NUC980 OpenWrt Quick Start Guide

Application Note for 32-bit NuMicro® Family

Document Information

Abstract	NUC980 OpenWrt Quick Start Guide
Apply to	NuMicro® NUC980 series.

For additional information or questions, please contact: Nuvoton Technology Corporation.

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1 Overview

The OpenWrt Project is a Linux operating system targeting embedded devices. Instead of trying to create a single, static firmware, OpenWrt provides a fully writable filesystem with package management. NUC980 OpenWrt is based on OpenWrt/LEDE 17.01.7.

2 Quick Start

2.1 Requirements

Before the installation, please make sure there is enough free space for project building. The expected used space is about 12 GB.

2.2 Installation

Refer to *NUC980 Linux 4.4 BSP User Manual* for the steps to download NUC980 Linux BSP and set up development environment. After that, please clone the NUC980 OpenWrt with following command:

```
$ git clone https://github.com/OpenNuvoton/NUC980-OpenWrt.git
```

After download is completed, execute following commands to update the OpenWrt feeds script.

```
$ ./scripts/feeds update -a
$ ./scripts/feeds install -a
```

2.3 Configuration

The NUC980 OpenWrt supports Chili, IoT and EVB boards. Please use the correct setting for the target board. For example, to use the Chili board, user needs to follow the steps below:

In folder NUC980-OpenWrt, use the file Nuvoton/config/config_nuc980_chili as the OpenWrt configuration file.

```
cp Nuvoton/config/config_nuc980_chili .config
```

Run “make menuconfig” to configure OpenWrt. Confirm if the Target System is Nuvoton NUC980, and the Subtarget is the “NUC980 Chili”, as shown in Figure 2-1.

```
$ make menuconfig
```

