

# Linux 5.15 Yocto SDK

User Manual

V 2.3

# 1 Introduction

Thank you for choosing a miriac Single Board Computer from MicroSys. This User Manual shows the steps needed to boot Linux, to run programs on the SBC, including your own benchmarks, and provides links how to make modifications and updates to the U-Boot bootloader and/or the Linux kernel to meet your own requirements.

The Linux 5.15.71 Yocto Software Development Kit is valid for the following miriac Single Board Computers from MicroSys:

SBC-LS1043A  
SBC-LS1046A  
SBC-LS1088A  
SBC-LS1046A-TSN  
SBC-LX2160A  
AIP-LX2160A

## 2 Prerequisites

### 2.1.1 Host Machine Requirements

To operate the board, you will need a host machine with the following capabilities:

- an Ethernet interface to connect to the SBC either directly or via your local network. In addition, to be able to build a Linux kernel you'll need an internet connection.
- a USB port running a terminal software program (e.g. TeraTerm, HyperTerminal, putty, Kermit...), or else a hardware serial console.

**Choose the following parameters:**

- (a) **115200 Bd**
- (b) **8 Data bits**
- (c) **No parity**
- (d) **1 Stop Bit**

If you want to build the Linux kernel, you'll need to have Linux running on your host. If the host is a Windows machine, then you'll need to run Linux in VirtualBox, VMware or a similar virtual machine.

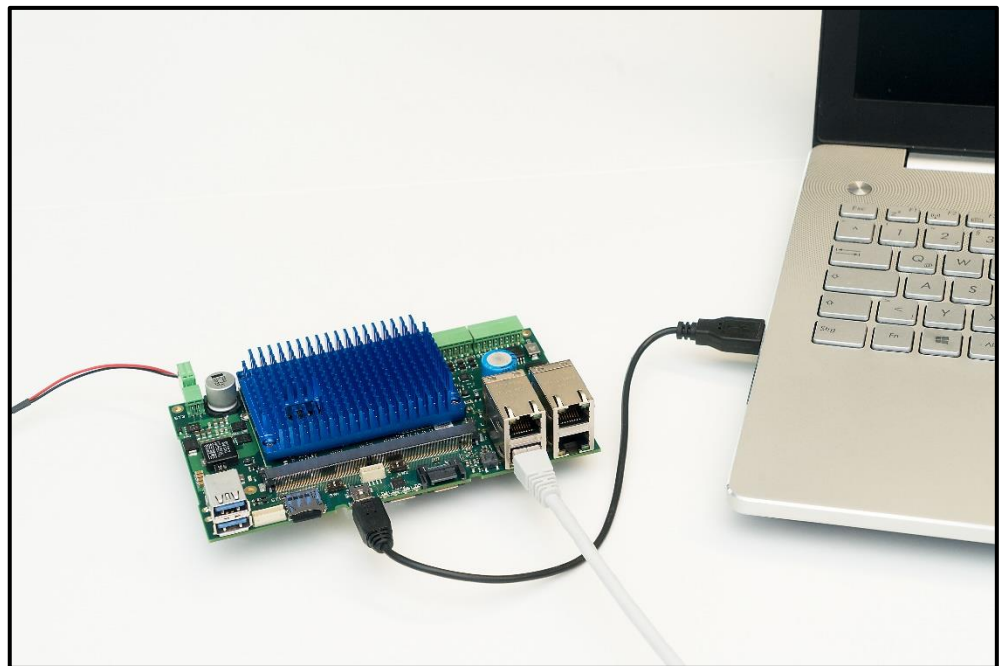
Please have a look into readme file provided alongside the board for latest updates.

