NanoPi R3S

Contents

Overview

1 Introduction

- The NanoPi R3S(as "R3S") is an open source platform with dual-Gbps Ethernet ports designed and developed by FriendlyElec for IoT applications.
- The NanoPi R3S uses the RK3566 SoC, It has two Gbps Ethernet ports and 2G LPDDR4X RAM, 32GB eMMC (optional), FriendlyElec ported an OpenWrt system for it. It works with Docker CE. It is a good platform for developing IoT applications, NAS applications etc.
- The NanoPi R3S can be optionally equipped with an integrated CNC anodized aluminum case and a 2-inch LCD screen for status monitoring.

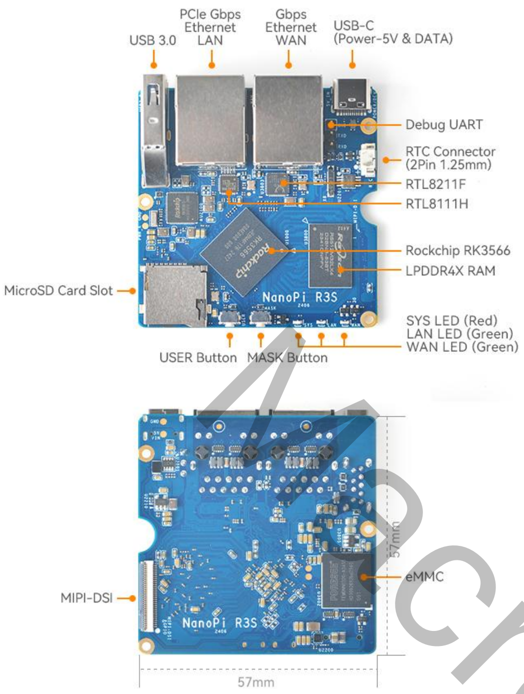
2 Hardware Spec

- CPU: Rockchip RK3566, Quad-core Cortex-A55
- RAM: 2GB LPDDR4X
- Ethernet: one Native Gigabit Ethernet, and one PCIe Gigabit Ethernet
- USB3.0 Host: Type-A x1
- Storage: MicroSD Slot x 1, and on-board 32GB eMMC
- Debug Serial Port: 3.3V TTL, 3-pin 2.54mm pitch connector, 1500000 bauds
- LED: LED x 3
- RTC: One low-power RTC, support backup battery input
- Buttons: 1x User BUtton, 1x MASK button for eMMC flashing via USB-C

- Display: 1x MIPI-DSI 30-Pin FPC connector
- PCB Size: 57*57*1.2mm
- Power supply: USB-C 5V/2A input
- Temperature measuring range: 0℃ to 80℃
- OS/Software: U-boot，Ubuntu-Core，Debian-Core，OpenMediaVault, OpenWrt

3 Diagram, Layout and Dimension

3.1 Layout



Front

Back

Case

Case

Case

- **MIPI-DSI**

  0.5mm FPC Connector

Pin#	Signal	Description
1,2,3	VCC5V0_SYS	5V Power ouput
4,7,9,11,15,18,21,24,27,30	GND	Power and Signal Ground
5	I2C2_SDA_M0	3.3V, I2C Data, has been pulled up to 3.3V with 2.2K on R3S
6	I2C2_SCL_M0	3.3V, I2C Clock, has been pulled up to 3.3V with 2.2K on R3S
8	GPIO0_C6	3.3V, GPIO
10	GPIO0_C3 or PWM4	3.3V, GPIO/PWM
12	GPIO0_C4	3.3V, GPIO
13	/NC	No Connection
14	GPIO0_C5	3.3V, GPIO
16	MIPI_DSI_TX1_D3N	MIPI TX Lane3 ouput N
17	MIPI_DSI_TX1_D3P	MIPI TX Lane3 ouput P
19	MIPI_DSI_TX1_D2N	MIPI TX Lane2 ouput N
20	MIPI_DSI_TX1_D2P	MIPI TX Lane2 ouput P
22	MIPI_DSI_TX1_D1N	MIPI TX Lane1 ouput N
23	MIPI_DSI_TX1_D1P	MIPI TX Lane1 ouput P
25	MIPI_DSI_TX1_D0N	MIPI TX Lane0 ouput N
26	MIPI_DSI_TX1_D0P	MIPI TX Lane0 ouput P
28	MIPI_DSI_TX1_CLKN	MIPI TX Clock ouput N
29	MIPI_DSI_TX1_CLKP	MIPI TX Clock ouput P

- **Debug UART**

  3.3V level signals, 1500000bps

Pin#	Assignment	Description
1	GND	0V
2	UART2_TX_M0_DEBUG	output
3	UART2_RX_M0_DEBUG	intput

- **USB3.0 A port**

  2A output current limited

- **RTC**

  RTC backup current is 0.25μA TYP (VDD =3.0V, TA =25°C).
  Connector P/N: Molex 53398-0271

Case

File:R3sc-05.jpg
Case

4 Get Started

4.1 Essentials You Need

Before starting to use your NanoPi R3S get the following items ready

- NanoPi R3S
- MicroSD Card/TF Card: Class 10 or Above, minimum 8GB SDHC
- USB-C 5V/3A power adapter
- If you need to develop and compile,you need a computer that can connect to the Internet. It is recommended to install Ubuntu 20.04 64-bit system and use the following script to initialize the development environment, or use docker container:
  - How to setup the Compiling Environment on Ubuntu bionic (https://github.com/friendlyarm/build-env-on-ubuntu-bionic)
  - docker-cross-compiler-novnc (https://github.com/friendlyarm/docker-cross-compiler-novnc)

4.2 TF Cards We Tested

Refer to： TFCardsWeTested

4.3 Configure parameters for serial port

Use the following serial parameters:

Baud rate	1500000
Data bit	8
Parity check	None
Stop bit	1
Flow control	None

4.4 Install OS

4.4.1 Downloads

4.4.1.1 Official image

Visit download link (http://download.friendlyelec.com/NanoPiR3S) to download official image files (in the "01_Official images" directory).
The table below lists all official images, the word 'XYZ' in image filename meaning:

- **sd**: Use it when you need to boot the entire OS from the SD card
- **eflasher**: Use it when you need to flash the OS to eMMC via TF card
- **usb**: Use it when you need to flash the OS to eMMC via USB

Icon	Image Filename	Version	Description	Kernel Version
	rk3566-XYZ-debian-bookworm-core-6.1-arm64-YYYYMMDD.img.gz	bookworm	**Debian 12 Core**, No desktop environment, command line only	6.1.y
	rk3566-XYZ-ubuntu-noble-core-6.1-arm64-YYYYMMDD.img.zip	noble	64-bit Ubuntu image file based on Ubuntu core 24.04 64bit	6.1.y
	rk3566-XYZ-openmediavault-6.1-YYYYMMDD.img.gz	Shaitan	OpenMediaVault NAS system, base on Debian 12	6.1.y
	rk3566-XYZ-proxmox-6.1-YYYYMMDD.img.gz	8.2.7	Proxmox VE OS (Preview), base on Debian 12	6.1.y
	rk3566-XYZ-friendlywrt-24.10-YYYYMMDD.img.gz	24.10	FriendlyWrt, based on OpenWrt 24.10	6.1.y
	rk3566-XYZ-friendlywrt-24.10-docker-YYYYMMDD.img.gz	24.10	FriendlyWrt with Docker, based on OpenWrt 24.10	6.1.y
	rk3566-XYZ-friendlywrt-23.05-YYYYMMDD.img.gz	23.05	FriendlyWrt, based on OpenWrt 23.05	6.1.y
	rk3566-XYZ-friendlywrt-23.05-docker-YYYYMMDD.img.gz	23.05	FriendlyWrt with Docker, based on OpenWrt 23.05	6.1.y
Other Image				
	FriendlyWrt (Github Actions)	24.10,23.05	FriendlyWrt (https://github.com/friendlyarm/Actions-FriendlyWrt/releases)	6.1.y
	Alpine-Linux (Github Actions)	-	Alpine-Linux (https://github.com/friendlyarm/Actions-Alpine-Linux/releases)	6.1.y
	rk3566-XYZ-multiple-os-YYYYMMDD-25g.img.gz	-	It contains multiple OS image files, making it convenient for testing different operating systems, this image disables automatic flashing at startup; you will need to manually select the OS to flash.	

4.4.1.2 Tools (optional)

Visit download link (http://download.friendlyelec.com/NanoPiR3S) to download tools (in the "05_Tools" directory).

