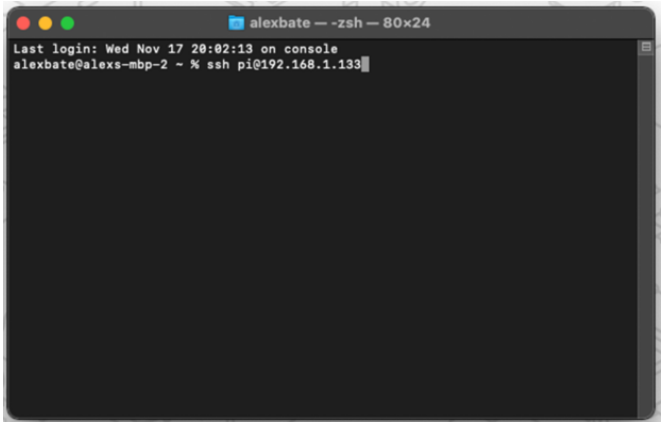
You'll need the Raspberry Pi's IP address to connect to it via SSH on your standard PC. The IP address, a unique string of digits, is used to identify a device on your Network. Logging into your home network lets you quickly determine which devices are connected over Ethernet (LAN). The login information for your router should be printed on it (check for a sticker on the side or the bottom). Still, if not, you can also find it on the manufacturer's website (or the website of your ISP, if they provided the router), which you can access by typing the manufacturer's name and the word "login" into the search bar.

Connect via SSH

To access your Raspberry Pi, launch Terminal on your computer and enter the commands below, replacing "pi" with the username you previously decided to use and XXX.XXX.X.XXX with the IP address:

ssh pi@XXX.XXX.X.XXX

Use the password you made in Raspberry Pi Imager when prompted for it.



Run the following tests to make sure your Raspberry Pi is appropriately configured for networking:

sudo rm -f /etc/systemd/network/99-default.link

Run these commands to restart your Raspberry Pi after you're done:

sudo reboot

OpenMediaVault

We'll use OpenMediaVault, a free piece of software, to control our network storage. OpenMediaVault provides a user-friendly web-based interface as well as a variety of add-on choices for power users.

Installing OpenMediaVault

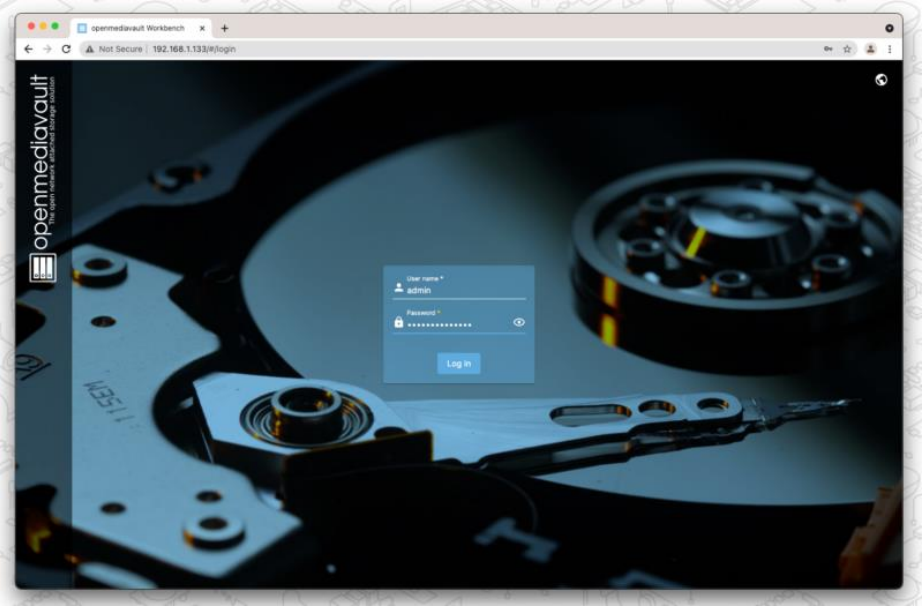
When the Raspberry Pi has restarted, go to the Terminal and SSH back into it once more.

ssh pi@XXX.XXX.X.XXX

Run the following to install OpenMediaVault:
sudo wget -O - https://github.com/OpenMediaVault-Plugin-Developers/installScript/raw/master/install | sudo bash
Close the Terminal once you're finished.