## 3 Board Preparation and Power-Up

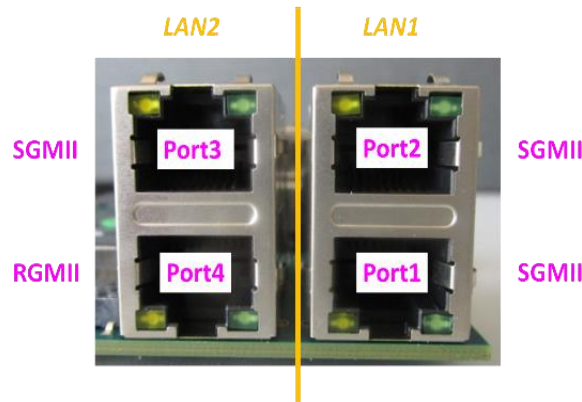
### 3.1 CRX05

Make sure that switch SW1-1 is ON and SW1-2 is ON to select SD card as the boot media or use both switch OFF for QSPI boot into U-Boot. Linux is loaded after U-Boot from SD card.

- Insert the SD card provided into ST1
- The board comes pre-configured to boot correctly on arrival
- Connect the mini USB cable to ST5.
- Connect an Ethernet cable to an RJ45 connector (see table 3-1)
- Connect the power cable to the ST3 connector, while the power supply is still switched off.
- Open a terminal console on the host PC (set to 115200, 8, N, 1)
- Switch on the power.



The following picture shows the front view of the two dual RJ-45 connectors as placed on the CRX05 carrier.



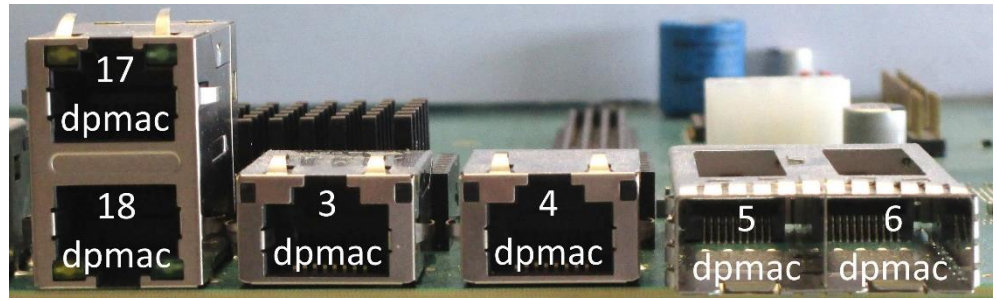
| LAN port | LS1043A interface | LS1046A interface | LS1088A interface | PHY address |
|----------|-------------------|-------------------|-------------------|-------------|
| 1        | fm1-mac9          | fm1-mac9          | dpmac2            | 0000        |
| 2        | n/c               | fm1-mac6          | dpmac3            | 0001        |
| 3        | fm1-mac2          | fm1-mac5          | dpmac7            | 0010        |
| 4        | fm1-mac3          | fm1-mac3          | dpmac4            | 0011        |

Table 3-1 Ethernet port to Linux interface assignment

### 3.2 CRX08

Make sure that switch SW5-1 is ON and SW5-2 is ON which selects the SD card as the boot media.

- Insert the SD card provided into ST31
- The board comes pre-configured to boot correctly on arrival (by default from SD card)
- Connect the mini USB cable to ST29.
- Connect an Ethernet cable to an RJ45 connector (see table 3-1)
- Connect the ATX power cable (24 Pin Molex Mini-Fit) to the ST3 connector and 8 Pin Molex Mini-Fit to ST5, while the power supply is still switched off.
- Open a terminal console on the host PC (set to 115200, 8, N, 1)
- Switch on the ATX power supply and press the power up button.



| LAN port | LX2160A interface | PHY address |
|----------|-------------------|-------------|
| 1        | dpmac17           | 0x0         |
| 2        | dpmac18           | 0x1         |
| 3        | dpmac3            | 0x10        |
| 4        | dpmac4            | 0x11        |
| 5        | dpmac5            | SFP-25G     |
| 6        | dpmac6            | SFP-25G     |

## 4 Operation



*After Power-up, the green LED on the module should light up and any red LED should be off.*

**IF NOT, DISCONNECT THE UNIT FROM POWER AND CHECK FOR FAULTS!**

### 4.1 Boot Procedure

When power is supplied the system will boot into U-Boot.