Filename	Description
win32diskimager.rar	This program is designed to write a raw disk image to a removable device or backup a removable device to a raw image file
SD Card Formatter	A program (application) that allows easy and quick clear the SD card
RKDevTool_Release_v2.84.zip	Rockchip flashing tool, for USB upgrade

4.4.2 Flashing the OS to the microSD card

Follow the steps below:

- Get an 8G microSD card;
- Visit download link (http://download.friendlyelec.com/NanoPiR3S)to download image files (in the "01_Official images/01_SD card images" directory);
- Download the win32diskimager tool (in the "05_Tools" directory), or use your preferred tool;
- Extract the .gz format compressed file to get the .img format image file;
- Run the win32diskimager utility under Windows as administrator. On the utility's main window select your SD card's drive, the wanted image file and click on "write" to start flashing the SD card.
- Take out the SD and insert it to NanoPi-R3S's microSD card slot;
- Power on NanoPi-R3S and it will be booted from your TF card, some models may require pressing the Power button to start;

4.4.3 Install OS to eMMC

4.4.3.1 Option 1: Install OS via TF Card

This method firstly boots a mini Linux from a TF card and then automatically runs an EFlasher utility to install the OS to eMMC. You can connect your system to an HDMI monitor and watch its progress.
This is optional. You can watch its progress by observing its LEDs as well:

Progress	SYS LED(Red)	LAN LED(Green)	WAN LED(Green)
Power On	Solid On	Off	Off
System Boot	Slow Flashing	Off	Off
Installation in Progress	Fast Flashing	Off	Off
Installation Done	Slow Flashing	Solid On	Solid On

By default, flashing starts automatically upon power-up, so be sure to back up the data in eMMC. If you don't want it to start automatically, you can use image file with a filename containing the words 'multiple-os' and manually select the OS you want to flash on the interface.

4.4.3.1.1 Flash Official OS to eMMC

Follow the steps below:

- Get an SDHC card with a minimum capacity of 8G
- Visit download link (http://download.friendlyelec.com/NanoPiR3S)to download image files (in the "01_Official images/02_SD-to-eMMC images" directory) and win32diskimager tool (in the "05_Tools" directory);
- Extract the .gz format compressed file to get the .img format image file;
- Run the win32diskimager utility under Windows as administrator. On the utility's main window select your SD card's drive, the wanted image file and click on "write" to start flashing the SD card.
- Eject your SD card and insert it to NanoPi-R3S's microSD card slot.
- Turn on NanoPi-R3S, it will boot from the SD card and automatically run EFlasher to install the OS to the board's eMMC.
- After flashing is complete, eject the SD card from NanoPi-R3S, NanoPi-R3S will automatically reboot and boot from eMMC.

4.4.3.1.2 Flash third party OS (Image file) to eMMC

- Auto Install (Default Behavior)

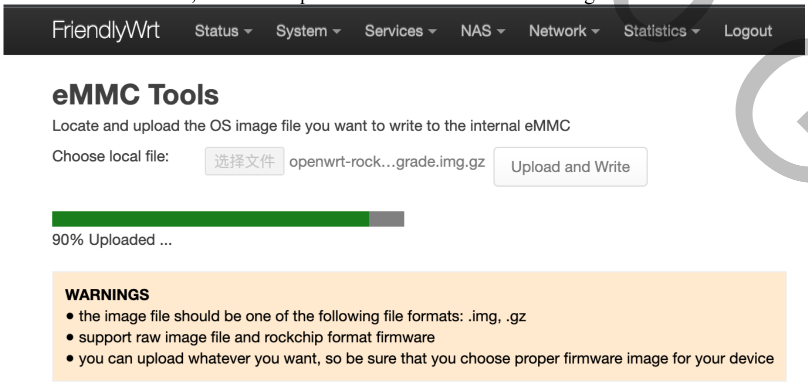
1) Download an “eflasher” firmware from network drive (http://download.friendlyelec.com/NanoPiR3S)(in the "01_Official images/02_SD-to-eMMC images" directory), extract it and install it to a TF card ;
2) Eject and insert the TF card to your PC, after a “FriendlyARM” device shows up(Under Linux, it is a “FriendlyARM” directory), copy the image file ending with .raw or .gz into the directory (Note: if your file is in .img format, please rename it to .raw format).
3) Open the eflasher.conf file on the TF card, set “autoStart=” to the name of your image file, such as:

```
autoStart=openwrt-rockchip-armv8_nanopi-ext4-sysupgrade.img.gz
```

In addition to third-party image, official image files which with the '-sd-' word in the filename are also supported, for example: rk3NNN-sd-friendlywrt-24.10-YYYYMMDD.img.gz
4) Eject the TF card, insert the TF card to NanoPi-R3S, power it on it will automatically install your firmware. You can watch the installation progress by observing the LEDs’ status.

4.4.3.2 Option 2: Install OS on Web Page

Get a TF card which has been installed with FriendlyWrt, log in FriendlyWrt on the web page, click on “System” ->”eMMC Tools”. Click on “Select file” to select your wanted image file, either an official image (filename containing '-sd-') or a third party image. The file should be a “.gz” or “.img” file.
After a file is selected, click on “Upload and Write” to start installing an OS.



eMMC Tools

Locate and upload the OS image file you want to write to the internal eMMC

Choose local file: openwrt-rock...grade.img.gz

90% Uploaded ...

WARNINGS
- the image file should be one of the following file formats: .img, .gz
- support raw image file and rockchip format firmware
- you can upload whatever you want, so be sure that you choose proper firmware image for your device

After installation is done, eject the SD card, the system will automatically reboot and load the OS from eMMC. After the OS begins to load, if the system LED is flashing and the network LED is on, it means the the OS has loaded successfully. If the OS is FriendlyWrt, you can click on “Go to Homepage” to enter the homepage.
For official OS, you need select the file with the filename containing '-sd-', for example: rk3NNN-sd-friendlywrt-24.10-YYYYMMDD.img.gz, the compression file only supports the .gz format. If the file is too large, you can compress it into .gz format before uploading.

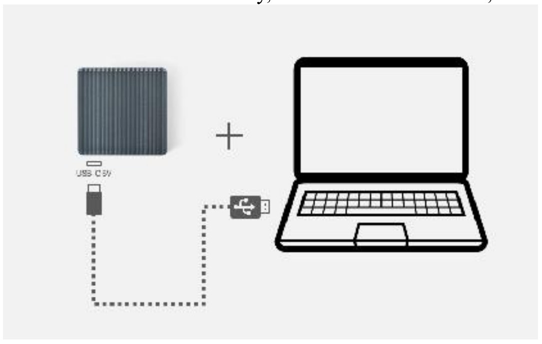
4.4.3.3 Option 3: Install OS via USB

4.4.3.3.1 Step 1: Install USB Driver and Tools/Utilities

Download a driver file DriverAssitant_v5.12.zip under the “tools” directory from network drive (http://download.friendlyelec.com/NanoPiR3S), extract and install it. Under the same directory, download a utility RKDevTool_Release_v2.84.zip and extract it.

4.4.3.3.2 Step 2: Connect NanoPi-R3S to PC and Enter Installation Mode

Press and hold the “Mask” key, Use a USB C-to-A cable, connect NanoPi-R3S to a PC，After the status LED has been on for at least 3 seconds, release the Mask key;



4.4.3.3.3 Step 3: Install image to eMMC

A firmware in general is packaged in either of the two options: the first is an whole image (ie, update.img) which is often offered by third party developers, the second is that an image is packaged and placed in multiple partition images. FriendlyElec offers an image in the latter option.

- Option 1: Install whole image (ie, update.img)

On a PC which has the extracted RKDevTool_Release_v2.84 utility, go to the RKDevTool_Release_v2.84 directory, run the RKDevTool.exe file. If everything works, you will see a “Found a new Maskrom device” message on the utility;
Go to “Upgrade Firmware(升级固件)”, click on “Firmware(固件)”, select your wanted image file, and click on “Upgrade(升级)” to install. After installation is done, your board will reboot automatically and load the system from eMMC;

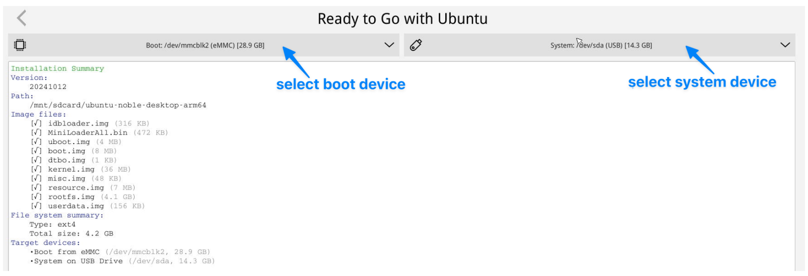
- Option 2: Install OS that is packaged & placed in multiple partition images

Go to network drive (http://download.friendlyelec.com/NanoPiR3S) to download your needed package and extract it (in the "01_Official images/03_USB upgrade images). After it is extracted, you will see some utilities and a configuration file under the directory. double click on RKDevTool.exe, you will see a “Found a new Maskrom device” message on the utility. Click on the “Execute”, wait a moment and it will be installed. After installation is done your system will automatically reboot and load the system from eMMC.

