## Introduction

During development, we often install numerous programs and configure complex environments on development boards. When setting up the same environment on another board, it can be time-consuming and error-prone. This document provides a method to export the file system from a development board and repackage it into a root file system image.

## 1. Development Environment

Development Board: [armsom-p2pro](https://docs.armsom.org/armsom-p2pro)

- CPU: RK3308
- Kernel: 5.10
- OS: Debian11

PC: Ubuntu22.04

Note: The file system on the development board is synchronized with the PC, so both devices must be on the same local network.

## 2. File Synchronization

We will use `rsync` to copy all files from the root file system (roorfs) to another Linux server. `rsync` is a powerful file synchronization tool used to sync files and directories locally or via remote protocols like SSH. It is more flexible and efficient than the standard `cp` command, especially for large data or regular backups.

### 2.1 Operations on the Development Board

#### 2.1.1 Install SSH and rsync

```
sudo apt-get install ssh
sudo apt-get install rsync
```

#### 2.1.2 Set Root Password

```
sudo passwd root

# If the current user is already root, run
passwd
```

#### 2.1.3 Enable Root Login

The `PermitRootLogin` option in the SSHD configuration determines if root can log in via SSH. It can be set to:

1. yes: Allow root login via SSH.
2. no: Disallow root login via SSH.
3. without-password: Allow root login only with public key authentication.

4. forced-commands-only: Allow root login only with forced commands (e.g., scp).

Edit the SSH configuration file and ensure `PermitRootLogin` is set to:

```
vi /etc/ssh/sshd_config

# Default is
#PermitRootLogin prohibit-password
Change to
PermitRootLogin yes
```

After saving the file, restart the SSH service:

```
sudo systemctl restart sshd
```

#### 2.1.4 Clean Up Unnecessary Files

Clean up leftover caches or temporary files on the development board to free up space.

First, check disk usage:

```
```

```
du -sh /*
```

Remove temporary files and caches:

```
sudo rm -rf /tmp/*
sudo rm -rf /var/tmp/*
sudo rm -rf /var/cache/
```

This step can be skipped if firmware size is not a concern.

### 2.2 Operations on the Ubuntu Host

#### 2.2.1 Install SSH and rsync

```
sudo apt-get install ssh
sudo apt-get install rsync
```

#### 2.2.2 Synchronize Development Board Files

Ping the development board to ensure connectivity. Create a directory on the Ubuntu host for the exported file system.

```
lhd@lhd:~/3576_rootfs_test$ mkdir rootfs
```
Use the following command to sync the file system from the RK3308 development board:

```
sudo rsync -avx root@192.168.100.123:/ rootfs
```

Where:

- `root` is the development board username
- `192.168.100.123` is the development board's IP address
- `/` is the root directory on the development board
- `rootfs` is the directory on the Ubuntu host

This step requires root access, as described earlier.

Syncing may take some time. Once complete, the development board's file system will be synchronized to the Ubuntu host.

#### 2.2.3 Create an Image File

Create an empty image file using `dd`:

```
lhd@armsom:~/3576_rootfs_test$ dd if=/dev/zero of=rk3308_rootfs.img bs=1M count=7168
```

Where:

- `/dev/zero` generates a file of specified size with zero content
- `rk3308_rootfs.img` is the image file to be created
- `bs=1M` means read/write 1M of data at a time

- `count=4096` is the number of blocks to copy

Adjust `count` based on the development board’s system size, as determined by `df -h`.

#### 2.2.4 Format the Image File

Format the image file and add a Linux root label:

```
sudo mkfs.ext4 -F -L linuxroot rk3308_rootfs.img
```

This command creates an ext4 file system on `rk3308_rootfs.img`, suitable for data storage or as a disk image.

#### 2.2.5 Populate the Image File

Mount the root file system image and copy the modified file system:

```
mkdir rk3308_rootfs_mount
sudo mount rk3308_rootfs.img rk3308_rootfs_mount
sudo cp -rfp rootfs/* rk3308_rootfs_mount
```

If you encounter an error like `cp: write error; no space left on device`, the `dd` command’s `count` was set too small.

After copying, unmount the image:

```
sudo umount rk3308_mount
```

#### 2.2.6 Resize the Image File

The image file now contains the development board's file system, but the file size needs to be adjusted.