The factory default settings configure U-Boot to boot straight into Linux. So if you do not intervene, after a few seconds, you will see the Linux prompt:

```
MicroSys 3.3 mpxls10nn ttyS0
```

```
mpxls10xx login:
```

Enter 'root' and hit return. By default, no password is set for root.

```
mpxls10xx login: root
root@mpxls10xx:~#
```

You can now enter Linux commands and run programs. Continue in section 4.2

## 4.1.1 Only boot into U-Boot

If you want to view the U-Boot parameters, then you will need to prevent U-Boot from automatically booting into Linux by hitting any key during the autoboot timeout phase:

```

. . . . .
PCIE0: pcie@3400000 disabled
PCIE1: pcie@3500000 Root Complex: no link
PCIE2: pcie@3600000 disabled
FM1@DTSEC3 [PRIME], FM1@DTSEC5, FM1@DTSEC6, FM1@DTSEC9
Hit any key to stop autoboot: 0
=>

```

When you see the U-Boot prompt, =>, you can enter U-Boot commands to change some parameters, for example your IP address, and view various settings.

```

=> version                // show U-Boot version
=> help                   // show available commands
=> bdfinfo                // show board info
=> printenv               // show environment variables
=> setenv ipaddr 192.168.1.22 // set environment variable
=> imi                    // print header information for
                        application image
=> reset                  // reboot the board
=> boot                   // boot OS (in our case: Linux)

```

Note that the U-Boot environment variables are stored in an I2C EEPROM on the SoM. This means that if you have updated your boot medium there might be a mismatch in the envvars which prevents Linux from booting. To update the envvars in EEPROM enter the following:

```

=> env default -f -a      // fetch defaults from boot medium
=> saveenv                // save to EEPROM

```

Remember to set ipaddr and serverip to your requirements and save the settings.

If you want to return to U-Boot from Linux, then you need to reboot the board. This can be done either by power-cycling the board; or pressing the reset button; or, the most elegant and preferred method, by shutting down and rebooting Linux:

```

root@mpxsls10xx:~# reboot

The system is going down for reboot NOW! (ttyS0) (Fri Aug 20
11:17:00 2021):
INIT: Sending processes the TERM signal

```

## 4.2 Running Linux Programs

Once you see the Linux prompt and have logged on, you can enter Linux commands. Here are some useful commands:

```
# uname -a           // shows Linux kernel version and other info
# ifconfig -a       // shows the Ethernet interfaces, including IP addresses
# df                // display filesystems
# cat /proc/mtd     // shows the partitions in NAND Flash
# reboot           // gracefully shutdown Linux and reboot
# shutdown now     // shutdown Linux immediately (no reboot)
# restool dpmac info dpmac.17 // show status of the Ethernet port in MC domain
```

### 4.2.1 Ethernet Connectivity

One of the first things you are likely to want to do is transfer programs from your host machine to the SBC target.

By default, the Linux is not configured to use DHCP, therefore no IP address will have been assigned.

To see the Ethernet interfaces, enter:

```
root@mpx1s10xx:~# ifconfig -a
```

The SBC-LS1046A and SBC-LS1088A will show 4 Ethernet interfaces and the SBC-LS1043A will show 3 interfaces.

To assign an IP address to an Ethernet interface, you can either configure the interface manually:

CRX05:

```
root@mpx1s10xx:~# ifconfig fm1-mac3 192.168.0.111 up
```

CRX08:

```
root@mpx1s10xx:~# ifconfig dpmac17 192.168.0.111 up
```

Or, to avoid having to enter this every time you boot Linux, you can edit the `/etc/network/interfaces` file and add configurations for all the interfaces you intend to use. For example, here `fm1-mac3` is configured to use `dhcp`:

```
root@mpx1s10xx:~# cat /etc/network/interfaces
# /etc/network/interfaces -- configuration file for ifup(8), if-
down(8)

# The loopback interface
auto lo
iface lo inet loopback

# The fm1-mac3 interface
auto fm1-mac3
iface fm1-mac3 inet dhcp
```

Once you can ping the SBC from your host, you can transfer a file to the SBC, for example a benchmark program. If your host machine is running Windows, we recommend using WinSCP to transfer files between host and target.