4.4.4 Installing the System to M.2 or USB Drive

You can use a TF card to boot the eFlasher system, allowing the boot and system to be installed on different storage devices. However, since the CPU doesn’t support booting directly from M.2 and USB devices, the system can be installed on M.2 and USB devices, but the boot must still be installed on eMMC or a TF card.
Steps are as follows:

- Prepare a TF card with a capacity of 32GB or larger.
- Visit [the download link here](http://download.friendlyelec.com/NanoPiR3S) to download the firmware file named XXXX-eflasher-multiple-os-YYYYMMDD-30g.img.gz (located in the “01_Official images/02_SD-to-eMMC images” directory).
- Flash the firmware to the TF card, connect the storage device you intend to use on NanoPi-R3S, insert the TF card and power on, we need to perform the operations in the eFlasher GUI. If your NanoPi-R3S does not have a display interface, you can use VNC; refer to Using VNC to Operate eFlasher (https://wiki.friendlyelec.com/wiki/index.php/EFlasher#Remote_Control_eFlasher_via_VNC).
- In the eFlasher GUI, select the OS to install, and in the OS settings interface, choose the destination for boot installation (typically eMMC), then choose the destination for system installation (options include eMMC, M.2 hard drive, USB storage, etc.), as shown below:


Ready to Go with Ubuntu
Boot: /dev/mmcblk2 (eMMC) [28.9 GB]
System: /dev/sda (USB) [14.3 GB]
select boot device
select system device

```
Installation Summary
Version:
    20241012
Path:
    /mnt/sdcard/ubuntu-noble-desktop-arm64
Image files:
    [√] idbloader.img (316 KB)
    [√] MiniLoaderAll.bin (472 KB)
    [√] uboot.img (4 MB)
    [√] boot.img (8 MB)
    [√] dtbo.img (1 KB)
    [√] kernel.img (36 MB)
    [√] misc.img (48 KB)
    [√] resource.img (7 MB)
    [√] rootfs.img (4.1 GB)
    [√] userdata.img (156 KB)
File system summary:
    Type: ext4
    Total size: 4.2 GB
Target devices:
    •Boot from eMMC (/dev/mmcblk2, 28.9 GB)
    •System on USB Drive (/dev/sda, 14.3 GB)
```

- If no eMMC is available, the TF card can serve as the boot by inserting another TF card into the USB port via a USB card reader and selecting it as the boot destination, enabling booting from the TF card with the system stored on the M.2 or USB drive.
- After flashing, eject the SD card from NanoPi-R3S. If booting from eMMC, NanoPi-R3S will automatically restart into the newly flashed system. If boot installation is on a TF card, power off, insert the boot TF card, and power on again.
- For a more detailed installation guide, please refer to this link (https://wiki.friendlyelec.com/wiki/index.php/EFlasher#Installing_the_System_to_M.2_or_USB_Drive_.28Rockchip_Platform_Only.29).

5 Work with FriendlyWrt

5.1 Introduction to FriendlyWrt

FriendlyWrt is a customized system made by FriendlyElec based on an OpenWrt distribution. It is open source and well suitable for developing IoT applications, NAS applications etc.

5.2 First boot

For the first boot, the system needs to do the following initialization work：
1）Extended root file system
2）Initial setup（will execute /root/setup.sh)

So you need to wait for a while (about 2~3 minutes) to boot up for the first time, and then set FriendlyWrt, you can enter the ttyd terminal on the openwrt webpage, when the prompt is displayed as root@FriendlyWrt, it means the system has been initialized.

```
root@FriendlyWrt
```

5.3 Account & Password

The default password is password (empty password in some versions). Please set or change a safer password for web login and ssh login. It is recommended to complete this setting before connecting NanoPi-R3S to the Internet.

5.4 Login FriendlyWrt

Connect the PC to the LAN port of NanoPi-R3S. If your PC without a built-in ethernet port, connect the LAN port of the wireless AP to the LAN port of NanoPi-R3S, and then connect your PC to the wireless AP via WiFi , Enter the following URL on your PC's browser to access the admin page:

- http://friendlywrt/
- http://192.168.2.1/
- http://[fd00:ab:cd::1]

The above is the LAN port address of NanoPi-R3S. The IP address of the WAN port will be dynamically obtained from your main router through DHCP.

5.5 Recommended security settings

The following settings are highly recommended to complete before connecting NanoPi-R3S to the Internet。

- Set a secure password
- Only allow access to ssh from lan, change the port
- Check the firewall settings

Set up as you wish.

5.6 Change LAN IP in LuCI

1) Click on Network → Interfaces, then click on the Edit button of the LAN Network;
2) In General Setup tab, input new IP address (for example: 192.168.11.1), click "Save" and then click "Save & Apply";
3) On the pop-up window with the title “Connectivity change“, click "Apply and revert on connectivity loss";
4) Wait a moment, enter the new address in your computer's browser and login to FriendlyWrt;

5.7 Safe shutdown operation

Enter the "Services" -> "Terminal", enter the "poweroff" command and hit enter, wait until the led light is off, and then unplug the power supply.

5.8 Soft Factory Reset

Enter "System"->"Backup/Flash firmware"， Click “Perform reset“ Button, Your device's settings will be reset to defaults like when FriendlyWrt was first installed. You can also do this in the terminal:

```
firstboot && reboot
```

5.9 Install Software Packages

5.9.1 Set up openwrt official opkg source

```
sed -i -e 's/mirrors.cloud.tencent.com/downloads.openwrt.org/g' /etc/opkg/distfeeds.conf
opkg update
```

5.9.2 Update Package List

Before install software packages update the package list:

```
$ opkg update
```

5.9.3 List Available Packages

```
$ opkg list
```

5.9.4 List Installed Packages

```
$ opkg list-installed
```

5.9.5 Install Packages

```
$ opkg install <package names>
```

5.9.6 Remove Packages

```
$ opkg remove <package names>
```

5.10 Disable IPv6

```
. /root/setup.sh
disable_ipv6
reboot
```

5.11 Configure the function of the user button

By default, the user button is configured to reboot the device, as shown below:

```
echo 'BTN_1 1 /sbin/reboot' >> /etc/triggerhappy/triggers.d/example.conf
```

You can change its behavior by changing the configuration file above.

5.12 Configuring Quectel EC20 (4G module) dial-up networking

- Go to "Network" -> "Interfaces"
- Click "Delete" next to "WAN6", then click "Save & Apply"
- Click "Edit" next to "WAN", in the "Device" drop-down menu, select "Ethernet Adapter: wwan0", in the "Protocol" drop-down menu, select "QMI Cellular" and click "Switch Protocol"
- Click the "Modem Device" drop-down menu, select "/dev/cdc-wdm0", fill in the APN information (e.g. for China Mobile, enter "cmnet")
- Click "Save" to close the dialog, Finally, click "Save & Apply" at the bottom of the page to initiate the dial-up process
- Devices connected to LAN will have access to the Internet, If your device has a WiFi module, you can enable wireless AP functionality on the "Wireless" page and connect to the Internet via devices connected wirelessly

5.13 Some common issues of FriendlyWrt

- Unable to dial up
  - Go to "Network" -> "Firewall" and set "Inbound Data", "Outbound Data" and "Forwarding" in "WAN Zone" to "Accept";
  - If you still cannot access the Internet, you can try to turn off IPV6;
- Dial-up successful, but no outgoing traffic
  - Go to "Services" -> "Terminal" and type "fw4 reload" to try to reload the firewall settings again;
- Unable to power on
  - Try to replace the power adapter and cable. It is recommended to use a power supply with specifications above 5V/2A;
  - Note that some fast chargers with Type-C interface will have a delay, it may take a few seconds to start providing power;
- When doing secondary routing, the computer cannot connect to the Internet
  - If your main network is IPv4, and NanoPi-R3S works in IPv6, the computer may not be able to connect to the Internet. It is recommended to turn off IPv6 (the method is described later in this WiKi), or switch the main route to IPv6;
- If you have questions or have better suggestions, please send an email to techsupport@friendlyarm.com;

