Set Up Your Own Raspberry Pi Cloud Server with Nextcloud Document

Course: CNE350 Unix and IoT

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1. Project Overview

Nextcloud is an open-source, self-hosted file-sharing and collaboration platform that allows users to store, manage, and share files securely. It offers a range of functionalities similar to popular cloud storage services like Google Drive, Dropbox, and Microsoft OneDrive but with the added advantage of giving users complete control over their data and privacy. Here are some of the key benefits of using Nextcloud:

1. **Data Ownership and Privacy**: Since Nextcloud is self-hosted, users have full control over their data. This means that files are stored on servers that the user owns or trusts, reducing the risk of data breaches and unauthorized access.
2. **Customization and Flexibility**: Being open-source, Nextcloud can be customized to meet specific needs. Users can modify the software and integrate additional features through a wide array of apps available in the Nextcloud app store.
3. **Security**: Nextcloud includes robust security features such as end-to-end encryption, two-factor authentication, and granular access controls. Regular security updates ensure that data remains protected against vulnerabilities.
4. **Collaboration Tools**: Nextcloud offers a variety of collaboration tools, including file sharing, collaborative document editing, calendar and contacts management, and communication apps like Nextcloud Talk for audio and video conferencing.
5. **Scalability**: Nextcloud can scale from small home setups to large enterprise environments, accommodating a growing number of users and increasing amounts of data.
6. **Compliance**: It helps organizations meet regulatory requirements related to data protection and privacy, such as GDPR, by providing full data control and transparency.
7. **Cost-Effectiveness**: While there are costs associated with hosting and maintaining the server, Nextcloud itself is free to use, potentially reducing expenses compared to proprietary cloud services.
8. **Integration Capabilities**: Nextcloud integrates seamlessly with other enterprise tools and services, including LDAP/AD for user management, various storage backends, and third-party productivity applications.

Overall, Nextcloud provides a powerful, secure, and flexible alternative to proprietary cloud services, giving users and organizations the ability to manage their data according to their own policies and requirements.

2. Project scope

- Install and configure NextCloudPi OS on Raspberry Pi.
- Activate and configure NextCloud.
- Setup external storage for Cloud Server.
- Configure external access over the Internet.

II. Install and configure NextCloudPi OS on Raspberry Pi

1. Install NextCloudPi OS

Download the NextCloudPi OS image file from:

https://github.com/nextcloud/nextcloudpi/releases.

It is in Zip format (NextcloudPi_RaspberryPi4_v1.54.0.zip). So, we have to extract it.

Then, download Raspberry Pi Imager from:

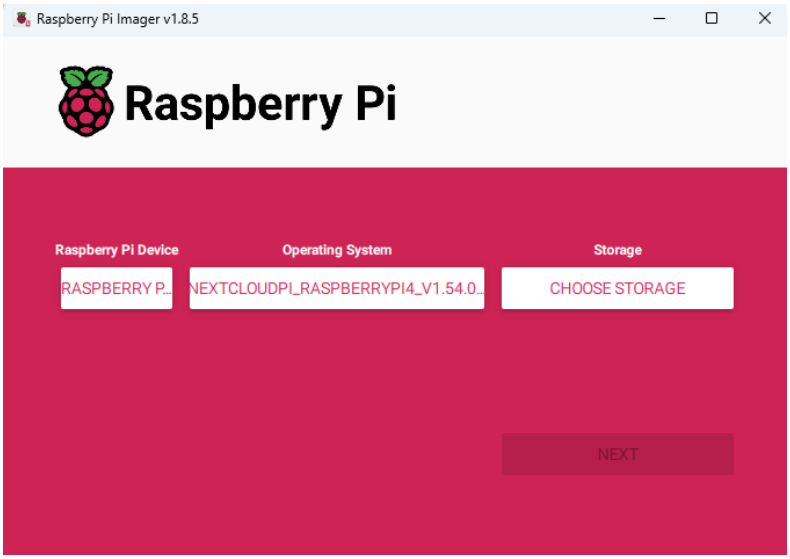
https://www.raspberrypi.com/software/

Double-click the download file to start the setup of the Raspberry Pi Imager.

After completing the setup, click Choose Device to select your Pi device (Raspberry Pi 4).

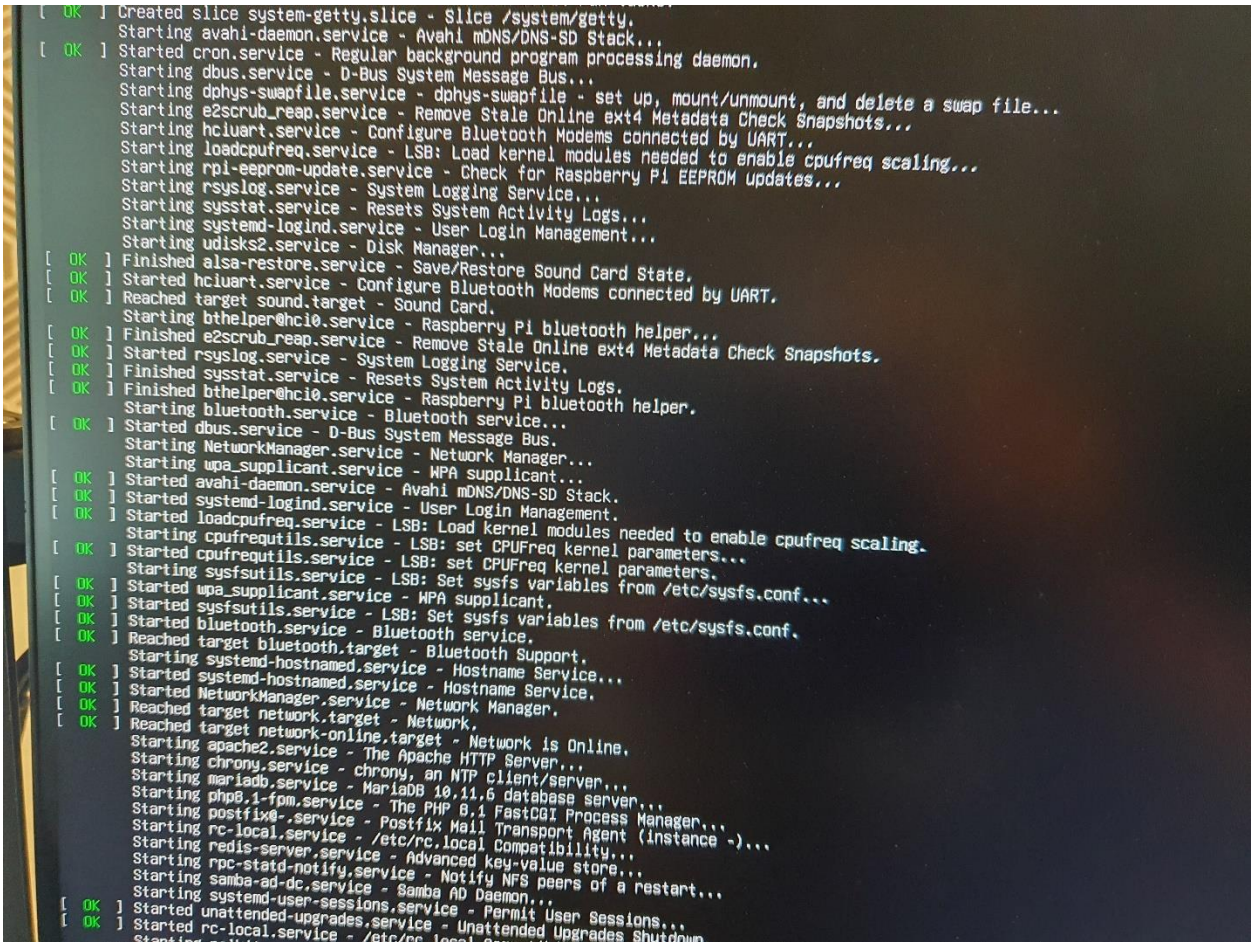
Then, click Choose OS and browse to the location of the zip extracted file.