#### 4.2.2 Ethernet Performance

The NXP Layerscape processors contain an Ethernet controller known as DPAA (Datapath Acceleration Architecture). The LS1043A and LS1046A contain a DPAA and the LS1088A and LX2160A contain the second generation DPAA2. Further documentation on the DPAA and DPAA2 can be found in NXP's Reference Manuals for the corresponding processor and the separate DPAA Reference Manual.

One of the hardware blocks within the DPAA is the Frame Manager (FMan) – a functional unit that combines the Ethernet network interfaces with packet distribution logic to provide intelligent distribution and queuing decisions for incoming traffic at line rate.

The Frame Manager Configuration Tool (FMC) is a command line tool used to configure the FMan to perform the desired parse-classify-distribute function for a given application. The FMC needs to be invoked to improve receive performance on the Ethernet interfaces.

```
root@mpx1s10xx:~# cd /etc/fmc/config/private/mpx1s1046
root@mpx1s10xx:~# fmc -c mpx1s1046_config.xml -p policy_ipv4.xml -a
```

#### 4.2.3 Compiling Programs On The Target

If you booted from the SD card, then the default root filesystem already contains a gcc toolchain (GCC 11.3.0) allowing you to compile natively on the target.

```
root@mpx1s10xx:~# cc helloWorld.c -o hello
```

This creates an executable with the name `hello`. To run it:

```
root@mpx1s10xx:~# ./hello
```

#### 4.2.4 Cross-compilation On The Linux Host

To cross-compile for an ARMv8 target you first need to build the cross-toolchain on your Linux host. Please refer to section **Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden..**

After you have sourced the environment file you can verify the setup and build your application

```
$ echo $CC
```

```
aarch64-fsl-linux-gcc --sysroot=/home/user/yocto-
sdk/build_mpx1s1046/tmp/work/aarch64-fsl-linux/meta-ide-sup-
port/1.0-r3/recipe-sysroot
```

```
$ $CC helloWorld.c -o hello
```

Now you can transfer the executable file `hello` over to your target and run it there.









# 5 Restoring The Default Images

## 5.1 Boot Media

### 5.1.1.1.1 CRX05

Per default the board will boot into Linux from the SD card (assuming you have inserted it correctly). The alternative boot media are provided so that you can experiment. In addition, they serve as a means of recovery should you accidentally corrupt or delete any of the boot images. The following table shows how to select between the three boot media. Note that booting from NAND Flash is only supported on the MPX-LS1043A.

| Setting   | SW 1-1 | SW 1-2 | Boot device | Features | Boot location |
|---|--------|--------|-------------|----------|---------------|
|    | OFF    | OFF    | QSPI Flash  |          | module        |
|   | OFF    | ON     | NAND Flash  |          | module        |
|  | ON     | OFF    | SD/MMC      |          | carrier board |
|  | ON     | ON     | SD/MMC      |          | carrier board |

The accompanying SD card contains a complete U-Boot, Linux kernel and root filesystem whereas only U-Boot is programmed in the SPI Flash (and also in NAND on the MPX-LS1043A).

The default images for each boot media are provided on the USB stick delivered with the Evaluation Kit. The following sections describe how to deploy these images to the respective boot media.

Copy the build images to your nfsserver directory on a Linux host. If you are running on a Windows host, then use the directory shared between Windows and your Linux VM (VirtualBox or VMware). Also for Windows hosts you will need to have a TFTP server running.

### 5.1.2 CRX08

Per default the board will boot into Linux from the SD card (assuming you have inserted it correctly). The alternative boot media are provided so that you can experiment. In addition, they serve as a means of recovery should you accidentally corrupt or delete any of the boot images. The following table shows how to select between the boot media.

|                          | SEL3 | SEL2 | SEL1 | SEL0 | Boot Source           | Description   |
|--------------------------|------|------|------|------|-----------------------|---|
| 0xF                      | 1    | 1    | 1    | 1    | Flex-SPI Serial-NOR A | default   |
| 0xD<br>0x9<br>0x5<br>0x1 | X    | X    | 0    | 1    | SD Card               |   |
| 0x7                      | 0    | 1    | 1    | 1    | Flex-SPI Serial-NOR B | Second NOR Flash<br>(Available only when the PLL is configured accordingly) |

## 5.2 Memory Map

This version of the MicroSys Yocto SDK contains major changes to the boot flow compared to the previous release for the 5.10.35 kernel. This version uses TF-A instead of PPA as used in the previous release.