5.14 Use USB2LCD to view IP and temperature

Plug the USB2LCD module to the USB interface ofNanoPi-R3S and power on, the IP address and CPU temperature will be displayed on the LCD:

5.15 How to use USB WiFi

5.15.1 Check USB WiFi Device with Command Line Utility

(1) Click on "services>ttyd" to start the command line utility

(2) Make sure no USB devices are connected to your board and run the following command to check if any USB devices are connected or not

```
lsusb
```

(3) Connect a USB WiFi device to the board and run the command again

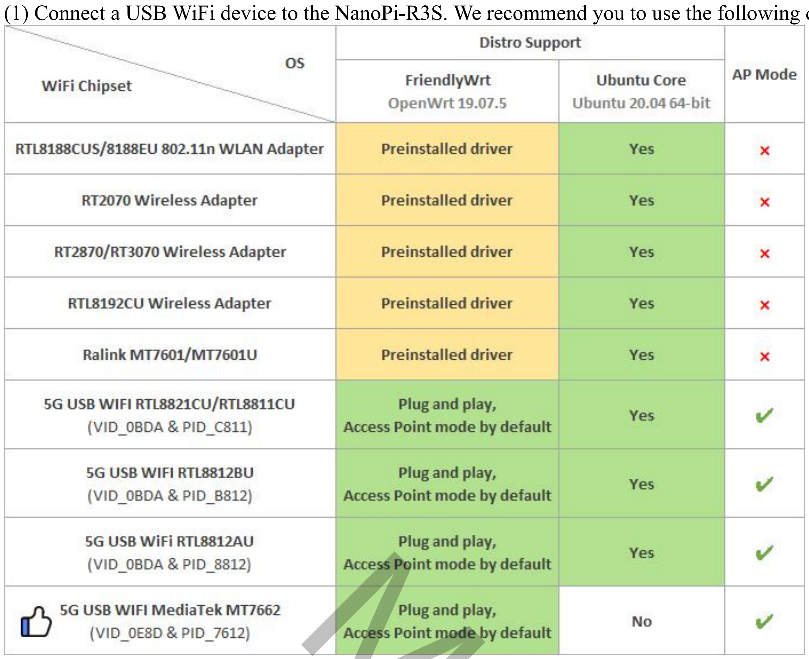
```
lsusb
```

You will see a new device is detected. In our test the device's ID was 0BDA:C811

(4) Type your device's ID (in our case it was "0BDA:C811" or "VID_0BDA&PID_C811") in a search engine and you may find a device that matches the ID. In our case the device we got was Realtek 8811CU.

5.15.2 Configure a USB WiFi Device as AP

(1) Connect a USB WiFi device to the NanoPi-R3S. We recommend you to use the following devices:



OS / WiFi Chipset	Distro Support		AP Mode
	FriendlyWrt OpenWrt 19.07.5	Ubuntu Core Ubuntu 20.04 64-bit	
RTL8188CUS/8188EU 802.11n WLAN Adapter	Preinstalled driver	Yes	✗
RT2070 Wireless Adapter	Preinstalled driver	Yes	✗
RT2870/RT3070 Wireless Adapter	Preinstalled driver	Yes	✗
RTL8192CU Wireless Adapter	Preinstalled driver	Yes	✗
Ralink MT7601/MT7601U	Preinstalled driver	Yes	✗
5G USB WIFI RTL8821CU/RTL8811CU (VID_0BDA & PID_C811)	Plug and play, Access Point mode by default	Yes	✓
5G USB WIFI RTL8812BU (VID_0BDA & PID_B812)	Plug and play, Access Point mode by default	Yes	✓
5G USB WiFi RTL8812AU (VID_0BDA & PID_8812)	Plug and play, Access Point mode by default	Yes	✓
👍 5G USB WIFI MediaTek MT7662 (VID_0E8D & PID_7612)	Plug and play, Access Point mode by default	No	✓

Note: devices that match these VID&PIDs would most likely work.

(2) Click on "System>Reboot" and reboot your NanoPi-R3S

(3) Click on "Network>Wireless" to enter the WiFi configuration page

(4) Click on "Edit" to edit the configuration

(5) On the "Interface Configuration" page you can set the WiFi mode and SSID, and then go to "Wireless Security" to change the password. By default the password is "password". After you make your changes click on "Save" to save

(6) After you change the settings you can use a smartphone or PC to search for WiFi

5.15.3 Common USB WiFi issues

1) It is recommended to plug in the usb wifi in the off state, then power it on, FriendlyWrt will automatically generate the configuration file /etc/config/wireless, if not, see if there is wlan0 by ifconfig -a, if there is no wlan0, usually there is no driver.
2) If ifconfig -a sees wlan0, but the hotspot is not working properly, try changing the channel and country code, an inappropriate country code can also cause the WiFi to not work.
3) Some USB WiFis (e.g. MTK MT7662) work in CD-ROM mode by default and need to be switched by usb_modeswitch, you can try to add usb_modeswitch configuration to the following directory: /etc/usb_modeswitch.d.

5.15.4 Change the default WiFi hotspot configuration

FriendlyWrt sets the country, hotspot name and other parameters for USB WiFi by default, with the aim of being as plug-and-play as possible, but this does not guarantee that all modules will be compatible with this setting, you can change these behaviors by modifying the following file：

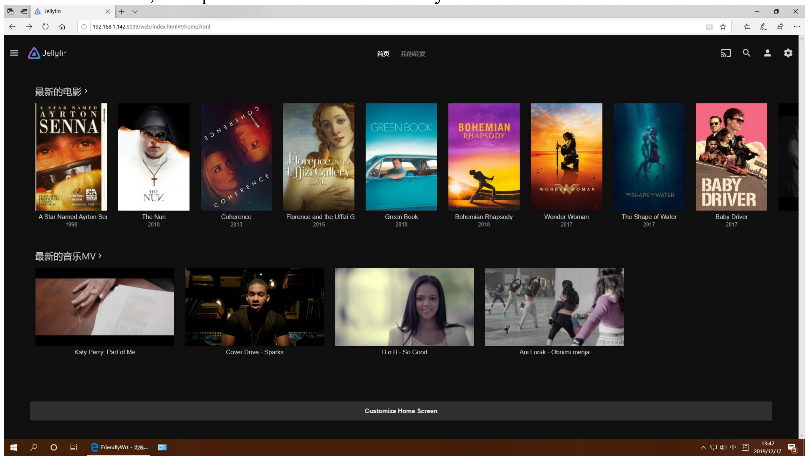
```
/lib/wifi/mac80211.sh
```

5.16 Work with Docker Applications

5.16.1 Work with Docker: Install JellyFin

```
mkdir -p /jellyfin/config
mkdir -p /jellyfin/videos
docker run --restart=always -d -p 8096:8096 -v /jellyfin/config:/config -v /jellyfin/videos:/videos jellyfin/jellyfin:10.1.0-arm64 -name myjellyfin
```

After installation, visit port 8096 and here is what you would find:



5.16.2 Work with Docker: Install Personal Nextcloud

```
mkdir /nextcloud -p
docker run -d -p 8888:80  --name nextcloud  -v /nextcloud/:/var/www/html/ --restart=always --privileged=true  arm64v8/nextcloud
```

After installtion, visit port 8888.