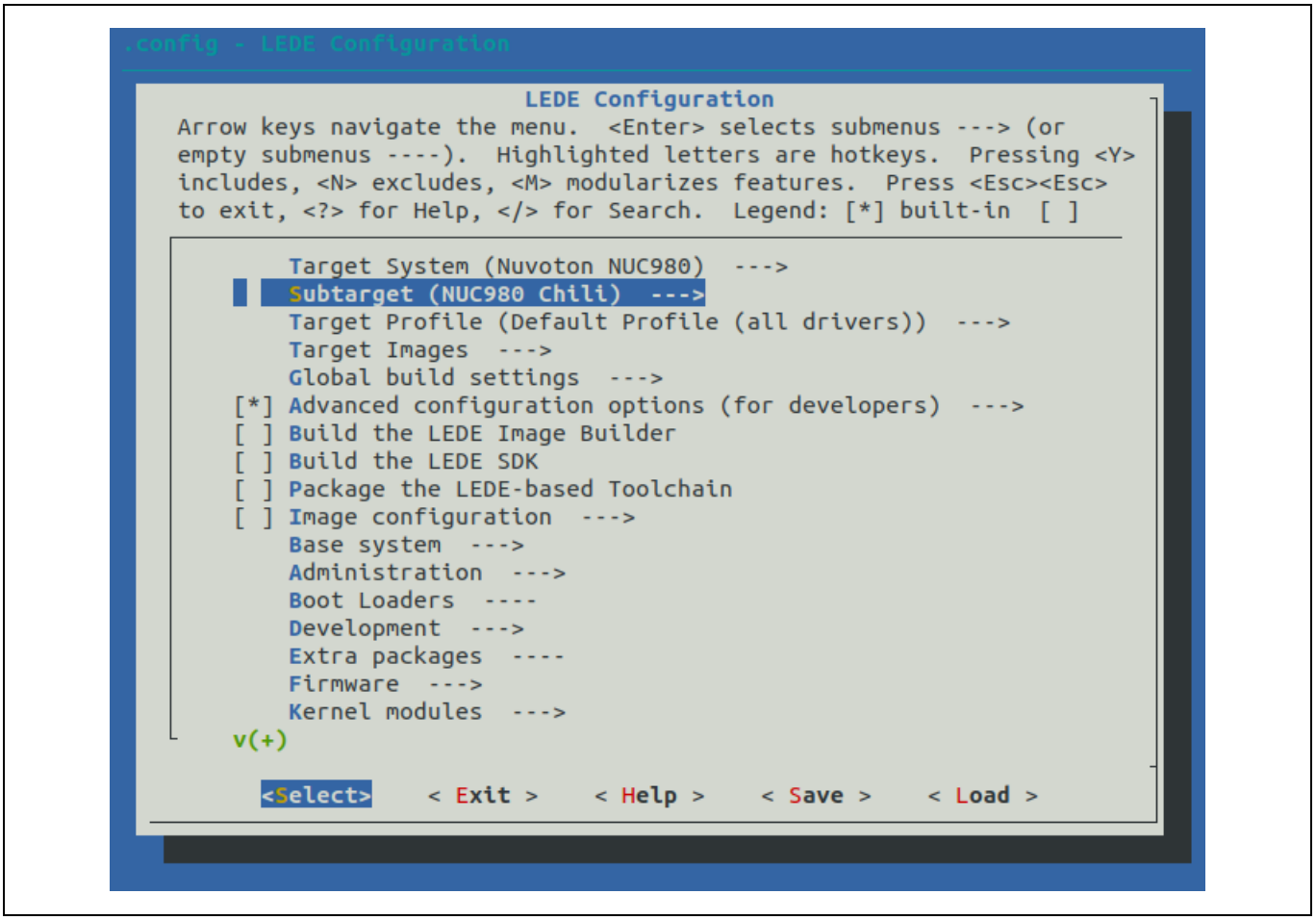

Figure 2-1 Select Target and Subtarget

In Advanced configuration options page, specify the git repository and branch to clone Linux kernel source.

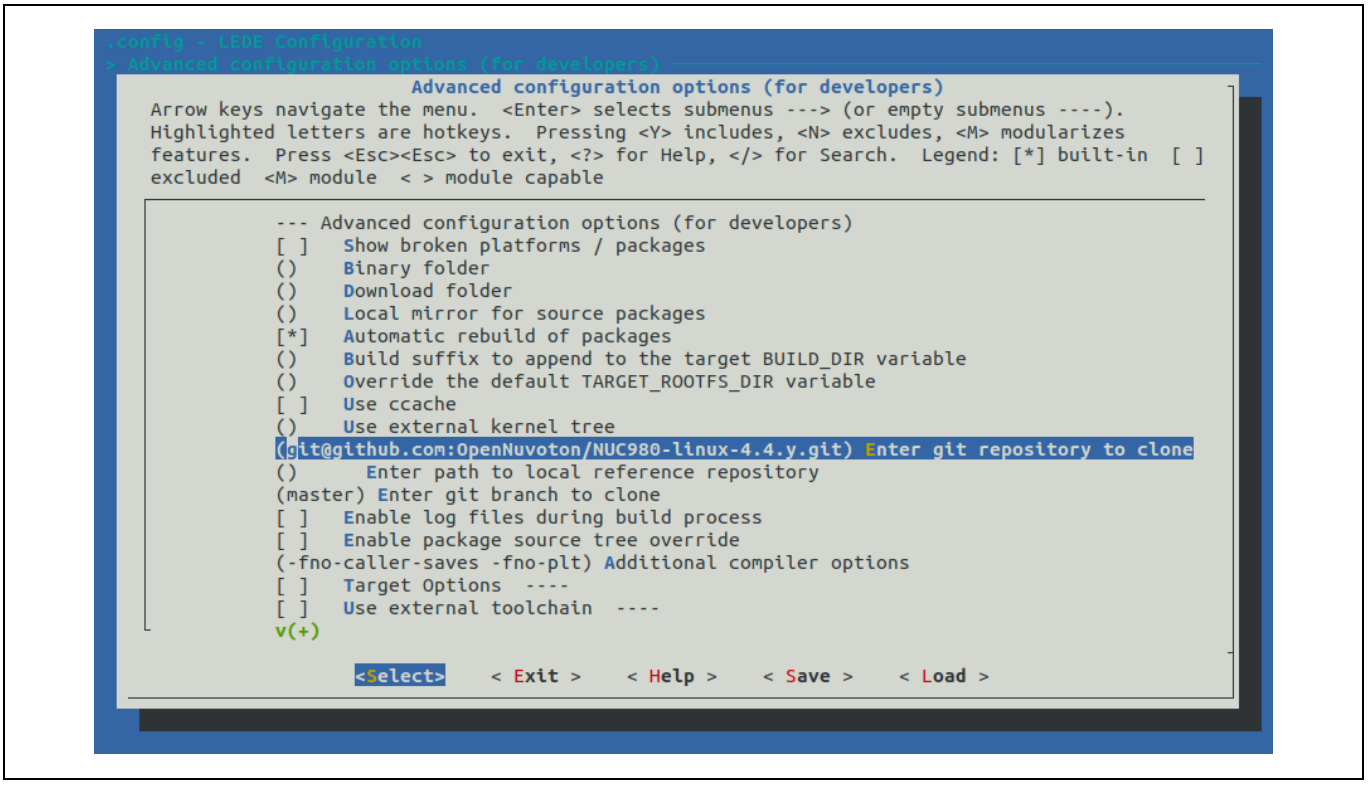

Figure 2-2 Configure Kernel Repository

The default setting uses the SSH method to clone git repository. Please make sure the public key of computer is attached to user's git account. If not, user can change to use the HTTPS method to clone. Table 2-1 lists available NUC980 Linux kernel repositories of using the HTTPS method.