For a detailed explanation of the changes, it is recommended to read NXP's LSDK 21.08 documentation:

[https://www.nxp.com/docs/en/user-guide/LSDKUG\\_Rev21.08.pdf](https://www.nxp.com/docs/en/user-guide/LSDKUG_Rev21.08.pdf)

The various hardware accelerator blocks in the QorIQ processors, for example DPAA in the LS1043A and LS1046A or DPAA2 in the LS1088A and LX2160A, require microcode to be loaded. The memory map is uniform across all the modules supported by this SDK, but not all the firmware needs to be loaded for a given module.

| Definition        | Max Size | QSPI/NAND Flash Offset | SD Card Start Block (hex) | SD Card Start Block (dec) |
|-------------------|----------|------------------------|---------------------------|---------------------------|
| bl2.pbl           | 1MB      | 0x0000.0000            | 0x00008                   | 8                         |
| fip_uboot.bin     | 2MB      | 0x0010.0000            | 0x00800                   | 2048                      |
| DPAA FMan ucode   | 256KB    | 0x0001.0000            | 0x04800                   | 18432                     |
| QE Firmware       | 256KB    | 0x0094.0000            | 0x04A00                   | 18944                     |
| DPAA2 MC Firmware | 3MB      | 0x00A0.0000            | 0x05000                   | 20480                     |
| DPAA2 DPL         | 1MB      | 0x00D0.0000            | 0x06800                   | 26624                     |
| DPAA2 DPC         | 1MB      | 0x00E0.0000            | 0x07000                   | 28672                     |

Table 5-2 Memory Map for Flash and SD Card

## 5.3 SD Card

It is advisable to deploy the default images to a second, new microSD card so that you have a back-up. MicroSys recommends using a microSD card with a capacity of at least 4GB. The SBC will accept SDHC cards up to 32GB and an SDXC card of 64GB has also been successfully tested.

The first step involves partitioning your virgin SD card. The second step involves copying the root filesystem and Image Tree Binary over and the third step is to copy U-Boot and the various firmware to the SD card.

Step 1) Create a new partition on the SD card.

Insert an SD card in your Linux host and use the `dmesg` command to determine the name it has been assigned.

```
$ dmesg | tail
[118013.491177] sd 4:0:0:2: [sdd] 3921920 512-byte logical blocks:
(2.00 GB/1.87 GiB)
[118013.495020] sd 4:0:0:2: [sdd] Write Protect is off
[118013.495023] sd 4:0:0:2: [sdd] Mode Sense: 43 00 00 08
[118013.499008] sd 4:0:0:2: [sdd] No Caching mode page found
[118013.499011] sd 4:0:0:2: [sdd] Assuming drive cache: write
through
```

From the above log, we can see that the SD card is `/dev/sdd`.

Use the `df` command to see if it has been mounted and, if yes, please unmount it using the `umount` command.

Use the `fdisk` command to create a new partition. (In most cases you can use the default value with the exception of the first sector which should be at least 131072 blocks since you need to leave space for all the firmware).

```
# fdisk /dev/sdd
Command (m for help): p

Disk /dev/sdd: 2008 MB, 2008023040 bytes, 3921920 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x00000000

   Device Boot      Start         End      Blocks   Id  System
/dev/sdd1            4096     3921919     1958912    83  Linux

Command (m for help): d
Selected partition 1
Partition 1 is deleted
```

```

Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-3921919, default 2048): 131072
Last sector, +sectors or +size{K,M,G} (131072-3921919, default
3921919):
Using default value 3921919
Partition 1 of type Linux and of size 1.9 GiB is set

```

```

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.