Setting up OpenMediaVault

On your primary computer, launch a browser, and then type in the Raspberry Pi's IP address.



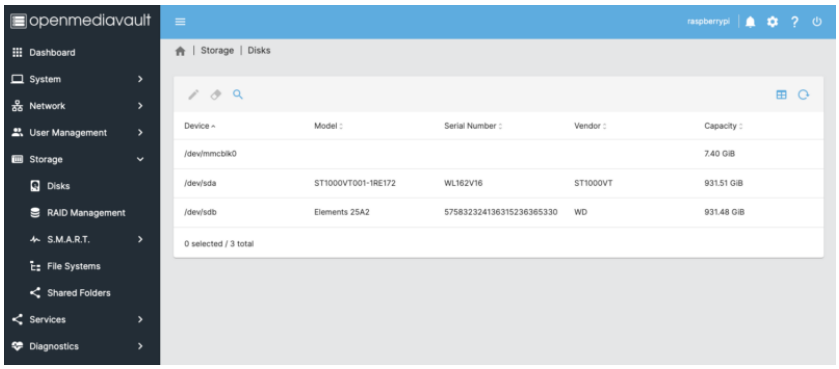
Use the following credentials to log into OpenMediaVault:
Username: admin
Password: openmediavault

Change your OpenMediaVault admin password.

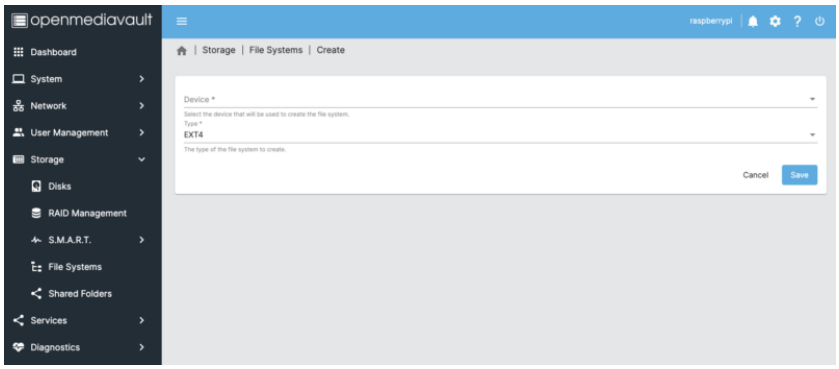
Your OpenMediaVault admin password can be changed by selecting the "cog" icon in the top-right corner of the screen.

Set up network access.

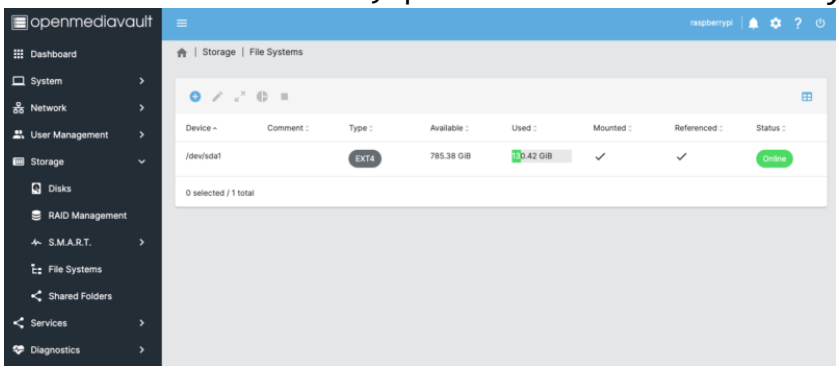
Choose Storage, then choose Disks. The SD card and all of your other linked Storage should be visible. If not, restart the computer, and everything is plugged in properly.