Repository Manger	URL
Github	https://github.com/OpenNuvoton/NUC980-linux-4.4.y.git
Gitlab	https://gitlab.com/OpenNuvoton/NuMicro-ARM7-ARM9-Family/NUC980-linux-4.4.y.git
Gitee	https://gitee.com/OpenNuvoton/NUC980-linux-4.4.y.git

Table 2-1 NUC980 Linux Kernel Repositories

Run "make kernel_menuconfig" to download NUC980 Linux BSP and related packages. This step may take 20 minutes. Then user can exit and save the config directly.

```
$ make kernel_menuconfig
```

2.3.1 NUC980 OpenWrt Configuration

This section introduces how the NUC980 OpenWrt configuration is generated. The following steps show how the configuration file Nuvoton/config/config_nuc980_iot is generated.

1. Specify the target and subtarget of NUC980 IoT board, and then run “make defconfig” to generate the OpenWrt default configuration. After this step is done, the OpenWrt configuration is stored in the file .config.

```
echo CONFIG_TARGET_nuc980=y > .config
echo CONFIG_TARGET_nuc980_nuc980_iot=y >> .config
make defconfig
```

2. After the default configuration is generated, run “make menuconfig” to modify the configurations. The necessary steps for NUC980 IoT board are shown in Figure 2-3.

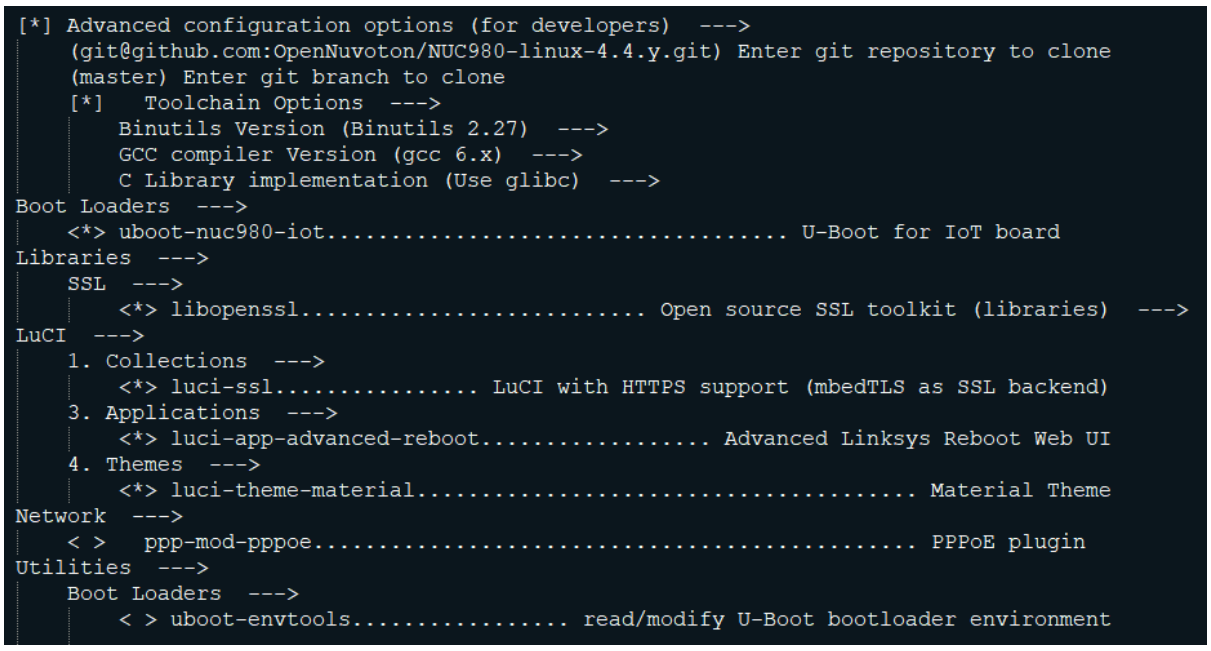

Figure 2-3 Modified Items to Generate NUC980 OpenWrt Configuration

3. After the configuration modification is completed, exit the setting and rename the file .config to Nuvoton/config/config_nuc980_iot.

2.4 Compilation

After configuration is completed, run “make” command to build the OpenWrt. The building may take around 90 minutes.

```
$ make
```

The generated images are located in the bin/targets/nuc980/-glibc/ directory. The output files are shown as Table 2-2. Please note for the Root file system, the Chili board (SPI-NOR) uses the JFFS2, but the IoT board (SPI-NAND) and EVB board (NAND) use the UBIFS by default.

Image Name	Description
${Subtarget}-uImage	Linux kernel uImage.