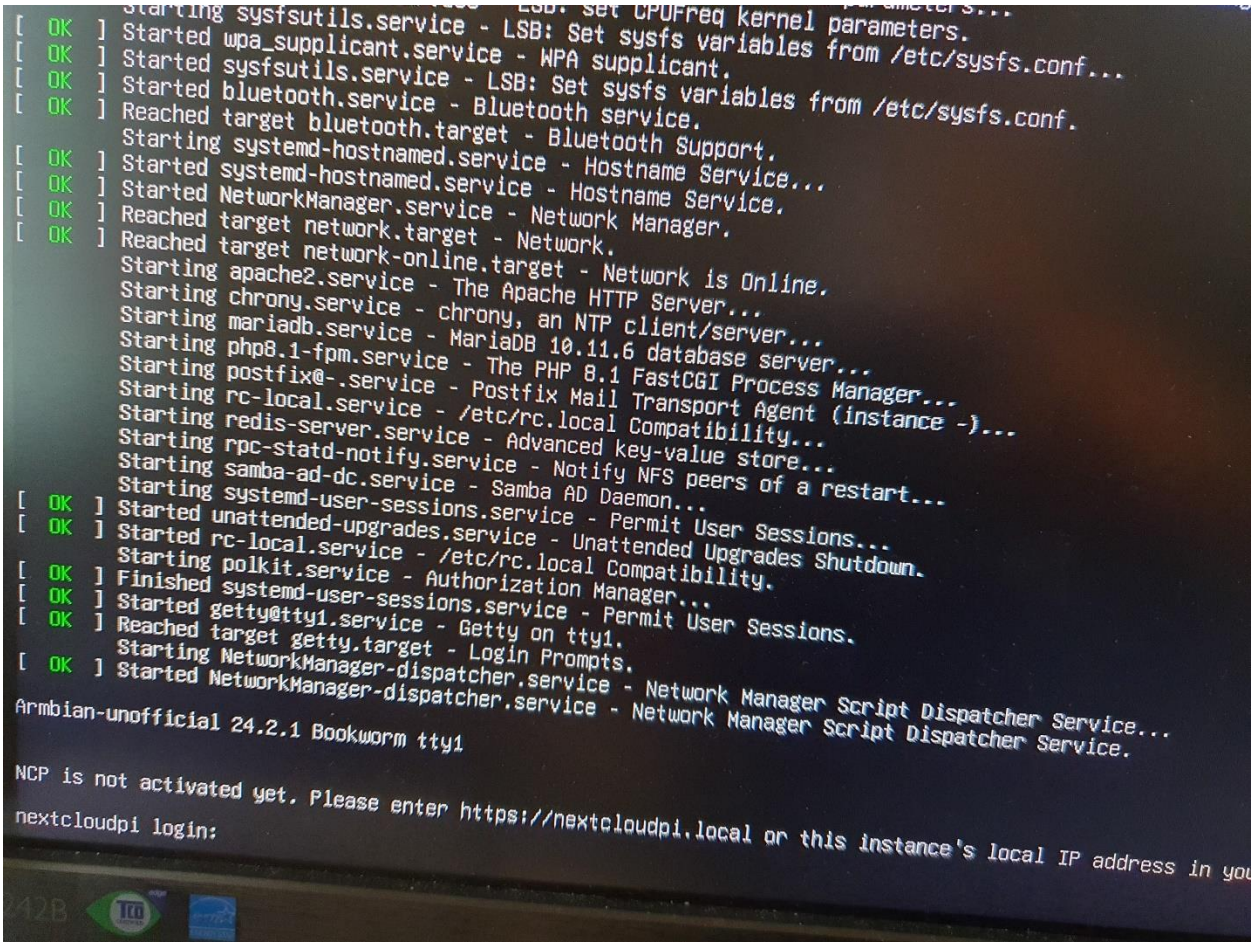
Click Choose Storage to select the microSD card.



Click Next to continue.

After the writing process is completed, remove the SD card and insert it into the Raspberry Pi 4's microSD card slot. Then, turn on the Raspberry Pi 4 to start the booting process.


[OK] Created slice system-getty.slice - Slice /system/getty.
Starting avahi-daemon.service - Avahi mDNS/DNS-SD Stack...
[OK] Started cron.service - Regular background program processing daemon.
Starting dbus.service - D-Bus System Message Bus...
Starting dphys-swapfile.service - dphys-swapfile - set up, mount/unmount, and delete a swap file...
Starting e2scrub_reap.service - Remove Stale Online ext4 Metadata Check Snapshots...
Starting hciuart.service - Configure Bluetooth Modems connected by UART...
Starting loadcpufreq.service - LSB: Load kernel modules needed to enable cpufreq scaling...
Starting rpi-eeprom-update.service - Check for Raspberry Pi EEPROM updates...
Starting rsyslog.service - System Logging Service...
Starting sysstat.service - Resets System Activity Logs...
Starting systemd-logind.service - User Login Management...
Starting udisks2.service - Disk Manager...
[OK] Finished alsa-restore.service - Save/Restore Sound Card State.
[OK] Started hciuart.service - Configure Bluetooth Modems connected by UART.
[OK] Reached target sound.target - Sound Card.
Starting bthelper@hci0.service - Raspberry Pi bluetooth helper...
[OK] Finished e2scrub_reap.service - Remove Stale Online ext4 Metadata Check Snapshots.
[OK] Started rsyslog.service - System Logging Service.
[OK] Finished sysstat.service - Resets System Activity Logs.
[OK] Finished bthelper@hci0.service - Raspberry Pi bluetooth helper.
Starting bluetooth.service - Bluetooth service...
[OK] Started dbus.service - D-Bus System Message Bus.
Starting NetworkManager.service - Network Manager...
Starting wpa_supplicant.service - WPA supplicant...
[OK] Started avahi-daemon.service - Avahi mDNS/DNS-SD Stack.
[OK] Started systemd-logind.service - User Login Management.
[OK] Started loadcpufreq.service - LSB: Load kernel modules needed to enable cpufreq scaling.
Starting cpufrequtils.service - LSB: set CPUFreq kernel parameters...
[OK] Started cpufrequtils.service - LSB: set CPUFreq kernel parameters.
Starting sysfsutils.service - LSB: Set sysfs variables from /etc/sysfs.conf...
[OK] Started wpa_supplicant.service - WPA supplicant.
[OK] Started sysfsutils.service - LSB: Set sysfs variables from /etc/sysfs.conf.
[OK] Started bluetooth.service - Bluetooth service.
[OK] Reached target bluetooth.target - Bluetooth Support.
Starting systemd-hostnamed.service - Hostname Service...
[OK] Started systemd-hostnamed.service - Hostname Service.
[OK] Started NetworkManager.service - Network Manager.
[OK] Reached target network.target - Network.
[OK] Reached target network-online.target - Network is Online.
Starting apache2.service - The Apache HTTP Server...
Starting chrony.service - chrony, an NTP client/server...
Starting mariadb.service - MariaDB 10.11.6 database server...
Starting php8.1-fpm.service - The PHP 8.1 FastCGI Process Manager...
Starting postfix@-.service - Postfix Mail Transport Agent (instance -)...
Starting rc-local.service - /etc/rc.local Compatibility...
Starting redis-server.service - Advanced key-value store...
Starting rpc-statd-notify.service - Notify NFS peers of a restart...
Starting samba-ad-dc.service - Samba AD Daemon...
[OK] Started systemd-user-sessions.service - Permit User Sessions...
[OK] Started unattended-upgrades.service - Unattended Upgrades Shutdown



The installation of NextCloudPi OS is completed.

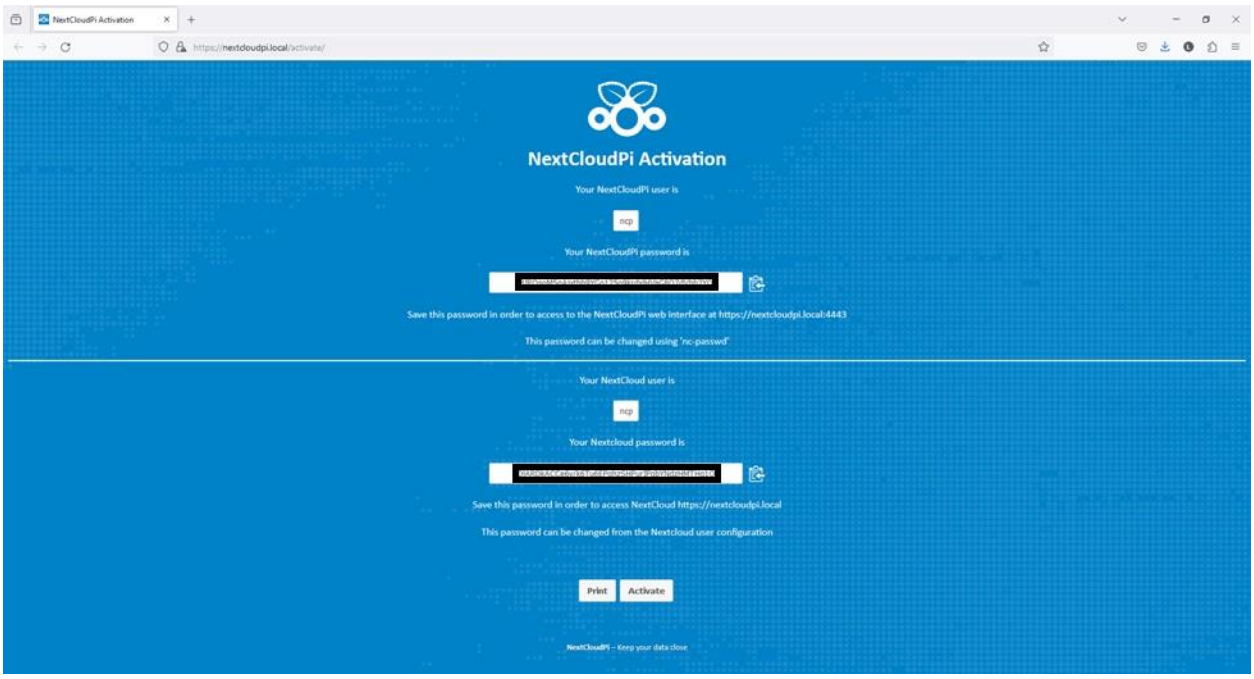
2. Configure NextCloudPi OS

Connect Raspberry Pi 4 to LAN to receive IP Address.

a. Activate the NextCloud account

Open the web browser then type:

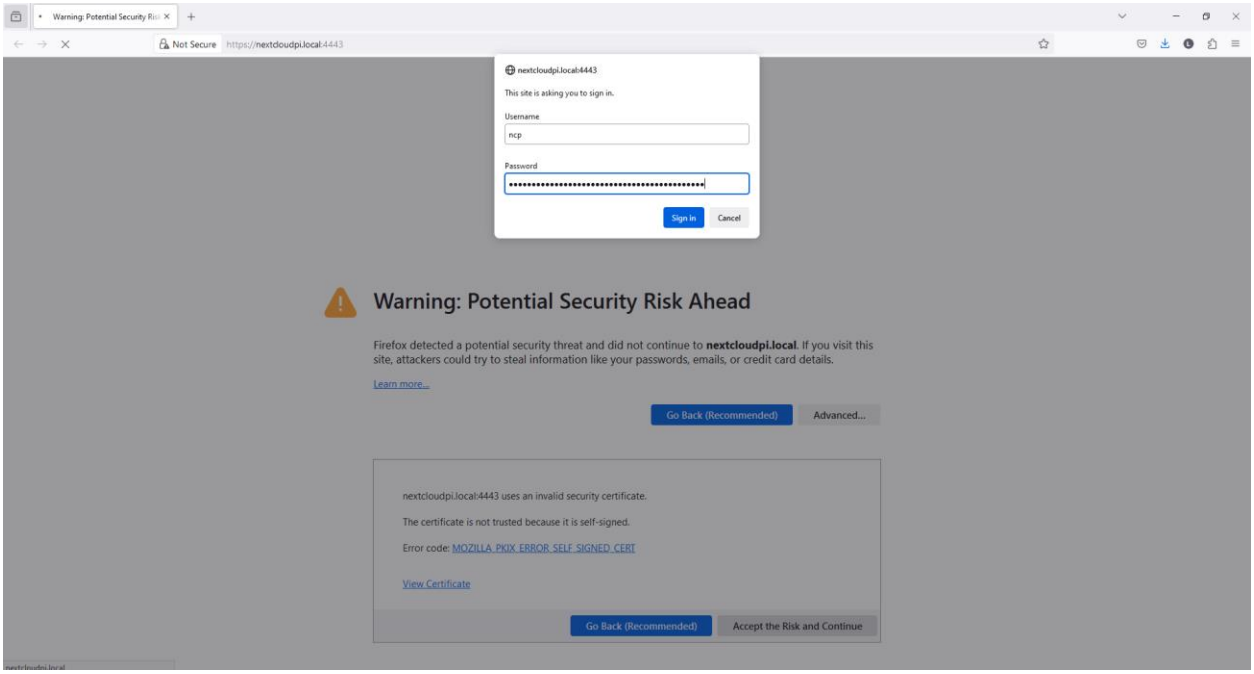
https://nextcloudpi.local/activate



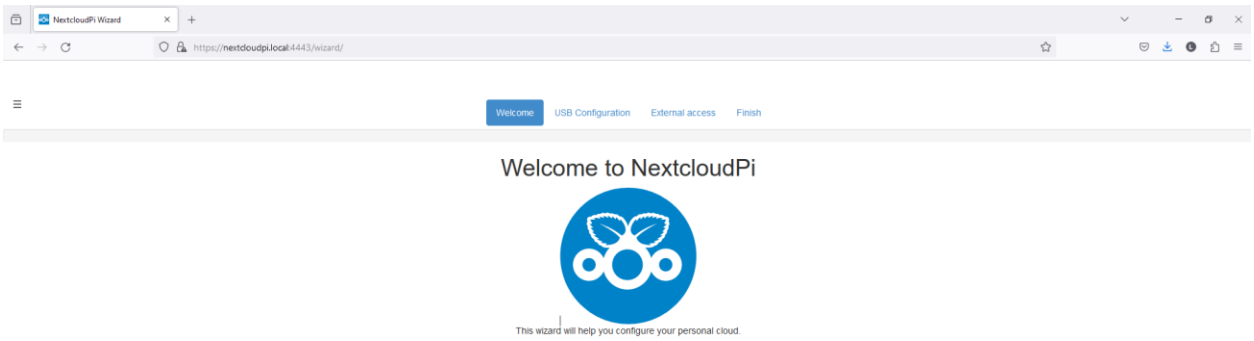
Then, click Activate to activate your account.

b. Change username and password

Type https://nextcloudpi.local:4443 on your web browser to access the GUI interface.

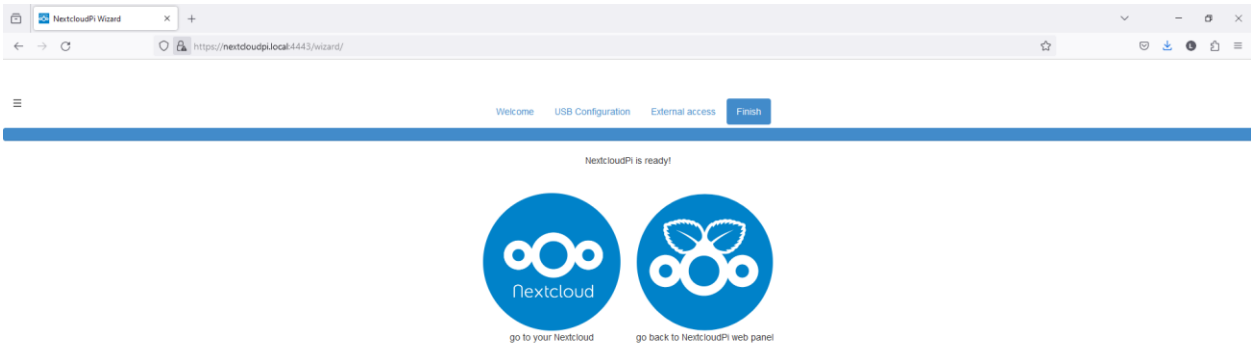


Type the default username and password (ncp/nc-passwd) to login.

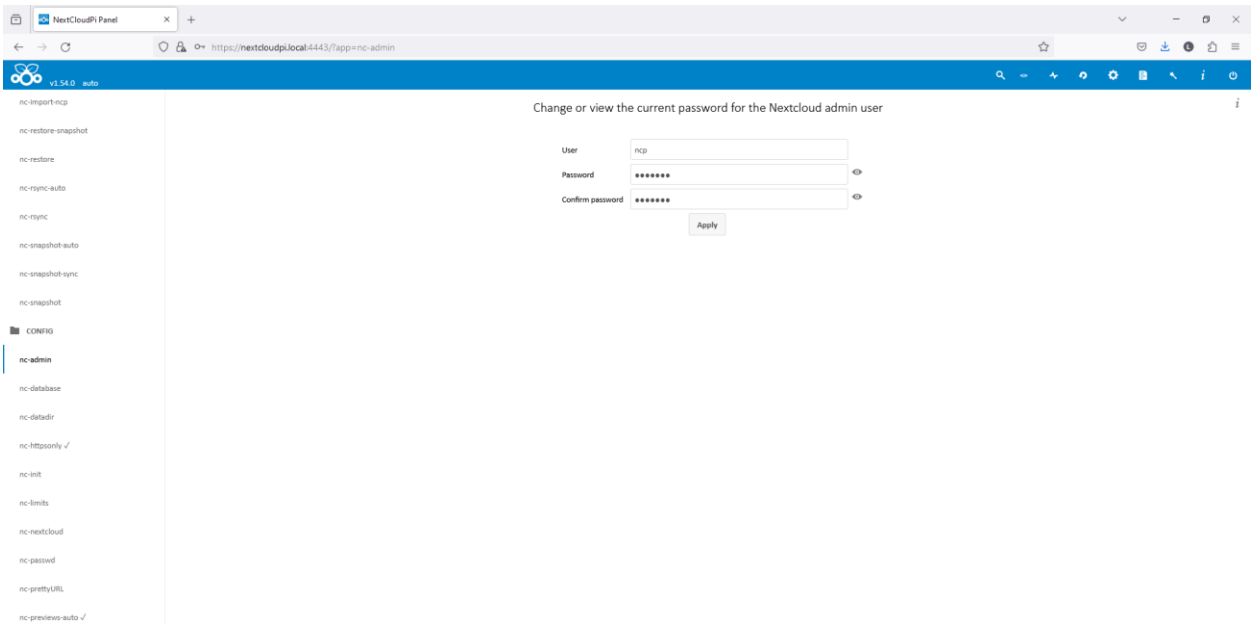


You have login successfully.

Click Finish and then select “go back to NextCloudPi web panel”.