5.16.3 Expand Docker Storage

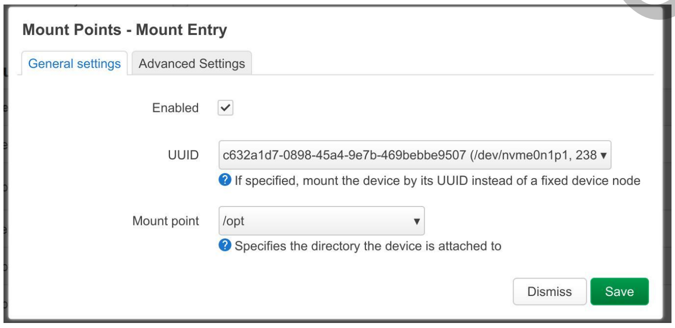
- Stop docker service first:

```
/etc/init.d/dockerd stop
```

- Rename the original /opt directory, create an empty /opt directory:

```
mv /opt /opt-old && mkdir /opt
```

- Format your drive as ext4, and mount it to the /opt directory:



Mount Points - Mount Entry

General settings | Advanced Settings

Enabled ✓

UUID: c632a1d7-0898-45a4-9e7b-469bebbe9507 (/dev/nvme0n1p1, 238 ▾

If specified, mount the device by its UUID instead of a fixed device node

Mount point: /opt

Specifies the directory the device is attached to

Dismiss | Save

- Enter the command "mount | grep /opt" to check the mount status:

```
root@FriendlyWrt:~# mount | grep /opt
/dev/nvme0n1p1 on /opt type ext4 (rw,relatime)
root@FriendlyWrt:~#
```

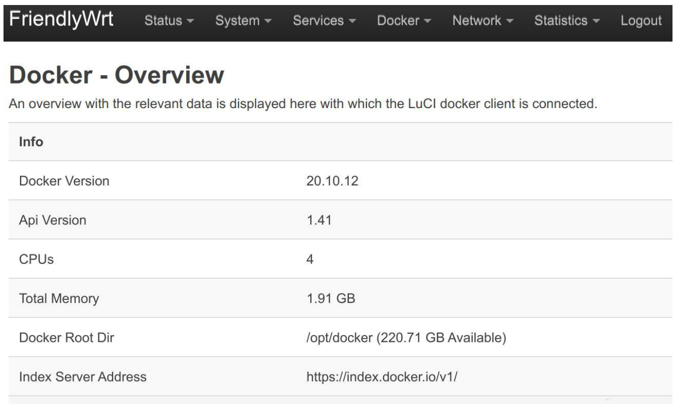
- Copy the files from the original /opt directory to the new /opt directory:

```
cp -af /opt-old/* /opt/ && rm -rf /opt-old
```

- Reboot the device

```
reboot
```

- After reboot, go to the "Docker" -> "Overview" page, check the information in the "Docker Root Dir" line, you can see that the Docker space has been expanded:



Docker - Overview

An overview with the relevant data is displayed here with which the LuCI docker client is connected.

Info	
Docker Version	20.10.12
Api Version	1.41
CPUs	4
Total Memory	1.91 GB
Docker Root Dir	/opt/docker (220.71 GB Available)
Index Server Address	https://index.docker.io/v1/

5.16.4 Docker FAQ and solutions

5.16.4.1 Unable to access the network services provided by the Docker container

Solution:

- Go to the "Firewall" settings and set "Forwarding" to "Accept";
- Turn off "Software Offload";

5.17 Mount smbfs

```
mount -t cifs //192.168.1.10/shared /movie -o username=xxx,password=yyy,file_mode=0644
```

5.18 Use sdk to compile the package

5.18.1 Install the compilation environment

Download and run the following script on 64-bit Ubuntu (version 18.04+): How to setup the Compiling Environment on Ubuntu bionic (https://github.com/friendlyarm/build-env-on-ubuntu-bionic)

5.18.2 Download and decompress sdk from the network disk

The sdk is located in the toolchain directory of the network disk:

```
tar xvf openwrt-sdk-*-rockchip-armv8_gcc-11.2.0_musl.Linux-x86_64.tar.xz
# If the path is too long, it will cause some package compilation errors, so change the directory name here
mv openwrt-sdk-*-rockchip-armv8_gcc-11.2.0_musl.Linux-x86_64 sdk
cd sdk
./scripts/feeds update -a
./scripts/feeds install -a
```

5.18.3 Compile the package

download the source code of the example (a total of 3 examples are example1, example2, example3), and copy to the package directory:

```
git clone https://github.com/mwarning/openwrt-examples.git
cp -rf openwrt-examples/example* package/
rm -rf openwrt-examples/
```

Then enter the configuration menu through the following command:

```
make menuconfig
```

In the menu, select the following packages we want to compile (actually selected by default):

```
"Utilities" => "example1"
"Utilities" => "example3"
"Network" => "VPN" => "example2"
```

execute the following commands to compile the three software packages:

```
make package/example1/compile V=99
make package/example2/compile V=99
make package/example3/compile V=99
```

After the compilation is successful, you can find the ipk file in the bin directory, as shown below:

```
$ find ./bin -name example*.ipk
./bin/packages/aarch64_generic/base/example3_1.0.0-220420.38257_aarch64_generic.ipk
./bin/packages/aarch64_generic/base/example1_1.0.0-220420.38257_aarch64_generic.ipk
./bin/packages/aarch64_generic/base/example2_1.0.0-220420.38257_aarch64_generic.ipk
```

5.18.4 Install the ipk to NanoPi

You can use the scp command to upload the ipk file to NanoPi:

```
cd ./bin/packages/aarch64_generic/base/
scp example*.ipk root@192.168.2.1:/root/
```

Then use the opkg command to install them:

```
cd /root/
opkg install example3_1.0.0-220420.38257_aarch64_generic.ipk
opkg install example1_1.0.0-220420.38257_aarch64_generic.ipk
opkg install example2_1.0.0-220420.38257_aarch64_generic.ipk
```

5.19 Build FriendlyWrt using GitHub Actions

Please refre this link: https://github.com/friendlyarm/Actions-FriendlyWrt

6 Work with Debian Core

6.1 Account & Password

Regular Account:
  User Name: pi
  Password: pi

Root:
  the root user account is disabled by default, you may configure the root password through the 'sudo passwd root' command.

6.2 View IP address

Since the Debian Bullseye hostname is the hardware model by default, you can use the ping command to get the IP address:`ping NanoPi-R3S`
Debian Bullseye uses network-manager to manage the network, and the network ports are configured to automatically obtain IP addresses by DHCP (including devices with multiple network ports).

6.3 Connect to Debian via SSH

Run the following commands`ssh pi@NanoPi-R3S`
The default password is: pi

6.4 Update Software Packages

```
$ sudo apt-get update
```

6.5 Change time zone

6.5.1 Check the current time zone

```
timedatectl
```

6.5.2 List all available time zones

```
timedatectl list-timezones
```

6.5.3 Set the time zone (e.g. Shanghai)

```
sudo timedatectl set-timezone Asia/Shanghai
```

6.6 Change startup LOGO

Replace the following two files in the kernel source code directory and recompile the kernel：
kernel/logo.bmp
kernel/logo_kernel.bmp
Or use the script to operate, as shown below：

- Download scripts:

```
git clone https://github.com/friendlyarm/sd-fuse_rk3399.git -b kernel-4.19 --single-branch
cd sd-fuse_rk3399
```

- Compile kernel and repackage firmware

```
convert files/logo.jpg -type truecolor /tmp/logo.bmp
convert files/logo.jpg -type truecolor /tmp/logo_kernel.bmp
sudo LOGO=/tmp/logo.bmp KERNEL_LOGO=/tmp/logo_kernel.bmp ./build-kernel.sh debian-bookworm-core-arm64
sudo ./mk-sd-image.sh debian-bookworm-core-arm64
sudo ./mk-emmc-image.sh debian-bookworm-core-arm64
```

6.7 Soft Factory Reset

Execute the following command in a terminal:

```
sudo firstboot && sudo reboot
```

6.8 Install Docker on Debian

Please refer to: How to Install Docker on Debian

7 How to Compile

7.1 Setup Development Environment

7.1.1 Method 1: Using docker to cross-compile

Please refre to docker-cross-compiler-novnc (https://github.com/friendlyarm/docker-cross-compiler-novnc)

7.1.2 Method 2: Setup build environment on the host machine

7.1.2.1 Install required packages

Install and run requirements ubuntu 20.04, install required packages using the following commands:

```
sudo apt-get -y update
sudo apt-get install -y sudo curl
sudo bash -c \
  "$(curl -fsSL https://raw.githubusercontent.com/friendlyarm/build-env-on-ubuntu-bionic/master/install.sh)"
```

The following cross-compilers will be installed:

Version	Architecture	Compiler path	Purpose
4.9.3	armhf	/opt/FriendlyARM/toolchain/4.9.3	Can be used to build 32-bit ARM applications
6.4	aarch64	/opt/FriendlyARM/toolchain/6.4-aarch64	Can be used to build kernel 4.4
11.3	aarch64	/opt/FriendlyARM/toolchain/11.3-aarch64	Can be used to build kernel 4.19 or higher and U-Boot