${Subtarget}-rootfs.jffs2-64k	Root file system in JFFS2 format with 64 KB block size (for Chili board).
${Subtarget}-rootfs.jffs2-128k	Root file system in JFFS2 format with 128 KB block size.
${Subtarget}-root.ubifs	Root file system in ubifs format (for IoT and EVB boards).
${Subtarget}-u-boot.bin	Main U-Boot loader.
${Subtarget}-u-boot-spl.bin	Load main U-Boot from NAND Flash to DDR (for IoT and EVB boards).

Table 2-2 OpenWrt Generated Images in Output Directory

If any error occurs during compilation, use the following command to gather error log for further check.

```
$ make -j1 V=sc
```

2.5 Firmware Programming

Before programming firmware, user needs to download the U-Boot environment files. Note that U-Boot can also be built through the NUC980BSP rather than OpenWrt. Each target board should use its own U-Boot firmware and U-Boot environment

When the target board uses the NAND related device as the storage media, such as IoT and EVB boards, user should do the “erase all” action first before programming the firmware.

Refer to *NUC980 NuWriter User Manual* to program U-Boot, U-Boot environment, kernel and root file system images to the target storage media, as shown in Figure 2-4 (for Chili board) and Figure 2-5 (for IoT board).

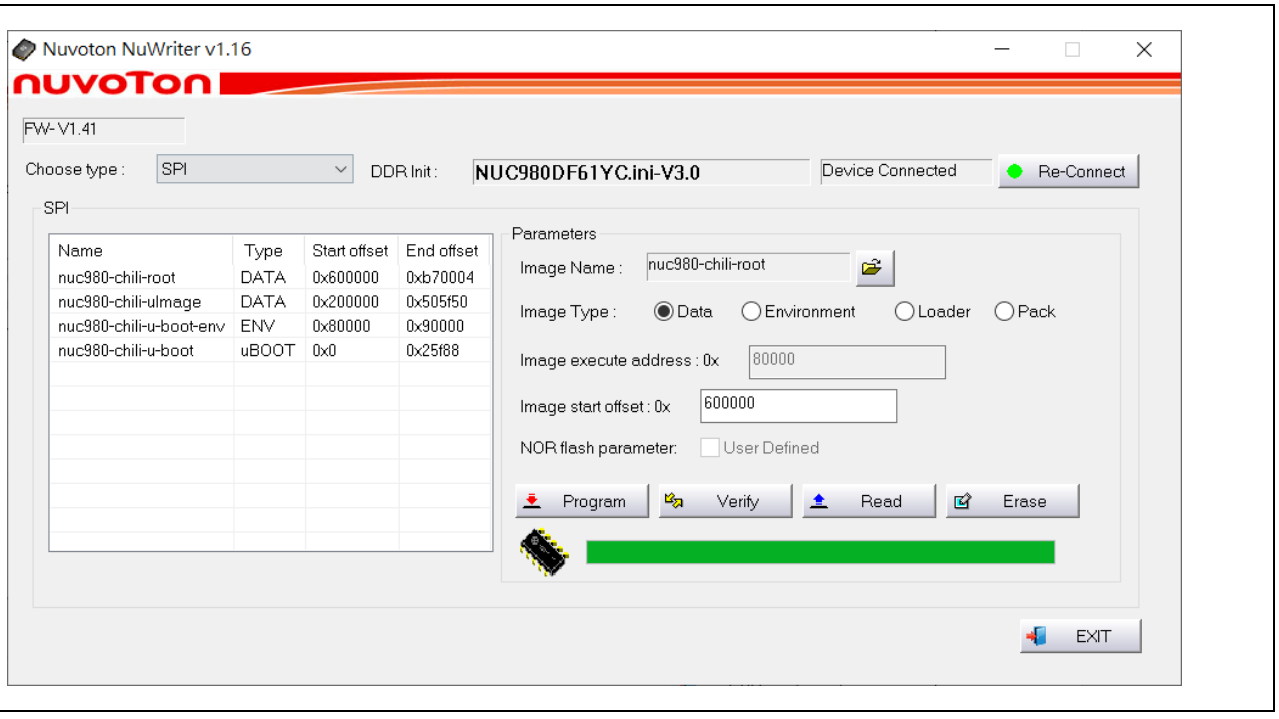

Figure 2-4 Use NuWriter to Program Images for Chili Board

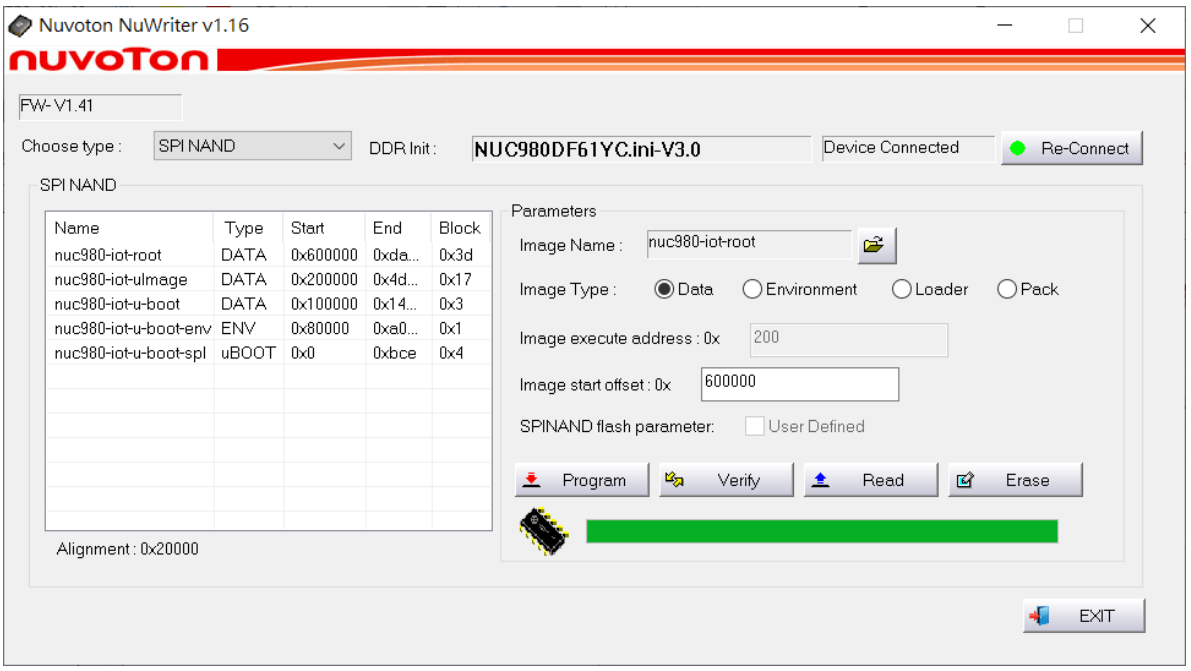

Figure 2-5 Use NuWriter to Program Images for IoT Board

The MTD partitions are defined in U-Boot environment. For the Chili board, user can see there are three MTD partitions as follows.

```
bootargs=noinitrd root=/dev/mtdblock2 rw rootfstype=jffs2 console=ttyS0,115200n8 rdinit=/sbin/init mem=64M
mtdparts=m25p80:0x200000@0x0(u-boot),0x400000@0x200000 (kernel),-(rootfs) ignore_loglevel
```

For the IoT board, user can see there are also three MTD partitions as follows.

```
bootargs=noinitrd ubi.mtd=2 root=ubi0:rootfs rw rootfstype=ubifs console=ttyS0,115200n8 rdinit=/sbin/init
mem=64M mtdparts=nand0:0x200000@0x0(u-boot),0x400000@0x200000(kernel),-(rootfs) ignore_loglevel
```

If user wants to change the MTD partitions, please modify the U-Boot environment file. The image start offset in NuWriter should also be changed.

2.6 Test the OpenWrt

After starting the device, user will see the OpenWrt booting messages, as shown in Figure 2-6.