Check and resize the image file:

```
lhd@armsom:~/3576_rootfs_test$ sudo e2fsck -p -f rk3308_rootfs.img
linuxroot: 97295/655360 files (0.1% fragmented), 1442978/2621440 blocks
lhd@armsom:~/3576_rootfs_test$ sudo resize2fs -M rk3308_rootfs.img
resize2fs 1.46.5 (30-Dec-2021)
Resized the file system on rk3308_rootfs.img to 1556652 blocks (4k each).
```

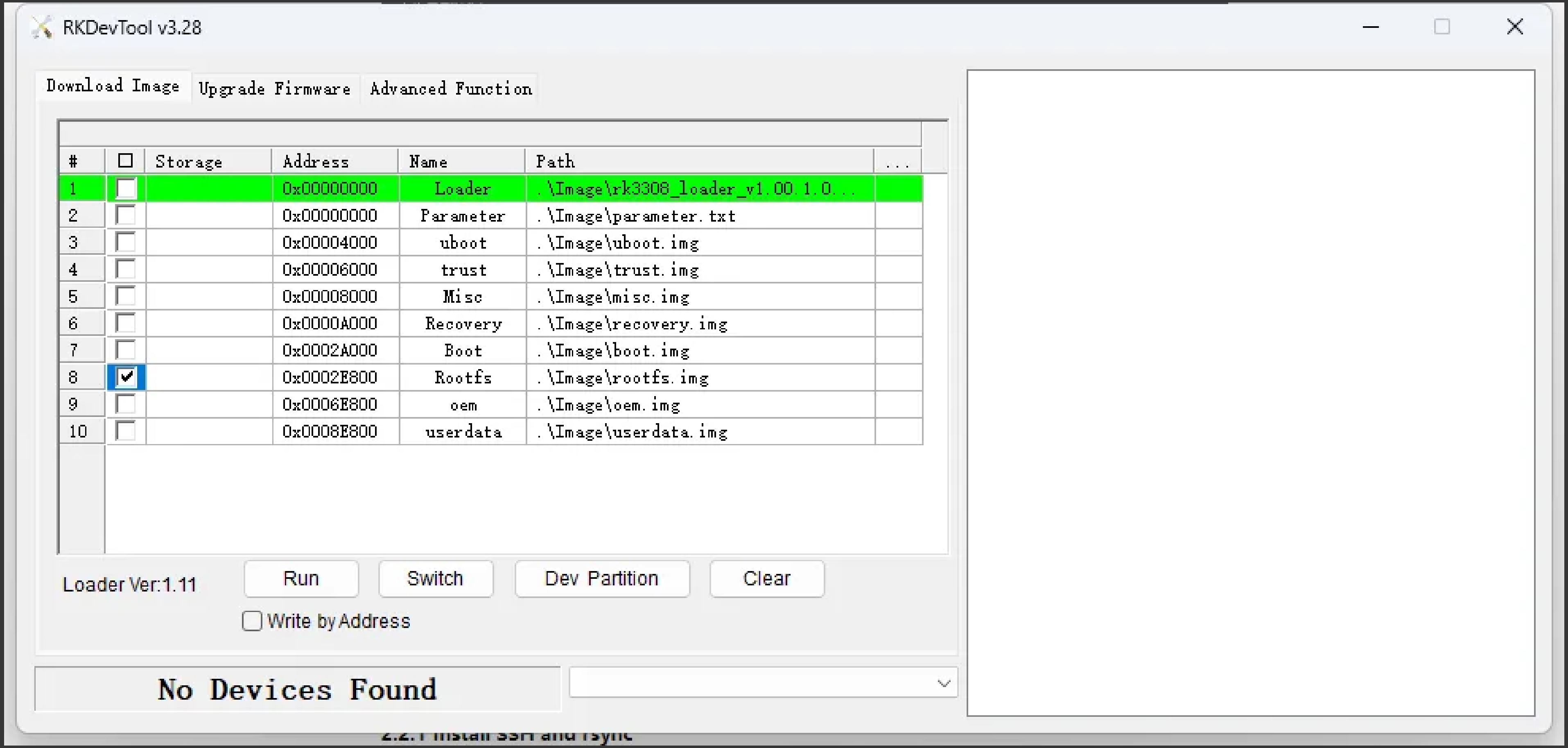
You now have a complete system image of the original development board.

## 3. Firmware Deployment

Once the firmware is ready, test and deploy it by flashing the root file system image back onto the development board:

1. Flash the firmware without application deployment.

2. Power on the development board and enter LOADER mode. Use the Rockchip RKDevTool v3.28 to flash the firmware, selecting the rootfs partition and verifying partition locations as shown in the image.
3. Verify if the previously deployed files are present in the system.



#	☐	Storage	Address	Name	Path	...
1	☐		0x00000000	Loader	.\Image\rk3308_loader_v1.00.1.0...	
2	☐		0x00000000	Parameter	.\Image\parameter.txt	
3	☐		0x00004000	uboot	.\Image\uboot.img	
4	☐		0x00006000	trust	.\Image\trust.img	
5	☐		0x00008000	Misc	.\Image\misc.img	
6	☐		0x0000A000	Recovery	.\Image\recovery.img	
7	☐		0x0002A000	Boot	.\Image\boot.img	
8	✓		0x0002E800	Rootfs	.\Image\rootfs.img	
9	☐		0x0006E800	oem	.\Image\oem.img	
10	☐		0x0008E800	userdata	.\Image\userdata.img	

Loader Ver:1.11

☐ Write by Address

No Devices Found