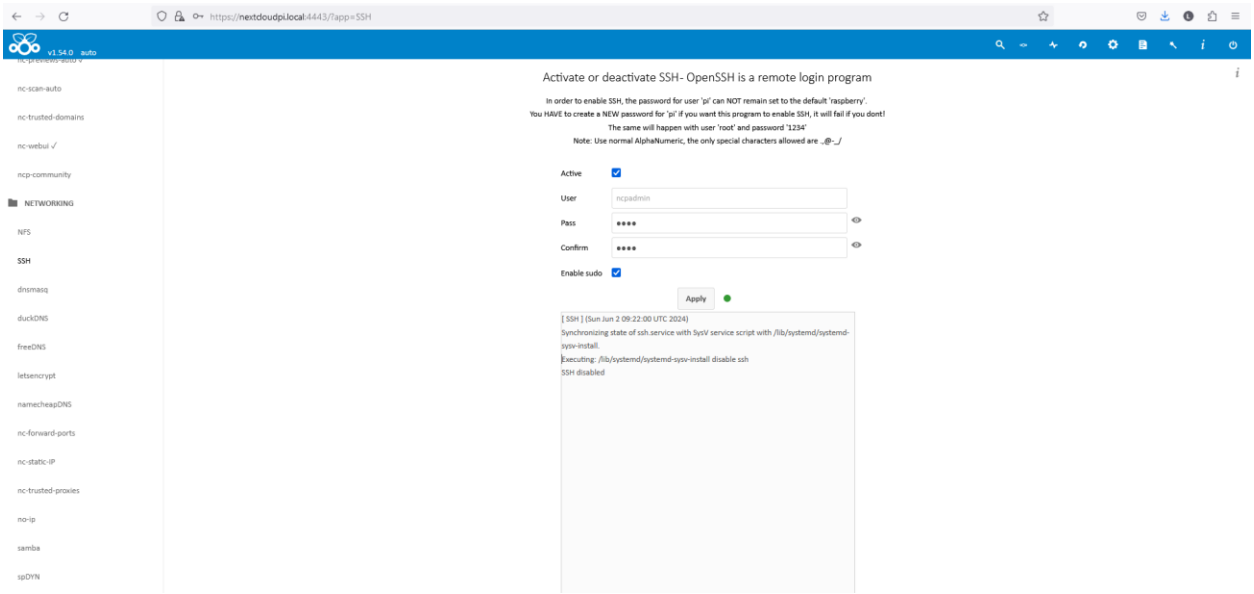


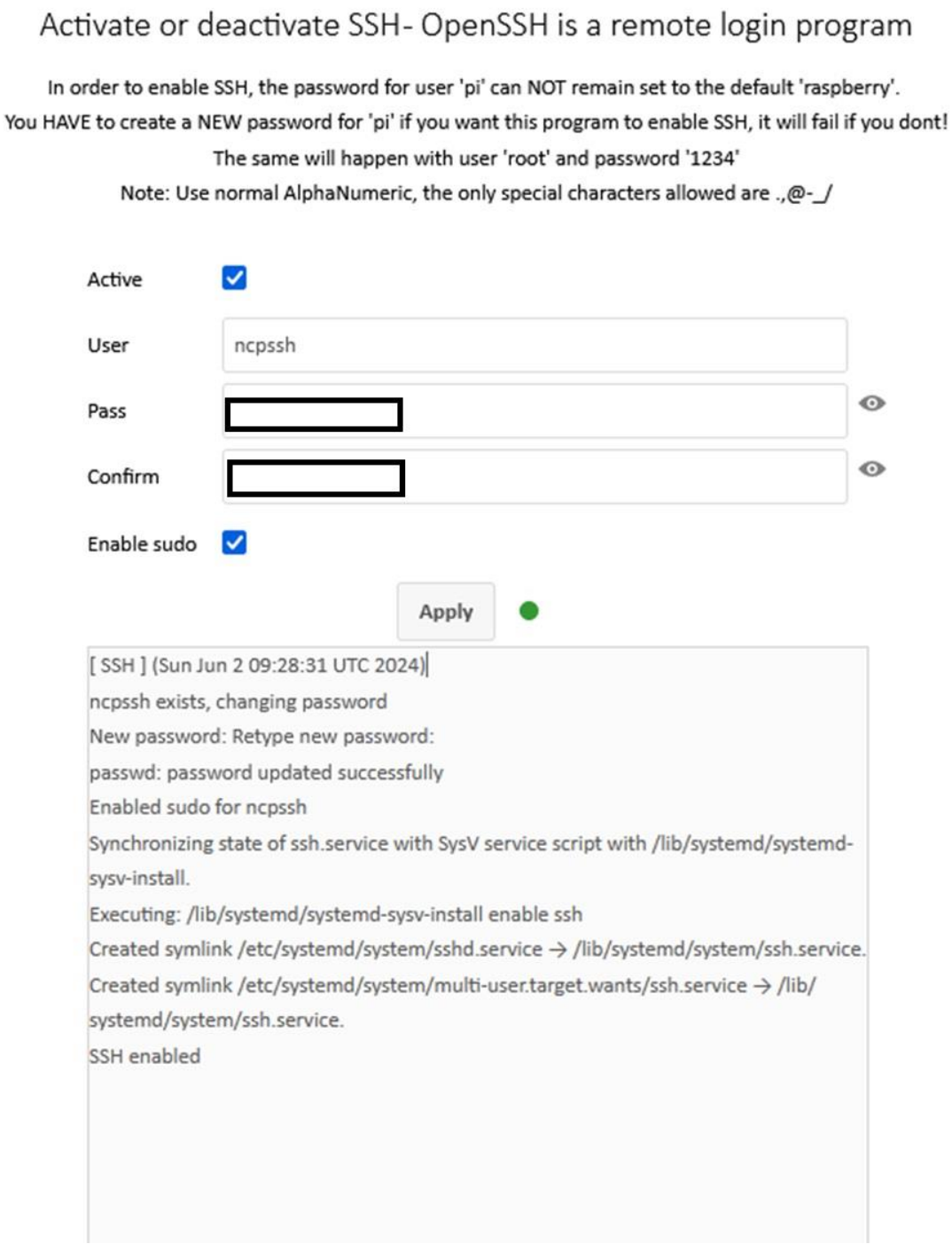
Click the Config tab and then click the nc-admin tab to access the change username and password page.



Type the new password and click Apply.

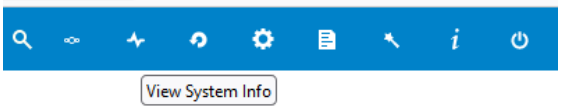
c. Activate SSH access





d. Find IP Address:

Click the in



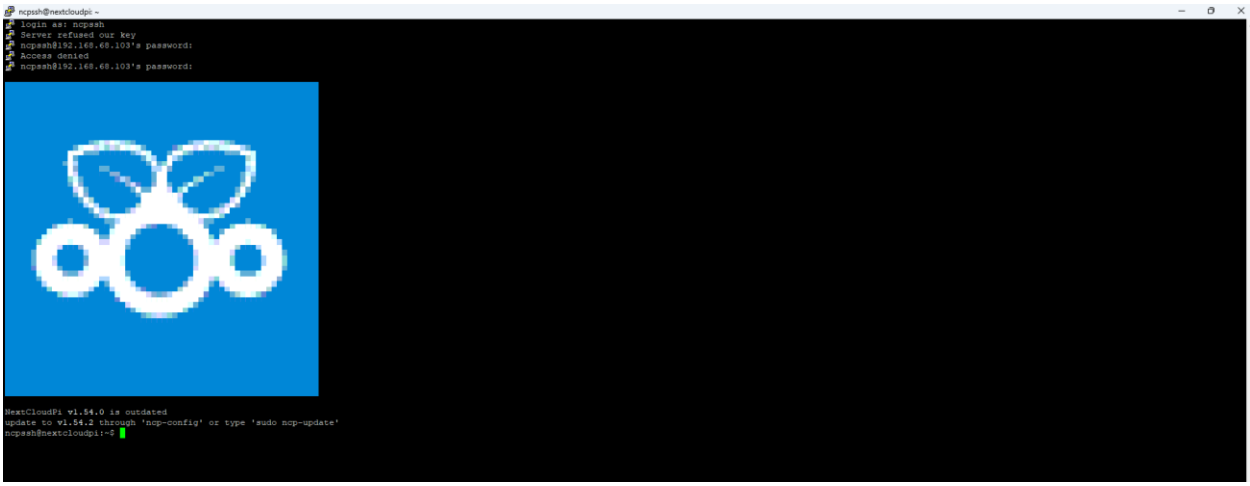
System Info

- You should run Lets Encrypt for trusted encrypted access
- You should open your ports for Lets Encrypt and external access

NextcloudPi version	v1.54.0
NextcloudPi image	
OS	Armbian-unofficial 24.2.1 Bookworm | . 6.6.18-current-bcm2711 (aarch64)
automount	no
USB devices	none
datadir	/opt/ncdata/data
data in SD	yes
data filesystem	ext2/ext3
data disk usage	4.8G/29G
rootfs usage	4.8G/29G
swapfile	/var/swap
dbdir	/var/lib/mysql
Nextcloud check	ok
Nextcloud version	28.0.5.1
HTTPD service	up
PHP service	up
MariaDB service	up
Redis service	up
HPB service	up
Postfix service	up
Internet check	ok
Public IPv4	73.254.236.206
Public IPv6	not found
Port 80	closed
Port 443	closed
IP	192.168.68.103
Gateway	192.168.68.18
Interface	end0
Certificates	none
NAT loopback	no
Uptime	7min

SSH to NextCloud Server and update.