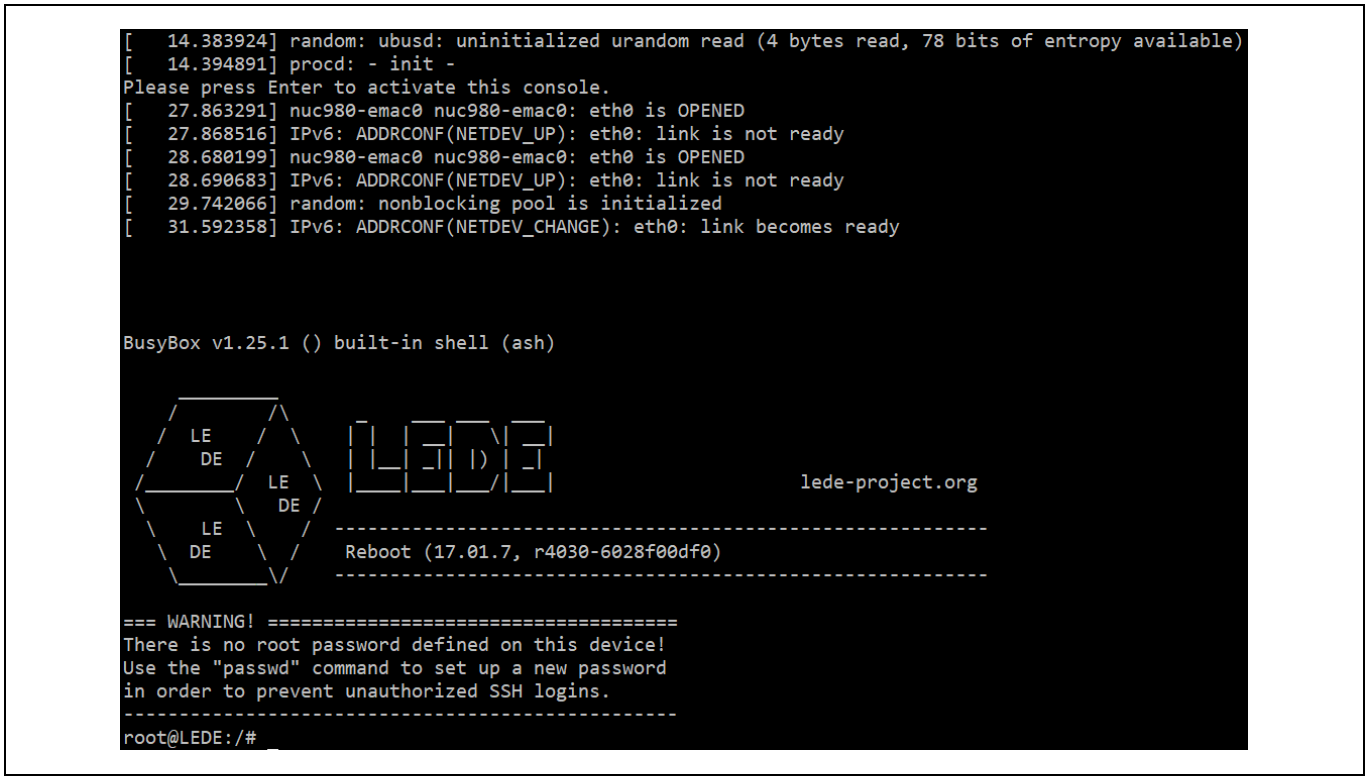

Figure 2-6 OpenWrt Booting Messages

2.6.1 Network Settings

To get the network setting information, user can run the following command.

```
uci show network
```

The default network setting is using the static address, as shown in Figure 2-7.

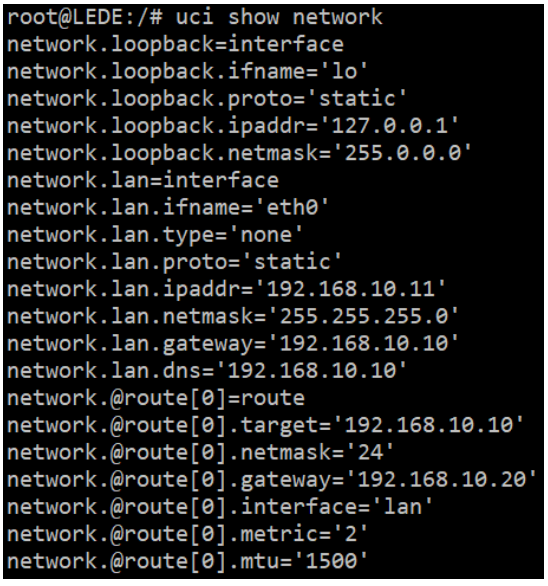

Figure 2-7 Default Network Settings

To change the network settings, user can modify the file path /etc/config/network directly, or run the “uci set” command. For example, to change to a dynamic address, user can run following commands to modify and reset the network settings.

```
uci set network.lan.proto=dhcp
/etc/init.d/network restart
```

2.6.2 LuCI Web Interface

To login the LuCI Web interface, user can connect to https://YOUR_IP_ADDRESS through a web browser such as Chrome. In the first time login, user may encounter a security warning message, as shown in Figure 2-8.

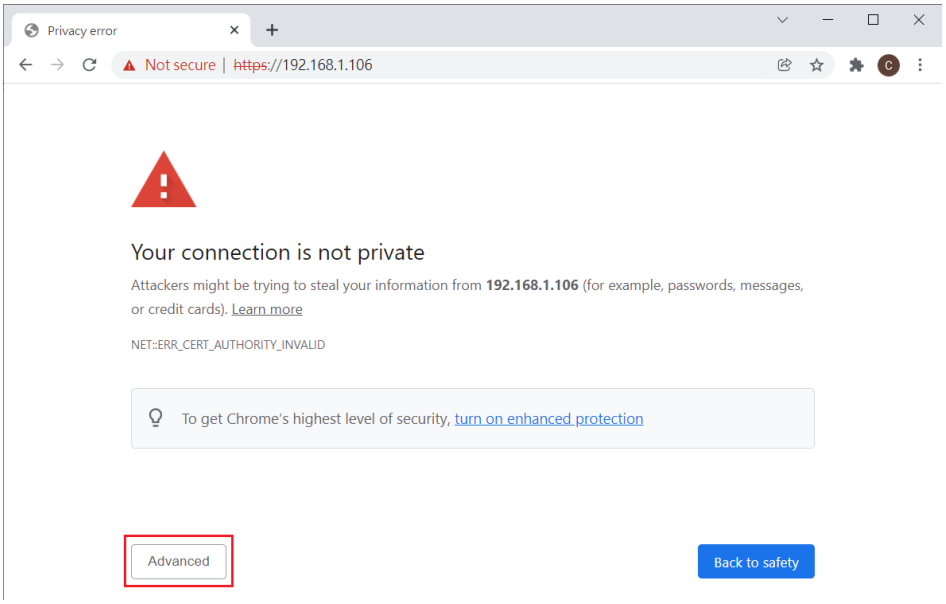

Figure 2-8 First Time to Login the LuCI Web Interface

After clicking the **Advanced** button, user will see a new screen, as shown in Figure 2-9. Please proceed with the connection.