7.1.2.2 Setting the compiler path

Based on the table in the previous section, select the appropriate version of the compiler and add the compiler's path to PATH. For example, if you want to use the 11.3 cross-compiler, edit ~/.bashrc using vi and add the following content to the end:

```
export PATH=/opt/FriendlyARM/toolchain/11.3-aarch64/bin:$PATH
export GCC_COLORS=auto
```

Run the ~/.bashrc script to make it effective in the current commandline. Note: there is a space after ".":

```
. ~/.bashrc
```

To verify if the installation was successful：

```
$ aarch64-linux-gcc -v
Using built-in specs.
COLLECT_GCC=aarch64-linux-gcc
COLLECT_LTO_WRAPPER=/opt/FriendlyARM/toolchain/11.3-aarch64/libexec/gcc/aarch64-cortexa53-linux-gnu/11.3.0/lto-wrapper
Target: aarch64-cortexa53-linux-gnu
Configured with: /home/cross/arm64/src/gcc/configure --build=x86_64-build_pc-linux-gnu --host=x86_64-build_pc-linux-gnu --target=aarch64-cortexa53-linux-gnu --prefix=/opt/FriendlyARM/t
Thread model: posix
Supported LTO compression algorithms: zlib
gcc version 11.3.0 (ctng-1.25.0-119g-FA)
```

7.2 Build Openwrt/Friendlywrt

7.2.1 Download Code

Two versions are available, please choose as required:

7.2.1.1 FriendlyWrt 24.10

```
mkdir friendlywrt24-rk3566
cd friendlywrt24-rk3566
git clone https://github.com/friendlyarm/repo --depth 1 tools
tools/repo init -u https://github.com/friendlyarm/friendlywrt_manifests -b master-v24.10 \
        -m rk3566.xml --repo-url=https://github.com/friendlyarm/repo  --no-clone-bundle
tools/repo sync -c  --no-clone-bundle
```

7.2.1.2 FriendlyWrt 23.05

```
mkdir friendlywrt23-rk3566
cd friendlywrt23-rk3566
git clone https://github.com/friendlyarm/repo --depth 1 tools
tools/repo init -u https://github.com/friendlyarm/friendlywrt_manifests -b master-v23.05 \
        -m rk3566.xml --repo-url=https://github.com/friendlyarm/repo  --no-clone-bundle
tools/repo sync -c  --no-clone-bundle
```

7.2.2 First compilation step

```
./build.sh rk3566.mk  # or rk3566-docker.mk
```

All the components (including u-boot, kernel, and friendlywrt) are compiled and the sd card image will be generated, then execute the following command to generate the image file for installing the system into the emmc:

```
./build.sh emmc-img
```

After making changes to the project, the sd card image needs to be repackaged by running the following command:

```
./build.sh sd-img
```

7.2.3 Secondary compilation steps

```
cd friendlywrt
make menuconfig
rm -rf ./tmp
make -j${nproc}
cd ../
./build.sh sd-img
./build.sh emmc-img
```

7.2.4 Build u-boot only

```
./build.sh uboot
```

7.2.5 Build kernel only

```
./build.sh kernel
```

7.2.6 Build friendlywrt only

```
./build.sh friendlywrt
```

Or go to the friendlywrt directory and follow the standard openwrt commands. If you get an error with the above command, try using the following command to compile in a single thread:

```
cd friendlywrt
make -j1 V=s
```

7.3 Build Other Linux

7.3.1 Kernel and u-boot versions

Operating System	Kernel Version	U-boot version	Cross-compiler	Partition type	Packaging Tool	Kernel branch	Ker
openmediavault-arm64	linux v6.1.y	u-boot v2017.09	11.3-aarch64	GPT (https://github.com/friendlyarm/sd-fuse_rk3566/blob/kernel-6.1.y/prebuilt/parameter-plain.txt)	sd-fuse (https://github.com/friendlyarm/sd-fuse_rk3566/tree/kernel-6.1.y)	nanopi6-v6.1.y (https://github.com/friendlyarm/kernel-rockchip/tree/nanopi6-v6.1.y)	nanop
ubuntu-noble-core-arm64				GPT (https://github.com/friendlyarm/sd-fuse_rk3566/blob/kernel-6.1.y/prebuilt/parameter.template)			
debian-bookworm-core-arm64							
friendlywrt21							nanop +frien
friendlywrt21-docker							
friendlywrt23							
friendlywrt23-docker							

- Kernel git repo：https://github.com/friendlyarm/kernel-rockchip
- U-boot git repo：https://github.com/friendlyarm/uboot-rockchip
- The cross-compile toolchain is located in the path: /opt/FriendlyARM/toolchain/

- The SD-Fuse is a helper script to make bootable SD card image.

7.3.2 Build kernel linux-v6.1.y

This section applies to the following operating systems:

friendlywrt21	friendlywrt21-docker	friendlywrt23	friendlywrt23-docker	ubuntu-noble-core-arm64	openmediavault-arm64	debian-bookworm-core-arm64

Clone the repository to your local drive then build:

```
git clone https://github.com/friendlyarm/kernel-rockchip --single-branch --depth 1 -b nanopi6-v6.1.y kernel-rockchip
cd kernel-rockchip
export PATH=/opt/FriendlyARM/toolchain/11.3-aarch64/bin/:$PATH
touch .scmversion
# Configuring the Kernel
# Load default configuration
make CROSS_COMPILE=aarch64-linux-gnu- ARCH=arm64 nanopi5_linux_defconfig
# Optionally, load configuration for FriendlyWrt
# make CROSS_COMPILE=aarch64-linux-gnu- ARCH=arm64 nanopi5_linux_defconfig friendlywrt.config
# Optionally, if you want to change the default kernel config
# make CROSS_COMPILE=aarch64-linux-gnu- ARCH=arm64 menuconfig
# Start building kernel
make CROSS_COMPILE=aarch64-linux-gnu- ARCH=arm64 -j$(nproc)
# Start building kernel modules
mkdir -p out-modules && rm -rf out-modules/*
make CROSS_COMPILE=aarch64-linux-gnu- ARCH=arm64 INSTALL_MOD_PATH="$PWD/out-modules" modules -j$(nproc)
make CROSS_COMPILE=aarch64-linux-gnu- ARCH=arm64 INSTALL_MOD_PATH="$PWD/out-modules" modules_install
KERNEL_VER=$(make CROSS_COMPILE=aarch64-linux-gnu- ARCH=arm64 kernelrelease)
[ ! -f "$PWD/out-modules/lib/modules/${KERNEL_VER}/modules.dep" ] && depmod -b $PWD/out-modules -E Module.symvers -F System.map -w ${KERNEL_VER}
(cd $PWD/out-modules && find . -name \*.ko | xargs aarch64-linux-strip --strip-unneeded)
```

Pack the kernel.img and resource.img:

```
wget https://raw.githubusercontent.com/friendlyarm/sd-fuse_rk3566/kernel-6.1.y/tools/mkkrnlimg && chmod 755 mkkrnlimg
wget https://raw.githubusercontent.com/friendlyarm/sd-fuse_rk3566/kernel-6.1.y/tools/resource_tool && chmod 755 resource_tool
wget https://raw.githubusercontent.com/friendlyarm/sd-fuse_rk3566/kernel-6.1.y/prebuilt/boot/logo.bmp
wget https://raw.githubusercontent.com/friendlyarm/sd-fuse_rk3566/kernel-6.1.y/prebuilt/boot/logo_kernel.bmp
./mkkrnlimg arch/arm64/boot/Image kernel.img
./resource_tool --dtbname arch/arm64/boot/dts/rockchip/rk3566-nanopi*-rev*.dtb logo.bmp logo_kernel.bmp
```

After the compilation, the following files will be generated:

kernel.img	resource.img	The kernel modules are located in the out-modules directory

Run your build:
Please refre to #Running the build

7.3.3 Build u-boot v2017.09

This section applies to the following operating systems:

friendlywrt21	friendlywrt21-docker	friendlywrt23	friendlywrt23-docker	ubuntu-noble-core-arm64	openmediavault-arm64	debian-bookworm-core-arm64

Clone the repository to your local drive then build:

```
git clone https://github.com/friendlyarm/rkbin --single-branch --depth 1 -b friendlyelec
git clone https://github.com/friendlyarm/uboot-rockchip --single-branch --depth 1 -b nanopi5-v2017.09
export PATH=/opt/FriendlyARM/toolchain/11.3-aarch64/bin/:$PATH
cd uboot-rockchip/
./make.sh nanopi_r3
```