```

**Use the `mkfs.ext2` command to format the filesystem (this command will take 4 or 5 secs to complete; user input is not required).**

```

# mkfs.ext2 /dev/sdd1
mke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
122640 inodes, 489728 blocks
24486 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=503316480
15 block groups
32768 blocks per group, 32768 fragments per group
8176 inodes per group
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912

Allocating group tables: done
Writing inode tables: done
Writing superblocks and filesystem accounting information: done

```

**Step 2) Now mount this partition and copy the rootfs and Image Tree Binary over.**

```
# mkdir /media/SD
# mount /dev/sdd1 /media/SD
# sudo tar xf microsys-image-networking-mpx1s10xx-date.rootfs.tar.gz
-C /media/SD
# cp fitImage.itb /media/SD/boot
```

Step 3) You still need to copy U-Boot and various microcodes to the SD card. There are 2 methods to do this. The easiest is to use Linux while you still have your SD card mounted on your Linux host.

For the LS1043A and LS1046A processors, the procedure is as follows:

```
# dd if=bl2_sd.pbl of=/dev/sdd bs=512 seek=8
# dd if=fip_uboot.bin of=/dev/sdd bs=512 seek=2048
# dd if=fsl_fman_ucose_ls1043_r1.1_106_4_18.bin of=/dev/sdd bs=512
seek=18432
# dd if=iram_Type_A_LS1021a_r1.0.bin of=/dev/sdd bs=512 seek=18944
```

For the LS1088A processor, use:

```
# dd if=bl2_sd.pbl of=/dev/sdd bs=512 seek=8
# dd if=fip_uboot.bin of=/dev/sdd bs=512 seek=2048
# dd if=ddr-phy/fip_ddr_all.bin of=/dev/sdd bs=512 seek=16384
# dd if=mc_app/mc.itb of=/dev/sdd bs=512 seek=20480
# dd if=dpl-eth.19.dtb of=/dev/sdd bs=512 seek=26624
# dd if=dpc-usxgmii.crx08.dtb of=/dev/sdd bs=512 seek=28672
```

Alternatively, you can insert the SD card into the SBC-LS10xxA and having booted into U-Boot from QSPI, enter the following commands:

```
=> setenv loadaddr a0000000
=> tftp bl2.pbl
=> mmc write $loadaddr 8 $filesize
=> tftp fip_uboot.bin
=> mmc write $loadaddr 800 $filesize
=> tftp fman_ucose_ls1046_r1.0_108_4_9.bin
=> mmc write $loadaddr 4800 $filesize
```

Note that the U-Boot mmc command requires the block number as a hexadecimal (0x4800 = 18432)

## 5.4 QSPI Flash

When programming the QSPI Flash, the RCW needs to be programmed separately and, for the MPXLS1043A and MPXLS1046A, you must use the swapped version.

The RCW file is to be found in a sub-directory from where the other images are.

For example:

```
$ cd
$BLD/tmp/deploy/images/mpxls10xxcrxxx/qspi_firmware_mpxls1043.img/
```

At the U-Boot prompt, edit the serverip address to suit your network and make sure you are able to ping the server:

```
=> ping $serverip
=> setenv loadaddr a0000000 // should already be set
=> tftp qspi_firmware.img // download from server
=> sf probe
=> sf erase 0 +$filesize
=> sf write $loadaddr 0 $filesize

=> reset
```

## 5.5 NAND Flash

If NAND Flash has been completely deleted or corrupted, meaning there is no U-Boot output when you power on the board, then you will need to boot into U-Boot from one of the other boot media in order to restore the contents of NAND Flash.

For an MPX-LS1043A, at the U-Boot prompt, enter the following commands:

```
=> setenv loadaddr a0000000
=> tftp nand_firmware.img
=> nand erase 0 +$filesize
=> nand write $loadaddr 0 $filesize

=> reset
```

NAND boot has been removed from BSP for all CPU's except MPX-LS1043A.

Even on 1043 it is not recommended to use NAND as boot source due to reliability.

## 5.6 XSPI Flash

If Flex-SPI Nor Flash has been completely deleted or corrupted, meaning there is no U-Boot output when you power on the board, then you will need to boot into U-Boot from one of the other boot media in order to restore the contents of SPI Nor Flash.