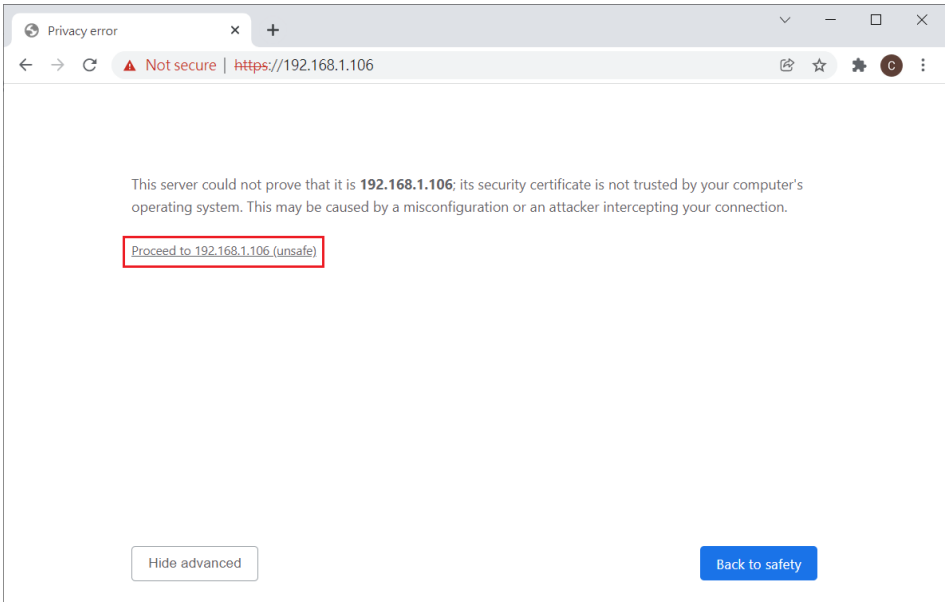

Figure 2-9 Proceed the Connection to LuCI

Then user can see the login screen. Since there is no password by default, user can login directly, or set a new password, as shown in Figure 2-10.