After the compilation, the following files will be generated:

uboot.img	trust.img	rk356x_spl_loader_vX.YY.ZZZ.bin (aka MiniLoaderAll.bin)

Run your build:
Please refre to #Running the build

7.3.4 Running the build

7.3.4.1 Install to target board

This section applies to the following operating systems:

friendlywrt21	friendlywrt21-docker	friendlywrt23	friendlywrt23-docker	ubuntu-noble-core-arm64	openmediavault-arm64	debian-bookworm-core-arm64

RK3566 uses GPT partitions by default, you can use the dd command, but be careful to choose the right output device:

- The SD/TF Card device node: /dev/mmcblk0
- The eMMC device node: /dev/mmcblk2

The following is an example of how to update the kernel to eMMC:
Use the 'parted' command to view the partition layout:

```
parted /dev/mmcblk2 print
```

Sample outputs:

```
Model: MMC BJTD4R (sd/mmc)
Disk /dev/mmcblk2: 31.3GB
Sector size (logical/physical): 512B/512B
Partition Table: gpt
Disk Flags:

Number  Start   End     Size    File system  Name      Flags
 1      8389kB  12.6MB  4194kB               uboot
 2      12.6MB  16.8MB  4194kB               trust
 3      16.8MB  21.0MB  4194kB               misc
 4      21.0MB  25.2MB  4194kB               dtbo
 5      25.2MB  41.9MB  16.8MB               resource
 6      41.9MB  83.9MB  41.9MB               kernel
 7      83.9MB  134MB   50.3MB               boot
 8      134MB   2500MB  2366MB  ext4         rootfs
 9      2500MB  31.3GB  28.8GB  ext4         userdata
```

as shown above, the resource partition is located at 5 and the kernel partition is located at 6. Use the dd command to write the resource.img and kernel.img files to these partitions, the commands are as follows:

```
dd if=resource.img of=/dev/mmcblk2p5 bs=1M
dd if=kernel.img of=/dev/mmcblk2p6 bs=1M
```

If you want to update u-boot:

```
dd if=uboot.img of=/dev/mmcblk2p1 bs=1M
```

To update new driver modules, copy the newly compiled driver modules to the appropriate directory under /lib/modules.

7.3.4.2 Packaging and creating an SD image

To create a new OS image file, you need to use the "sd-fuse" packaging tool.

"sd-fuse" is a collection of scripts that can be used to create bootable SD card images for FriendlyElec boards. Its main features include:

- Creation of root filesystem images from a directory
- Building of bootable SD card images
- Simple compilation of kernel, U-Boot, and third-party drivers

Please click on the following link to find out more:

Kernel version	Packaging Tool
linux v6.1.y	sd-fuse_rk3566/kernel-6.1.y (https://github.com/friendlyarm/sd-fuse_rk3566/tree/kernel-6.1.y)

7.3.4.3 USB flashing

7.3.4.3.1 Linux

Reboot the board and enter loader mode with the following command:

```
sudo reboot loader
```

To flash U-Boot and kernel using the "upgrade_tool_v2.30_for_linux" tool, please use the following command:

```
sudo upgrade_tool di -k kernel.img
sudo upgrade_tool di -re resource.img
sudo upgrade_tool di -u uboot.img
sudo upgrade_tool RD
```

Note: "upgrade_tool" is a command-line tool provided by Rockchip for Linux operating systems (Linux_Upgrade_Tool).

7.4 Build the code using scripts

7.4.1 Download scripts and image files

```
git clone https://github.com/friendlyarm/sd-fuse_rk3566.git -b kernel-6.1.y
cd sd-fuse_rk3566
wget http://112.124.9.243/dvdfiles/rk3566/images-for-eflasher/ubuntu-noble-core-arm64-images.tgz
tar xvzf ubuntu-noble-core-arm64-images.tgz
```

7.4.2 Compile the kernel

Download the kernel source code and compile it. the relevant image files in the ubuntu-noble-core-arm64 directory will be automatically updated, including the kernel modules in the file system:

```
git clone https://github.com/friendlyarm/kernel-rockchip --depth 1 -b nanopi6-v6.1.y kernel-rk3566
KERNEL_SRC=$PWD/kernel-rk3566 ./build-kernel.sh ubuntu-noble-core-arm64
```

7.4.3 Compile the kernel headers

```
git clone https://github.com/friendlyarm/kernel-rockchip --depth 1 -b nanopi6-v6.1.y kernel-rk3566
MK_HEADERS_DEB=1 BUILD_THIRD_PARTY_DRIVER=0 KERNEL_SRC=$PWD/kernel-rk3566 ./build-kernel.sh ubuntu-noble-core-arm64
```

7.4.4 Compile the uboot

Download the uboot source code and compile it. the relevant image files in the ubuntu-noble-core-arm64 directory will be automatically updated:

```
git clone https://github.com/friendlyarm/uboot-rockchip --depth 1 -b nanopi5-v2017.09
UBOOT_SRC=$PWD/uboot-rockchip ./build-uboot.sh ubuntu-noble-core-arm64
```

7.4.5 Generate new image

Repackage the image file in the ubuntu-noble-core-arm64 directory into sd card image:

```
./mk-sd-image.sh ubuntu-noble-core-arm64
```

After the command is completed, the image is in the out directory.

8 Using On-Board Hardware Resources

8.1 Using VPU

Please refer to NPU

8.2 Using NPU

Please refer to NPU

8.3 DTS files

Please refer to DTS files

9 Backup rootfs and create custom SD image (to burn your application into other boards)

9.1 Backup rootfs

Run the following commands on your target board. These commands will back up the entire root partition:

```
sudo passwd root
su root
cd /
tar --warning=no-file-changed -cvpzf /rootfs.tar.gz \
    --exclude=/rootfs.tar.gz --exclude=/var/lib/docker/runtimes \
    --exclude=/etc/firstuser --exclude=/etc/friendlyelec-release \
    --exclude=/usr/local/first_boot_flag --one-file-system /
```

Note: if there is a mounted directory on the system, an error message will appear at the end, which can be ignored.

9.2 Making a bootable SD card from a root filesystem

Only support RK3328/RK3399/RK3568/RK3566/RK3588

10 Common Linux-based operating system operations

10.1 Using ADB on Linux Systems

10.1.1 Enabling ADB in Buildroot System

Enable on Startup

```
mv /etc/init.d/K50usbdevice.sh /etc/init.d/S50usbdevice.sh
reboot
```

Enable Temporarily

```
usbdevice-wrapper start
```

10.1.2 Enabling ADB in Ubuntu and Debian Systems

Enable on Startup

```
sudo systemctl enable usbdevice
sudo reboot
```

Enable Temporarily

```
usbdevice-wrapper start
```

10.1.3 How to Connect

When using ADB, the port connected to the computer is the same as the USB flashing port.

10.2 Install Kernel Headers

To install the .deb file located in the /opt/archives directory:

```
sudo dpkg -i /opt/archives/linux-headers-*.deb
```

To download and update the kernel header files online:

```
wget http://112.124.9.243/archives/RK3566/linux-headers-$(uname -r)-latest.deb
sudo dpkg -i ./linux-headers-latest.deb
```

You can visit http://112.124.9.243/archives/RK3566 to see which kernel deb packages are available.

10.3 Setting Kernel Boot Parameters (eMMC Only)

Flash the firmware file XXXX-eflasher-multiple-os-YYYYMMDD-30g.img.gz to a TF card, then insert the TF card into your computer. Windows will usually recognize the TF card partition automatically (formatted as exFAT). For Linux or Mac users, manually mount the first partition of the TF card. Assuming the TF card's device name is /dev/sdX, mount /dev/sdX1.

Edit the info.conf configuration file in the OS directory on the TF card, adding the bootargs-ext parameter. For example:

```
bootargs-ext=rockchipdrm.fb_max_sz=2048
```

To remove a specified parameter, set it to empty. For example, to remove the userdata parameter:

```
bootargs-ext=userdata=
```

After editing, use this TF card to flash the system to eMMC.

To set kernel boot parameters during the creation of a mass production card, refer to the following script (example for RK3588): https://github.com/friendlyarm/sd-fuse_rk3588/blob/kernel-6.1.y/test/test-custom-bootargs.sh

11 Unbricking Method

If the ROM is not installed correctly, causing the development board to become bricked, and you might not have the opportunity to reinstall the ROM via an SD card, you need to enter Maskrom mode to unbrick it by erasing the storage device.