ncpssh@nextcloudpi:~$ sudo ncp-update



```
ncpssh@nextcloudpi:~$ sudo ncp-update
[sudo] password for ncpssh:
Downloading updates
Performing updates
Update root login prevention method...
done.
Fixing trusted proxies list...
done.
Updating PHP package signing key...
Hit:1 http://deb.debian.org/debian bookworm InRelease
Hit:2 http://security.debian.org bookworm-security InRelease
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease
Hit:4 http://deb.debian.org/debian bookworm-backports InRelease
Hit:6 https://packages.sury.org/php bookworm InRelease
Hit:5 http://armbian.tnahosting.net/apt bookworm InRelease
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
gnupg2 is already the newest version (2.2.40-1.1).
0 upgraded, 0 newly installed, 0 to remove and 4 not upgraded.
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
Executing: /tmp/apt-key-gpghome.4KL5hQzMpL/gpg.1.sh --fetch-keys https://packages.sury.org/php/apt.gpg
gpg: requesting key from 'https://packages.sury.org/php/apt.gpg'
gpg: key B188E2B695BD4743: "DEB.SURY.ORG Automatic Signing Key <deb@sury.org>" not changed
gpg: Total number processed: 1
gpg:              unchanged: 1
done.
Installing dependencies...
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
tmux is already the newest version (3.3a-3).
0 upgraded, 0 newly installed, 0 to remove and 4 not upgraded.
done.
Updating obsolete theming URL
done.
NextCloudPi updated to version v1.54.0
Reenable erroneously disabled package sources
done
Hit:1 http://security.debian.org bookworm-security InRelease
Hit:2 http://deb.debian.org/debian bookworm InRelease
Hit:3 http://deb.debian.org/debian bookworm-updates InRelease
Hit:4 http://deb.debian.org/debian bookworm-backports InRelease
Hit:6 https://packages.sury.org/php bookworm InRelease
Hit:5 http://armbian.lv.auroradev.org/apt bookworm InRelease
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  zstd
0 upgraded, 1 newly installed, 0 to remove and 4 not upgraded.
Need to get 584 kB of archives.
After this operation, 1,956 kB of additional disk space will be used.
Get:1 http://deb.debian.org/debian bookworm/main arm64 zstd arm64 1.5.4+dfsg2-5 [584 kB]
Fetched 584 kB in 0s (2,150 kB/s)
Selecting previously unselected package zstd.
(Reading database ... 36624 files and directories currently installed.)
Preparing to unpack .../zstd_1.5.4+dfsg2-5_arm64.deb ...
Unpacking zstd (1.5.4+dfsg2-5) ...
Setting up zstd (1.5.4+dfsg2-5) ...
Processing triggers for man-db (2.11.2-2) ...
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```
Processing triggers for man-db (2.11.2-2) ...
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  armbian-bsp-cli-rpi4b-current base-files linux-dtb-current-bcm2711 linux-image-current-bcm2711
4 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Need to get 27.6 MB of archives.
After this operation, 2,401 kB disk space will be freed.
Get:2 http://armbian.tnahosting.net/apt bookworm/main arm64 armbian-bsp-cli-rpi4b-current arm64 24.5.1 [428 kB]
Get:3 http://armbian.lv.auroradev.org/apt bookworm/main arm64 linux-dtb-current-bcm2711 arm64 24.5.1 [123 kB]
Get:1 http://apt.armbian.com bookworm/main arm64 base-files arm64 24.5.1-12.4+deb12u5-bookworm [53.1 kB]
Get:4 http://armbian.tnahosting.net/apt bookworm/main arm64 linux-image-current-bcm2711 arm64 24.5.1 [27.0 MB]
Fetched 27.6 MB in 7s (4,144 kB/s)
(Reading database ... 36646 files and directories currently installed.)
Preparing to unpack .../base-files_24.5.1-12.4+deb12u5-bookworm_arm64.deb ...
Unpacking base-files (24.5.1-12.4+deb12u5-bookworm) over (24.2.1-12.4+deb12u5-bookworm) ...
Setting up base-files (24.5.1-12.4+deb12u5-bookworm) ...
(Reading database ... 36645 files and directories currently installed.)
Preparing to unpack .../armbian-bsp-cli-rpi4b-current_24.5.1_arm64.deb ...
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PCfbcf-Vaf6d-H032a-Ba0e2-R6632': 'preinst' starting.
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PCfbcf-Vaf6d-H032a-Ba0e2-R6632': 'preinst' finishing.
Unpacking armbian-bsp-cli-rpi4b-current (24.5.1) over (24.2.1) ...
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PC13d1-Vc162-H032a-Ba537-R6632': 'postrm' starting.
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PC13d1-Vc162-H032a-Ba537-R6632': 'postrm' finishing.
Preparing to unpack .../linux-dtb-current-bcm2711_24.5.1_arm64.deb ...
Armbian 'linux-dtb-current-bcm2711' for '6.6.31-current-bcm2711': 'preinst' starting.
Armbian 'linux-dtb-current-bcm2711' for '6.6.31-current-bcm2711': 'preinst' finishing.
Unpacking linux-dtb-current-bcm2711 (24.5.1) over (24.2.1) ...
Preparing to unpack .../linux-image-current-bcm2711_24.5.1_arm64.deb ...
Armbian 'linux-image-current-bcm2711' for '6.6.18-current-bcm2711': 'prerm' starting.
Armbian 'linux-image-current-bcm2711' for '6.6.18-current-bcm2711': 'prerm' finishing.
Armbian 'linux-image-current-bcm2711' for '6.6.31-current-bcm2711': 'preinst' starting.
Armbian 'linux-image-current-bcm2711' for '6.6.31-current-bcm2711': 'preinst' finishing.
Unpacking linux-image-current-bcm2711 (24.5.1) over (24.2.1) ...
Armbian 'linux-image-current-bcm2711' for '6.6.18-current-bcm2711': 'postrm' starting.
Armbian 'linux-image-current-bcm2711' for '6.6.18-current-bcm2711': 'postrm' finishing.
Setting up linux-image-current-bcm2711 (24.5.1) ...
Armbian 'linux-image-current-bcm2711' for '6.6.31-current-bcm2711': 'postinst' starting.
update-initramfs: Generating /boot/initrd.img-6.6.31-current-bcm2711
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8156b-2.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8156a-2.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153c-1.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153b-2.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153a-4.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153a-3.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153a-2.fw for built-in driver r8152
Remove unused generated file: /boot/initrd.img-6.6.18-current-bcm2711
Armbian: update last-installed kernel symlink to 'Image'...
'/boot/Image' -> 'vmlinuz-6.6.31-current-bcm2711'
Armbian: Debian compat: linux-update-symlinks install 6.6.31-current-bcm2711 boot/vmlinuz-6.6.31-current-bcm2711
I: /vmlinuz.old is now a symlink to boot/vmlinuz-6.6.31-current-bcm2711
I: /initrd.img.old is now a symlink to boot/initrd.img-6.6.31-current-bcm2711
I: /vmlinuz is now a symlink to boot/vmlinuz-6.6.31-current-bcm2711
I: /initrd.img is now a symlink to boot/initrd.img-6.6.31-current-bcm2711
Armbian 'linux-image-current-bcm2711' for '6.6.31-current-bcm2711': 'postinst' finishing.
Setting up armbian-bsp-cli-rpi4b-current (24.5.1) ...
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PCfbcf-Vaf6d-H032a-Ba0e2-R6632': 'postinst' starting.
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PCfbcf-Vaf6d-H032a-Ba0e2-R6632': 'postinst' finishing.
Setting up linux-dtb-current-bcm2711 (24.5.1) ...
Armbian 'linux-dtb-current-bcm2711' for '6.6.31-current-bcm2711': 'postinst' starting.
Armbian: DTB: symlinking /boot/dtb to /boot/dtb-6.6.31-current-bcm2711...
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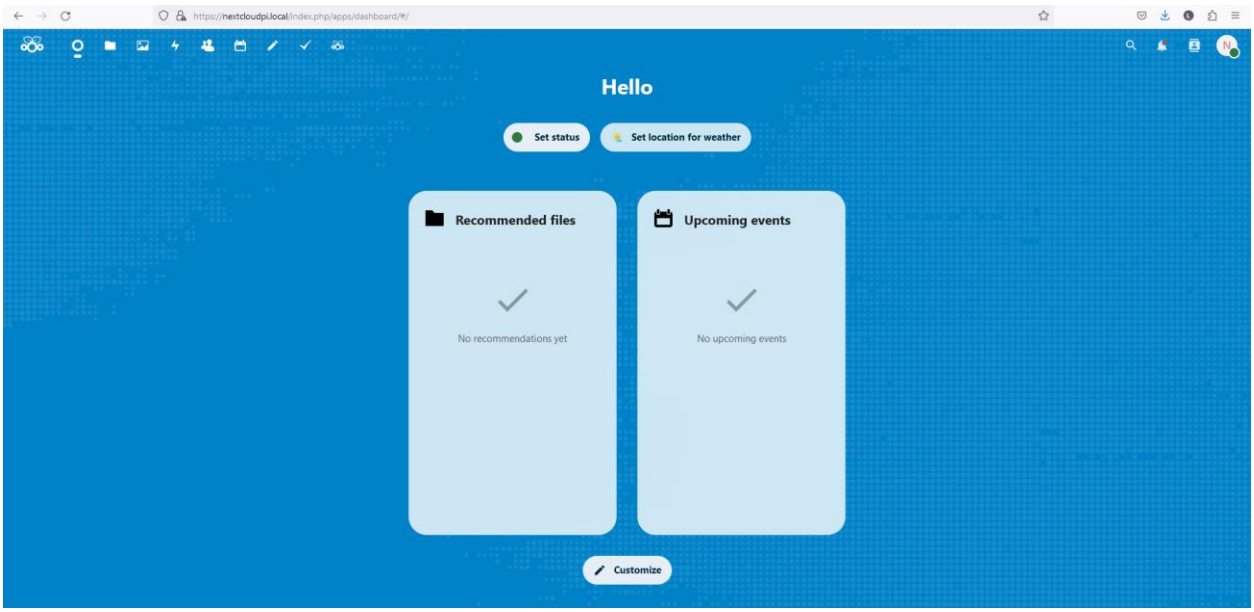
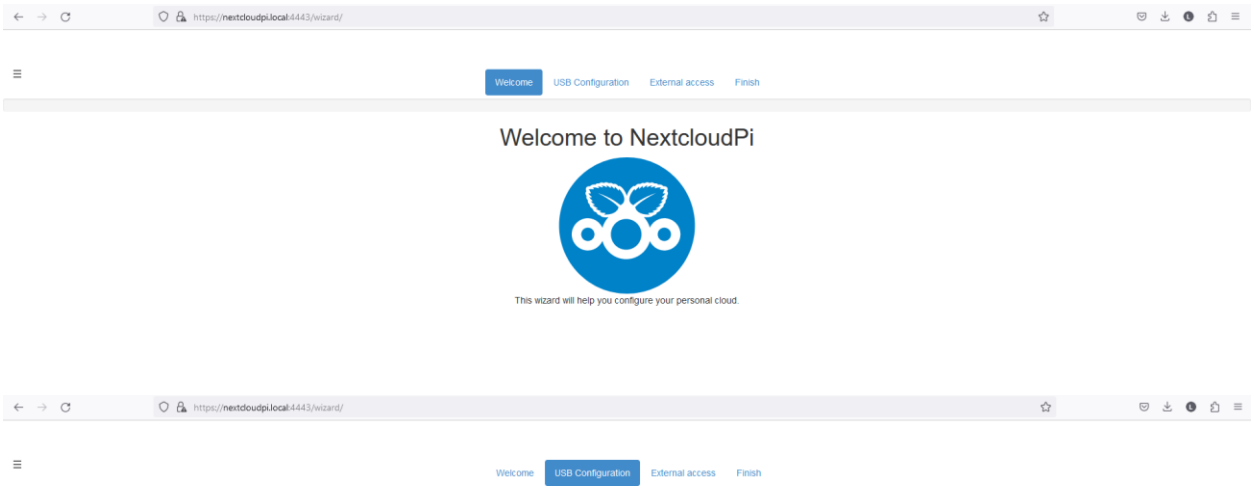
Armbian: update last-installed kernel symlink to 'Image'...
'/boot/Image' -> 'vmlinuz-6.6.31-current-bcm2711'
Armbian: Debian compat: linux-update-symlinks install 6.6.31-current-bcm2711 boot/vmlinuz-6.6.31-current-bcm2711
I: /vmlinuz.old is now a symlink to boot/vmlinuz-6.6.31-current-bcm2711
I: /initrd.img.old is now a symlink to boot/initrd.img-6.6.31-current-bcm2711
I: /vmlinuz is now a symlink to boot/vmlinuz-6.6.31-current-bcm2711
I: /initrd.img is now a symlink to boot/initrd.img-6.6.31-current-bcm2711
Armbian 'linux-image-current-bcm2711' for '6.6.31-current-bcm2711': 'postinst' finishing.
Setting up armbian-bsp-cli-rpi4b-current (24.5.1) ...
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PCfbcf-Vaf6d-H032a-Ba0e2-R6632': 'postinst' starting.
Armbian 'armbian-bsp-cli-rpi4b-current' for '1-PCfbcf-Vaf6d-H032a-Ba0e2-R6632': 'postinst' finishing.
Setting up linux-dtb-current-bcm2711 (24.5.1) ...
Armbian 'linux-dtb-current-bcm2711' for '6.6.31-current-bcm2711': 'postinst' starting.
Armbian: DTB: symlinking /boot/dtb to /boot/dtb-6.6.31-current-bcm2711...
'dtb' -> 'dtb-6.6.31-current-bcm2711'
Armbian 'linux-dtb-current-bcm2711' for '6.6.31-current-bcm2711': 'postinst' finishing.
Processing triggers for initramfs-tools (0.142) ...
update-initramfs: Generating /boot/initrd.img-6.6.31-current-bcm2711
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8156b-2.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8156a-2.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153c-1.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153b-2.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153a-4.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153a-3.fw for built-in driver r8152
W: Possible missing firmware /lib/firmware/rtl_nic/rtl8153a-2.fw for built-in driver r8152
Processing triggers for man-db (2.11.2-2) ...
NextCloudPi updated to version v1.54.1
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
zstd is already the newest version (1.5.4+dfsg2-5).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
NextCloudPi updated to version v1.54.2
```