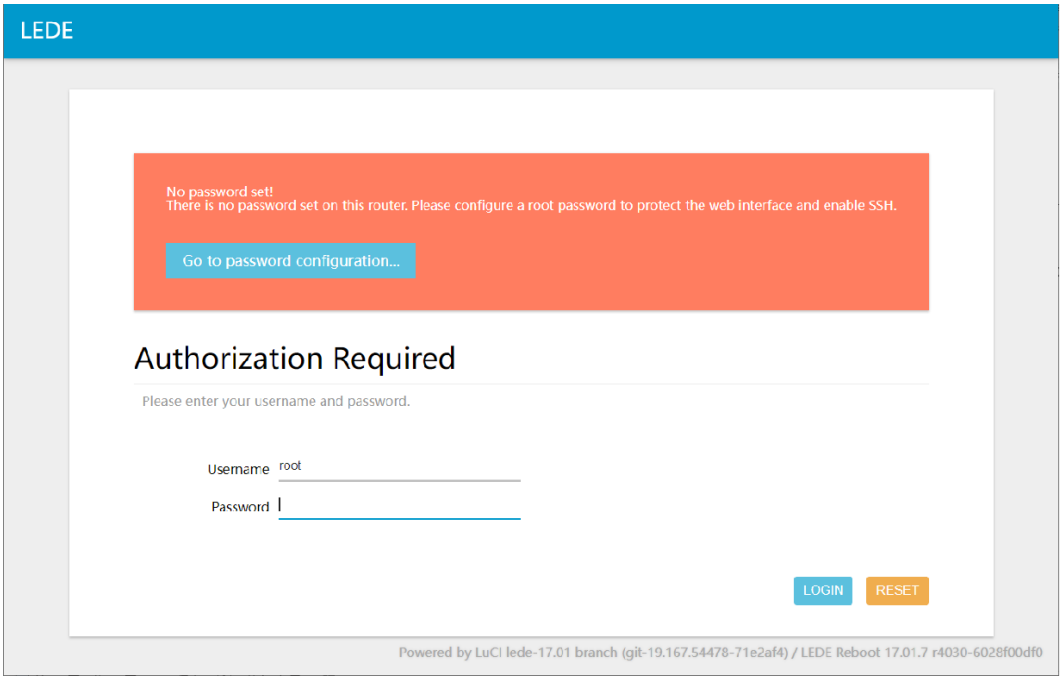

Figure 2-10 Login Screen of LuCI

2.6.3 Firmware Update

Before doing the firmware update, please confirm if the MTD partition name is matched between the system and upgrade setting. To check the system partition name, user can see the booting log, as shown in Figure 2-11.

```
[    1.638483] Creating 3 MTD partitions on "m25p80":
[    1.643691] 0x000000000000-0x000000200000 : "u-boot"
[    1.654516] 0x000000200000-0x000000600000 : "kernel"
[    1.665449] 0x000000600000-0x000002000000 : "rootfs"
```

Figure 2-11 MTD Partition Name in Booting

To check the upgrade partition name, user can see the file /lib/upgrade/platform.sh, as shown in Figure 2-12.

```
root@LEDE:/# cat /lib/upgrade/platform.sh
#
# Copyright (C) 2010 OpenWrt.org
#

PART_NAME="kernel:rootfs"

platform_check_image() {
        return 0

}
```

Figure 2-12 MTD Partition Name in Upgrade Setting

For the NUC980 Chili board using the SPI-NOR solution, user can upgrade either kernel only or kernel+rootfs. Use the image file “uImage” to upgrade kernel only, and use the following image file in the output directory to upgrade kernel+rootfs.

```
lede-nuc980-nuc980-chili-nuc980-chili-jffs2-64k-sysupgrade.bin
```

For the NUC980 IoT board using the SPI-NAND solution, user can upgrade kernel only in current time.

To do the kernel firmware upgrade, enter "System -> Backup/Flash Firmware". Choose the new kernel image file, and then click "**FLASH IMAGE**" button, as shown in Figure 2-13.

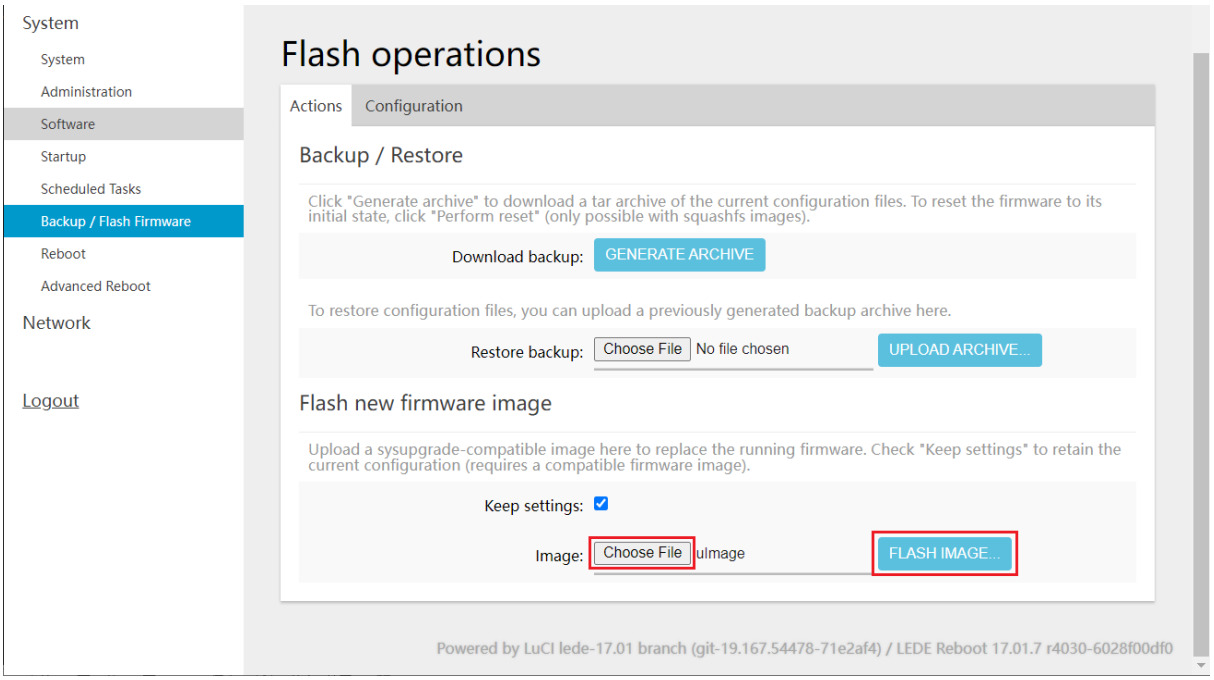

Figure 2-13 Firmware Upgrade in LuCI

Revision History

Date	Revision	Description
2022.03.15	1.00	1. Initially issued.

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