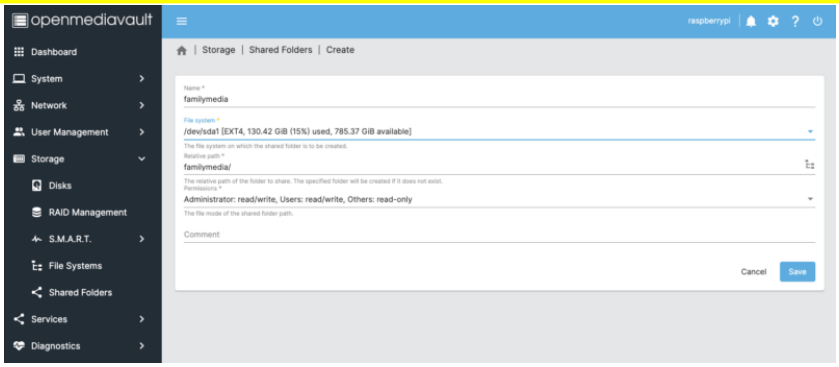
Navigate to Storage and File Systems next. Choose Create since you won't find anything here. Here, you can choose your storage option. The drive format should be set to EXT4. Select OK, then click Close.



To mount it and make modifications, please choose the file system.

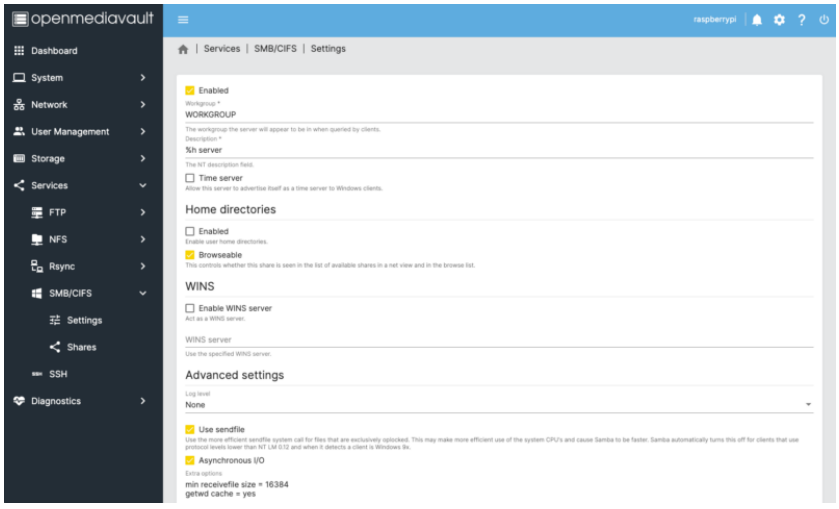


We must now make a shared folder.



Select Create after navigating to Storage and Shared Folders. Name, location on the drive, and user permissions can all be specified here for the folder. Although the permissions should be configured correctly by default, you can change them if your network configuration calls for a different structure. Add changes by saving.
The machines on your Network must be able to locate the folder, and that's it.

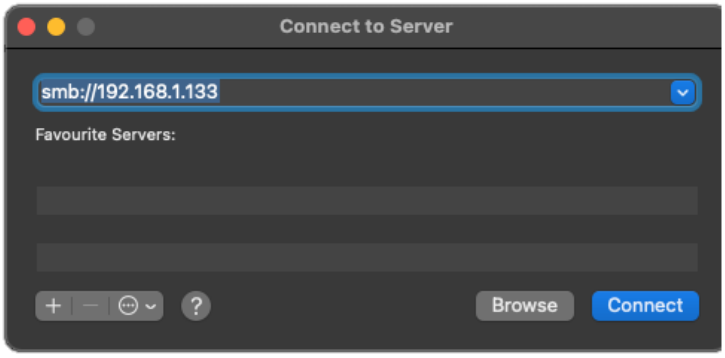
Choose SMB/CIFS under Services by navigating there.