After update completed, open web browser and type: https://nextcloudpi.local to login.

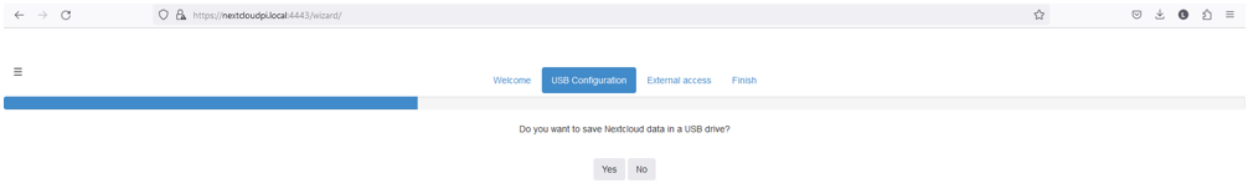


III. Setup external storage for the Cloud Server

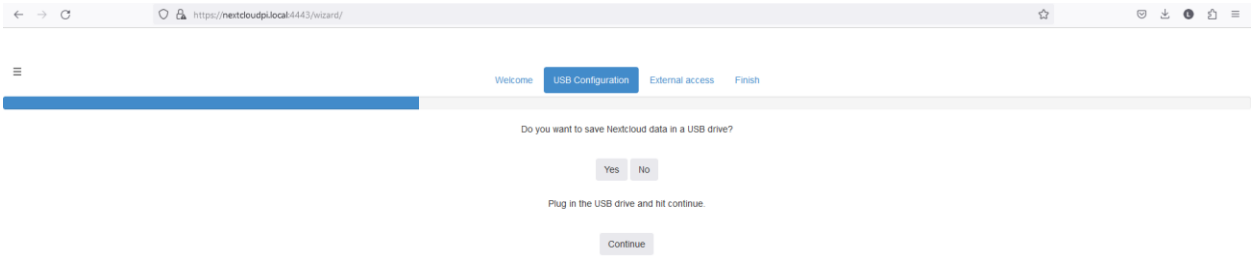
Click the Wizard icon to start the setup of the external storage:



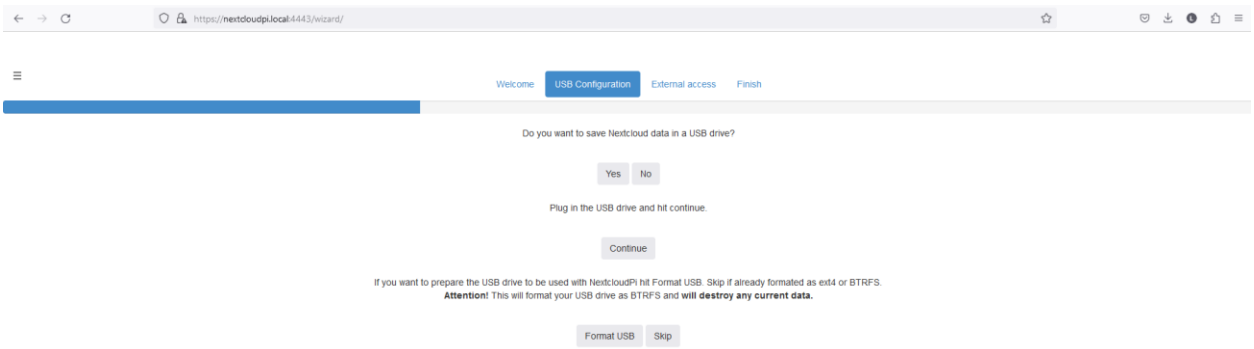
Click USB Configuration to continue.



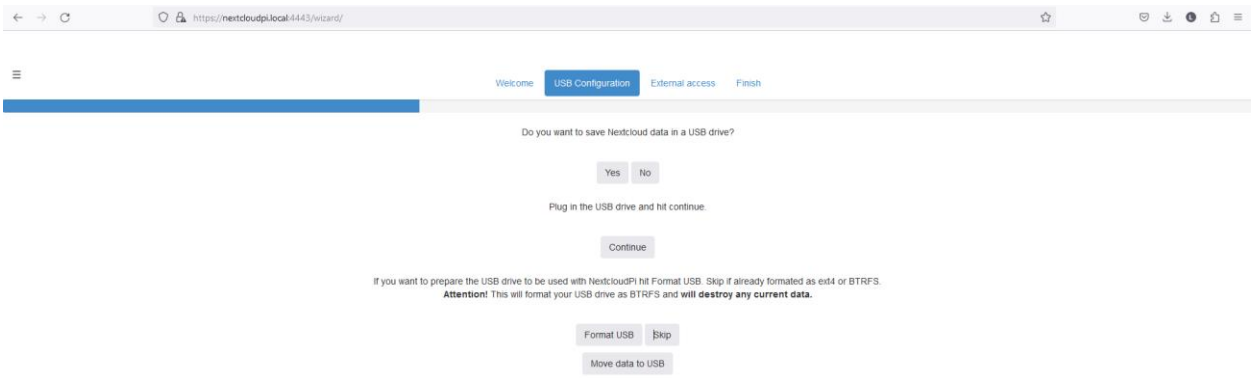
Click Yes to continue.



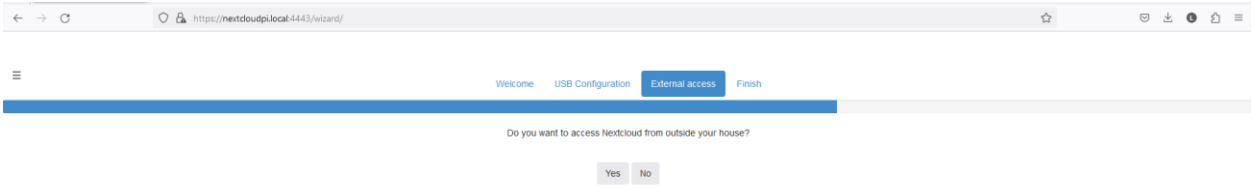
Plug in the USB HDD on Pi's USB port. Then, click Yes to continue.



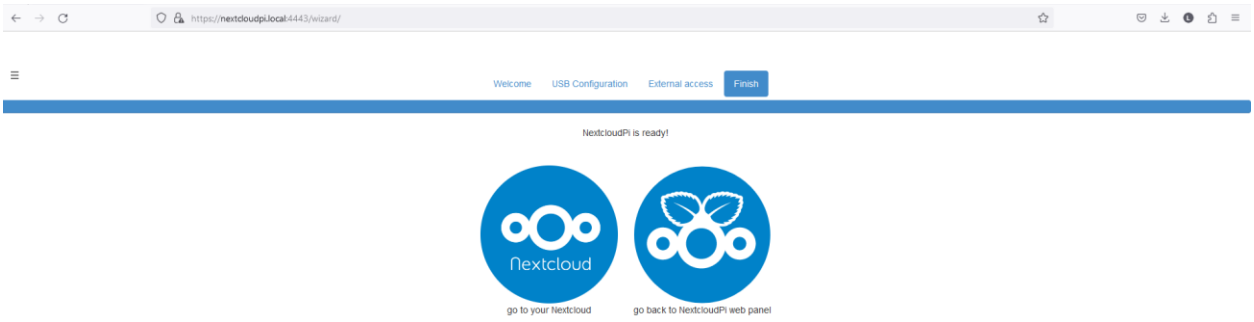
Click “Move data to USB”.



Click “No” to finish.

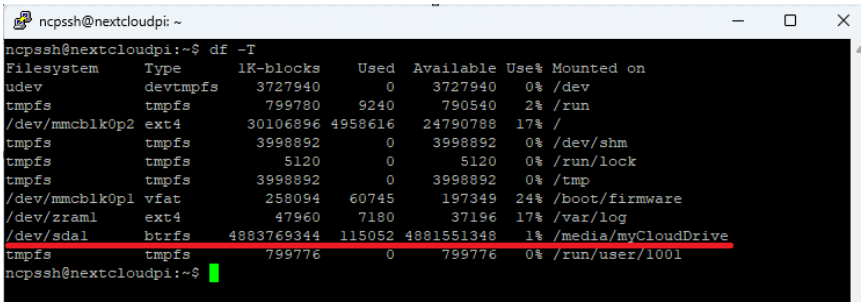


Click “go back to NextcloudPi web panel”.