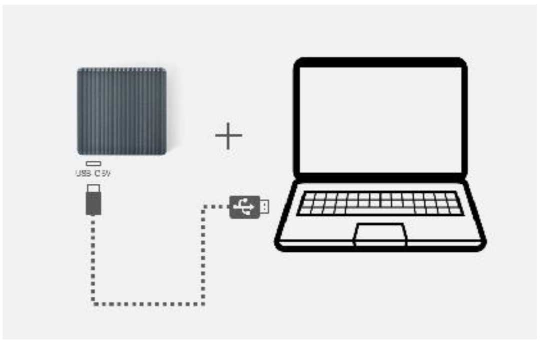
11.1 Windows Users

11.1.1 Download Required Files

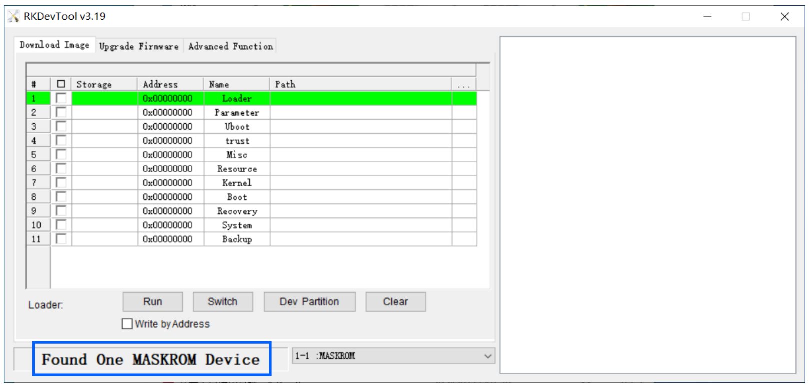
- **Get the necessary tools**: Visit here (https://dl.friendlyelec.com/NanoPi-R3S), find **RKDevTool_v3.19_for_window.zip** and **DriverAssitant_v5.12.zip** in the **05_Tools** directory, and download them to your local machine.
- **Install Rockchip USB driver and RKDevTool**: Extract **DriverAssitant_v5.12.zip** to install the Rockchip USB driver, and extract **RKDevTool_v3.19_for_window.zip** to obtain the Rockchip flashing tool **RKDevTool**.
- **Get the loader**: Visit here (http://112.124.9.243/dvdfiles/), enter the tools directory corresponding to your CPU model, and download **MiniLoaderAll.bin**.

11.1.2 Enter Maskrom Mode to Erase the Storage Device

- Remove the SD card, USB device, and other peripherals from the development board
- Start **RKDevTool** on your computer.
- Press and hold the "Mask" key, Use a USB C-to-A cable, connect NanoPi-R3S to a PC， After the status LED has been on for at least 3 seconds, release the Mask key



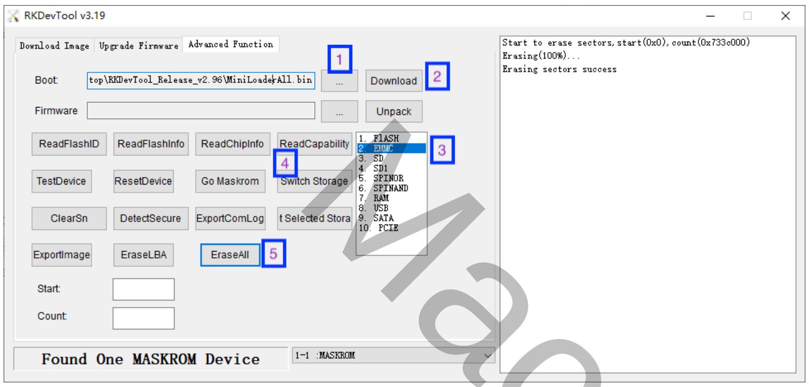
- You will see **Found One MASKROM Device** displayed at the bottom of the **RKDevTool** interface, as shown below:



#	Storage	Address	Name	Path
1		0x00000000	Loader	
2		0x00000000	Parameter	
3		0x00000000	Uboot	
4		0x00000000	trust	
5		0x00000000	Misc	
6		0x00000000	Resource	
7		0x00000000	Kernel	
8		0x00000000	Boot	
9		0x00000000	Recovery	
10		0x00000000	System	
11		0x00000000	Backup	

Found One MASKROM Device

- Click the **Advanced Function** tab in the **RKDevTool** interface.
- In the **Boot** text box, select **MiniLoaderAll.bin**, then click the **Download** button.
- Select **EMMC**, click **Switch Storage**, then click the **EraseAll** button to erase the eMMC.



Boot: top\RKDevTool_Release_v2.96\MiniLoaderAll.bin

```
Start to erase sectors,start(0x0),count(0x733c000)
Erasing(100%)...
Erasing sectors success
```

Found One MASKROM Device

- At this point, NanoPi-R3S is restored to its initial state and can be normally booted via SD card or eMMC.

11.2 Linux Users

11.2.1 Download the Required Files

- **Get the necessary tools**: Visit here (https://dl.friendlyelec.com/NanoPi-R3S) and find **upgrade_tool_v2.30_for_linux.tgz** in the **05_Tools** directory and download it locally.
- **Get the loader**: Visit here (http://112.124.9.243/dvdfiles/), enter the tools directory corresponding to your CPU model, and download **MiniLoaderAll.bin**.

11.2.2 Installation for upgrade_tool

Using the following commands:

```
tar xzf upgrade_tool_v2.30_for_linux.tgz
cd upgrade_tool_v2.30_for_linux
sudo cp upgrade_tool /usr/local/sbin/
sudo chmod 755 /usr/local/sbin/upgrade_tool
```

11.2.3 Enter Maskrom Mode to Erase the Storage Device

- Connect NanoPi-R3S to the computer using a USB data cable.
- Disconnect the power from NanoPi-R3S, hold down the **MASK** button, connect the power, and release the button after 4 seconds.
- Check the connection with the following command:

```
upgrade_tool LD
```

A result similar to "DevNo=1 Vid=0x2207,Pid=0x350b,LocationID=13 Mode=Maskrom SerialNo=" indicates that the device has been detected.

- Erase the eMMC with the following command:

```
upgrade_tool EF MiniLoaderAll.bin
```

- At this point, NanoPi-R3S has been restored to its initial state and can boot the system normally via SD card or eMMC.

11.3 Mac Users

Our tests found that upgrade_tool_v2.25 does not work properly on macOS. Therefore, we recommend using Windows or Linux unless an updated version of upgrade_tool becomes available.

12 Resources

12.1 Datasheets and Schematics

- Schematics

- NanoPi_R3S_2406_SCH.PDF (https://wiki.friendlyelec.com/wiki/images/a/a3/NanoPi_R3S_2406_SCH.PDF)

- PCB Dimensional Diagram
  - NanoPi_R3S_2D_CAD_DXF.zip (https://wiki.friendlyelec.com/wiki/images/a/a3/NanoPi_R3S_2D_CAD_DXF.zip)

- IC Datasheet
  - Rockchip_RK3566_Datasheet_V1.2-20220930.pdf (https://wiki.friendlyelec.com/wiki/images/8/89/Rockchip_RK3566_Datasheet_V1.2-20220930.pdf)

13 Update Logs

13.1 2025-01-23

13.1.1 Linux Kernel

- Synchronized upstream kernel update to version 6.1.99
- Updated rknpu driver to version v0.9.8

13.1.2 Debian/Ubuntu/OpenMediaVault/ProxmoxVE

- Updated Debian Bullseye system to linux-5.10-gen-rkr9 (including updates mpp, xserver, rkaiq, gstreamer-rockchip, rga2, libv4l-rkmpp, libmali, and related packages)
- Integrated hardware acceleration packages such as mpp, gstreamer, rknn, and libmali into the Core system without a desktop environment
- Update Chromium to the new stable version (130) for Debian 11

13.2 2024-11-12

- Improved ramdisk and eflasher for more flexibility and reliability when installing the system on external storage

13.3 2024-10-16

- KVM is enabled by default in the kernel
- Updated FriendlyWrt to version openwrt-23.05.05
- Added Proxmox VE system
- Added Buidroot (tag:linux-5.10-gen-rkr8)
- Added Debian bullseye desktop

13.4 2024-08-26

Initial Release

Retrieved from "https://wiki.friendlyelec.com/wiki/index.php?title=NanoPi_R3S&oldid=26530"

Category: Pages with broken file links

- This page was last modified on 29 October 2024, at 11:03.