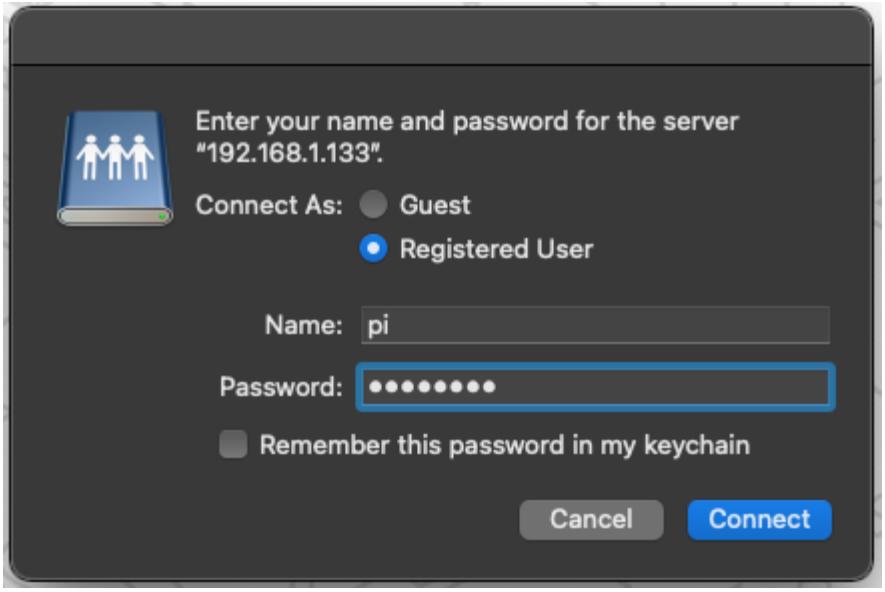
Check the Enabled box under Settings and then save. Choose Create from the Shares menu, then add your shared folder and save.
You should now be able to use your NAS system.

Access your NAS from macOS

Press Command+K on your computer's desktop. Type smb://XXX.XXX.X.XXX (in replacing of with your NAS Raspberry Pi's IP address).



Provide your login information. Your Raspberry Pi Imager login and password are what you made them.



A window in the finder will now display your shared folder.

Access your NAS from Windows

Activate Windows Explorer. In the path bar, type XXX.XXX.X.XXX (using your Raspberry Pi NAS's IP address).

In the left navigation bar, this should add a new entry under Network and display its contents. When prompted, double-click on the desired share and input the username and password you made in Raspberry Pi Imager.

Access your NAS from an iPhone

The iOS Files app on your iPhone lets you link it to your NAS.

Open the application, switch to Browse view, and then hit the "three dots" icon in the top right corner of the screen.

You can choose to Connect to Server from this menu. When prompted, enter

the IP address of your NAS Raspberry Pi along with the login and password you created in Raspberry Pi Imager, then hit Enter.

SUMMARY / CONCLUSION

This paper discusses our process of setting up a NAS (Network Attached Storage) system using a Raspberry Pi. NAS allows centralizing file storage and sharing over a network, offering benefits like centralized storage, easy file sharing, data redundancy, scalability, and accessibility.

We begin by installing Raspberry Pi OS Lite onto an SD card using Raspberry Pi Imager. We enable SSH during installation for remote access to the Raspberry Pi. We then connect some external storage devices like a USB drive or HDD to the Raspberry Pi using a powered USB hub, which will provide steady power. To start setting it up, we need to retrieve the Raspberry Pi's IP address on my network so we can SSH it from our computer.

Next, we install OpenMediaVault, a free and open-source NAS software, on the Raspberry Pi via the command line. We configure it through the web interface, setting our admin password, formatting and mounting the storage disks, and creating a shared folder. We enable the SMB service to allow sharing over the network. To test, we accessed the shared folder from my Windows computer by browsing the Raspberry Pi's IP address and authenticating it with our credentials.

In summary, we provide step-by-step instructions for setting up a basic yet fully functional NAS using a Raspberry Pi with OpenMediaVault for centralized and remotely accessible file storage on our local network. The process was straightforward to follow.

REFERENCES

[1] Raspberry Pi Foundation. (n.d.). How to build a Raspberry Pi NAS. Raspberry Pi. https://www.raspberrypi.com/tutorials/nas-box-raspberry-pi-tutorial/

[2] How to build a Raspberry Pi Nas (IT’S AWESOME!!). YouTube. (2021, October 2). https://youtu.be/gyMpI8csWis?si=mYcFPznFO6TInrro