To check if the external storage has been successfully mounted and ready to be used:

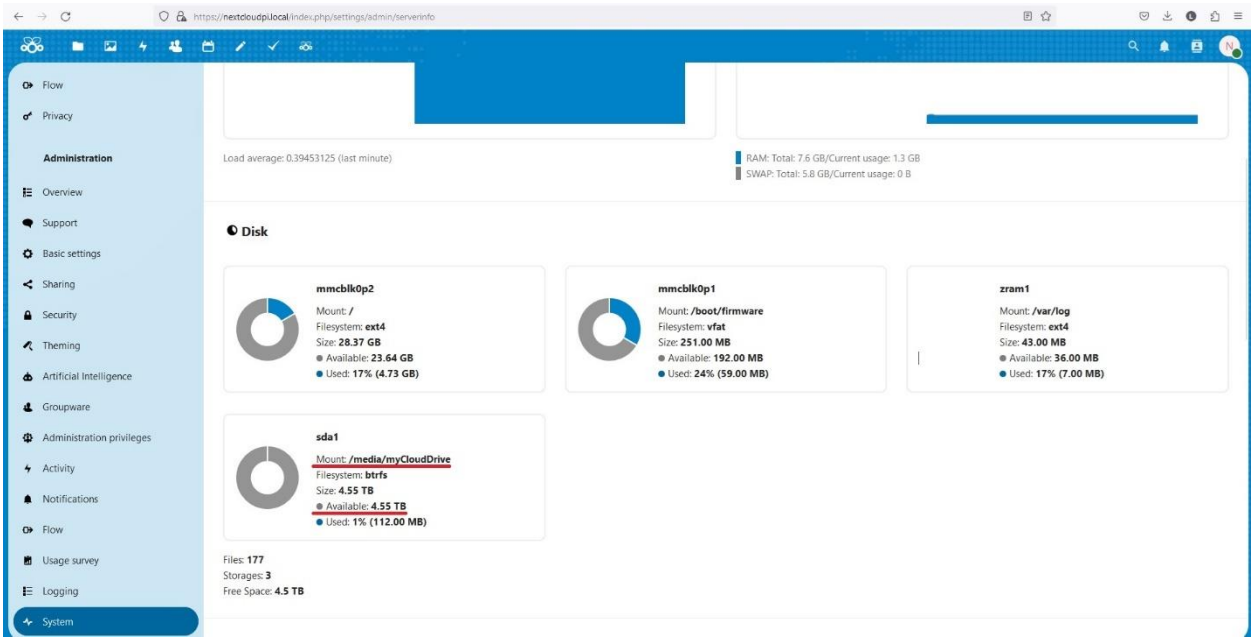
- SSH to the Ras Pi device.
- Type this command: “df -T”



You can see that the external storage has been mounted to /dev/sdal and the type is btrfs.

Btrfs is a powerful and flexible file system that offers numerous advanced features, making it suitable for a wide range of applications, from individual users to large enterprise environments. Its focus on data integrity, efficient storage management, and scalability sets it apart from traditional file systems, making it a compelling choice for modern storage needs.)

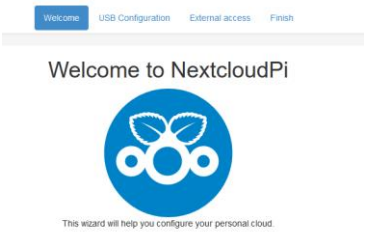
Or you can go to the Nextcloud Admin Page, click the System tab:



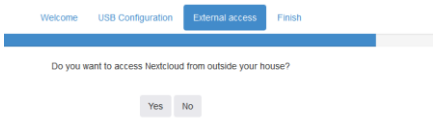
IV. Configure external access over the Internet

1. Configure external access

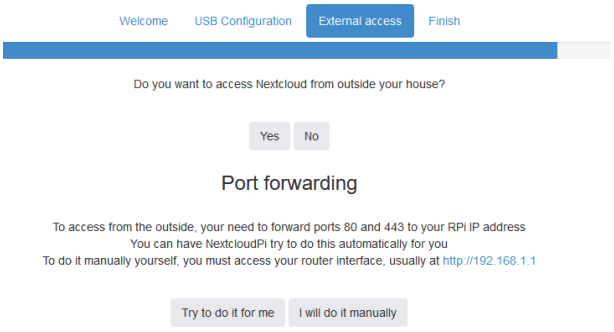
Go to the NextCloudPi Wizard page:



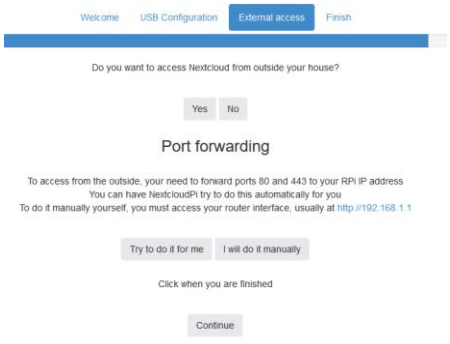
Click on the External Access:



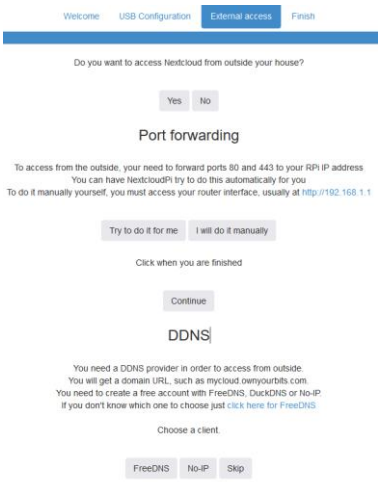
Click Yes to continue:



Click “I do it manually”. Then, you have to configure the Port Forwarding on your Internet Gateway.

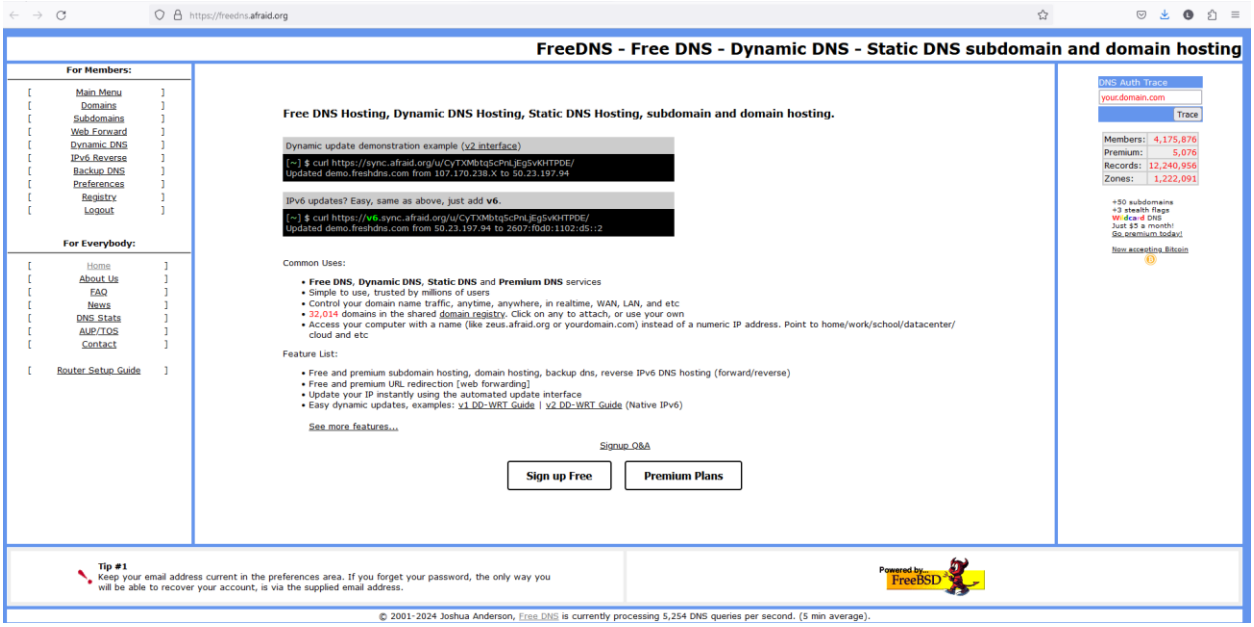


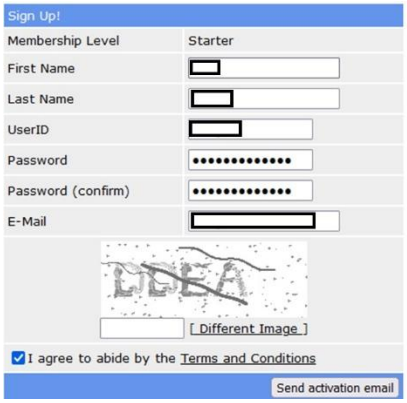
After completing, click “Continue”.

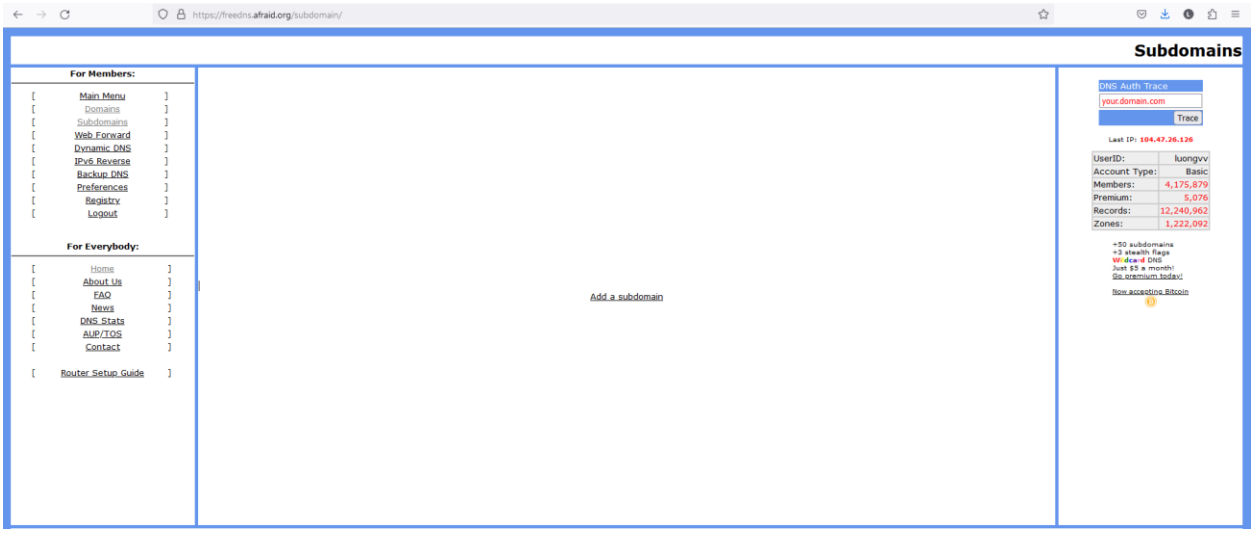


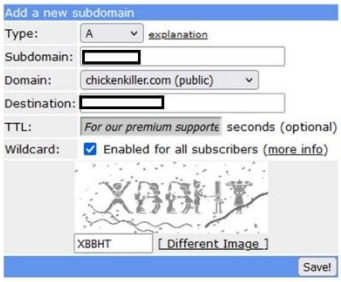
Click FreeDNS.

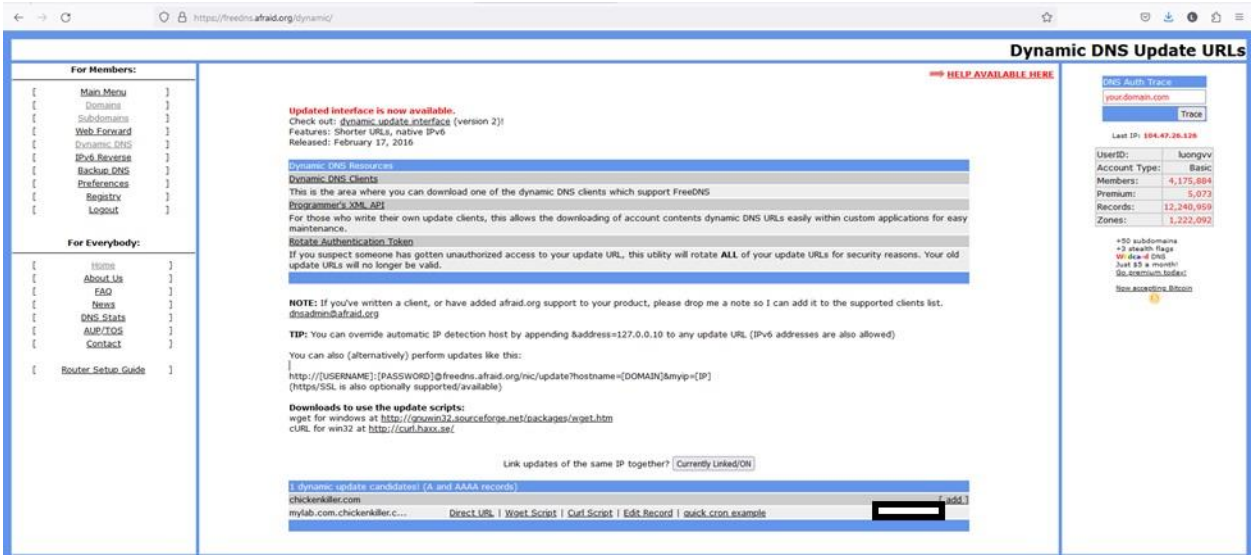
You have to register an account on FreeDNS and then register your domain.



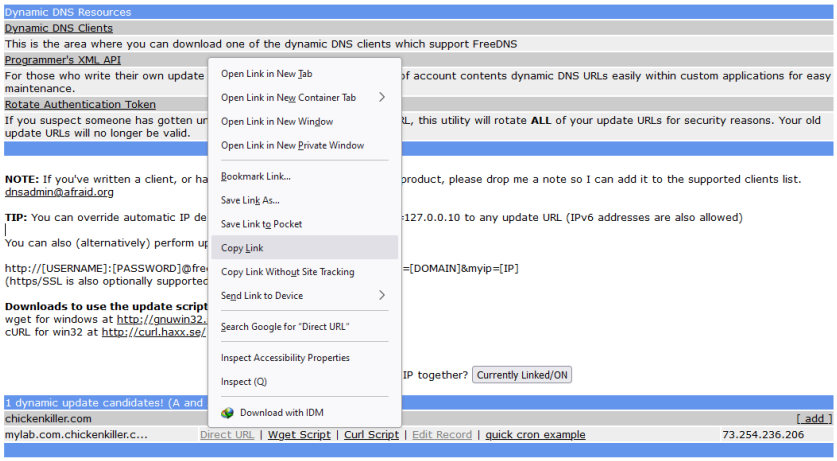


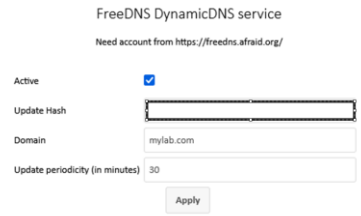






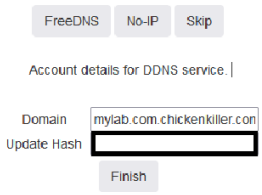
Select the **Dynamic DNS** option in the left panel and Copy the link address from the Direct URL link for your subdomain by right-clicking it then After the '?', copy the hash: the long string of letters and digits. Select FreeDNS in the NextCloudPi wizard. In the Domain area, type your subdomain, and in the Update Hash field, type your hash. Finish by clicking the Finish button.





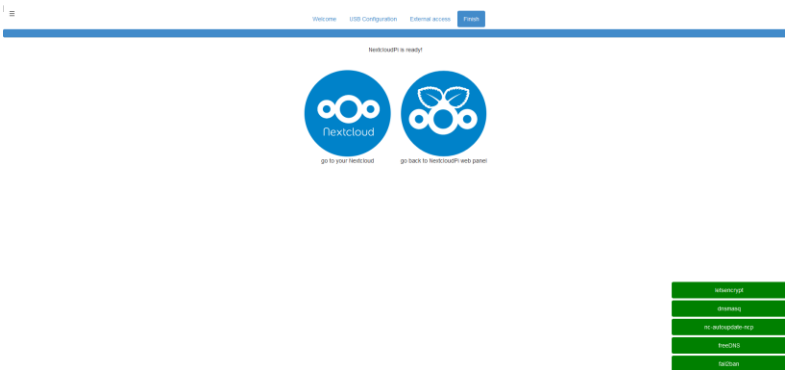
Copy the Hash to Notepad.

Then, from this Hash, you mark from the letter right after "?" to the rest of the Hash and paste to the "Update Hash" field.



Click finish. The system will take several minutes to set up the external connection.

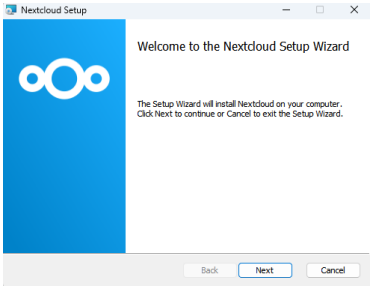
When the browser turns to this screen. Your NextCloud server is available to access from internet.



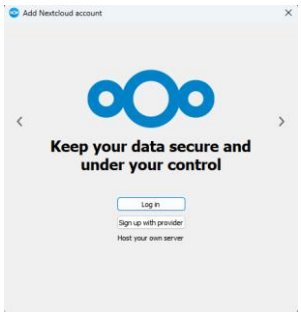
2. Access NextCloud Server by Desktop client

Download the Desktop client for Windows: https://nextcloud.com/install/#install-clients

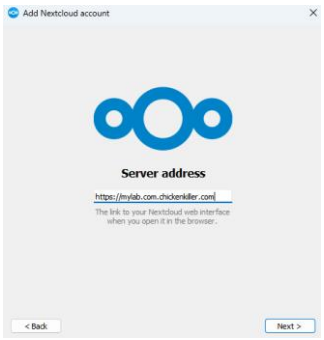
Click the downloaded file to setup.



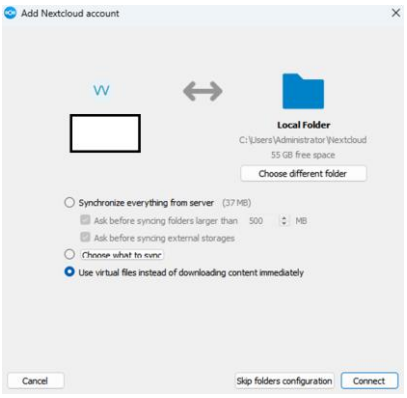
Following the instruction to complete the installation.



Click Login.

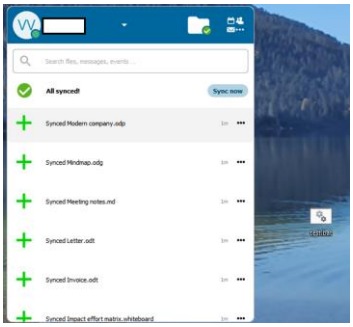


Type your domain and click next to continue. Then, typing username and password to login.



Click “Connect”.

The green icon will be displayed on your taskbar. Click on it, it will show your name and the recent activities.



Double click on the icon, File Explorer will be open the your Nextcloud folder.