For an MPX-LX2160A, at the U-Boot prompt, enter the following commands:

```
=> ping $serverip
=> setenv loadaddr a0000000 // should already be set
=> tftp xspi_firmware.img // download from server
=> sf probe
=> sf erase 0 +$filesize
=> sf write $loadaddr 0 $filesize
```

## 6 Rebuilding U-Boot and Linux

MicroSys uses a Yocto-based Software Development Kit (SDK) for the miriac Single Board Computers.

The current release of MicroSys' Linux 5.10 Yocto SDK uses "Yocto Poky 4.0.4". If you are new to Yocto, then documentation to get you started can be found at <https://docs.yoctoproject.org/4.0.4/>

The Yocto SDK is maintained by the SoC manufacturer NXP (previously Freescale). MicroSys has added patches to cater for the changes made to the MicroSys hardware. The MicroSys patches are available on the USB stick which was provided with the miriac SBC.

MicroSys's Linux 5.15.71 - 2.2.0 Yocto SDK is based on NXP's Layerscape SDK kirkstone and it is advisable to refer to some of the LSDK documentation from NXP for detailed explanations of various features.

Please go to: <https://www.nxp.com/lSDK>

You will need to download the Yocto SDK if you want to make changes to U-Boot or the Linux kernel, which will be the case if you want to modify U-Boot and Linux for your own carrier board. To be able to rebuild the Linux kernel you will need to have a Linux host machine. If your preferred host machine is running Windows, then you will need to use VirtualBox or VMware, or something similar, to run Linux. All popular Linux distributions should work (CentOS, Debian, Fedora, openSUSE, Ubuntu). A list of supported versions can be found here:

<https://docs.yoctoproject.org/4.0.4/ref-manual/system-requirements.html>

### 6.1 Using the Yocto SDK

For up-to-date prerequisites, installation steps and build instructions, please have a look at the readme provided with this release.



## 6.2 Hailo Benchmarking:

Please follow the installation procedure for installing the network data to perform benchmarking.

By default we have included yolov5m network data for benchmarking which can be run as follows:

```
# hailortcli run /home/root/yolov5m/files/yolov5m.hef
Running inference (/home/root/yolov5m/files/yolov5m.hef):
Mode: streaming
Transform data: true
Data is quantized: true
Format type: auto
Time to run: 00:00:05
Inference... 100% | 956 | FPS: 191.11 | ETA: 00:00:00
Inference result:
Duration: 00:00:05
FPS: 191.10
Send Rate: 1878.58 Mbit/s
Recv Rate: 3305.87 Mbit/s
```

For scanning the available Hailo devices please use:

```
# hailortcli scan
Hailo PCIe Devices:
[-] Device BDF: 0000:01:00.0
[-] Device BDF: 0001:01:00.0
#
```

## 7 Appendix

### 7.1 Offer to Provide Software Source Code

This product contains copyrighted software that is licensed under the General Public License (“GPL”) and under the Lesser General Public License Version (“LGPL”). The GPL and LGPL licensed code in this product is distributed without any warranty. Copies of these licenses are included in this product.

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MicroSys Electronics GmbH  
Muehlweg 1  
82054 Sauerlach  
Germany

In your request please provide the product name and version for which you wish to obtain the corresponding source code and your contact details so that we can coordinate the terms and cost of shipment with you.

The source code will be distributed WITHOUT ANY WARRANTY and licensed under the same license as the corresponding binary/object code.

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MicroSys Electronics GmbH is eager to duly provide complete source code as required under various Free Open Source Software licenses. If however you encounter any problems in obtaining the full corresponding source code we would be much obliged if you notify us using the email address [gpl@microsys.de](mailto:gpl@microsys.de), stating the product and describing the problem (please do NOT send large attachments such as source code archives to this email address)

### 7.2 Alternative Operating Systems

MicroSys Electronics GmbH offers Linux and Microware's OS-9 RTOS support for modules containing NXP's QorIQ processors.

Other Operating Systems are available on request only.

### 7.3 Further Reading

Documentation on NXP's QorIQ processors and the Layerscape SDK can be found here:

[www.nxp.com/qorIQ-arm](http://www.nxp.com/qorIQ-arm)

[www.nxp.com/lSDK](http://www.nxp.com/lSDK)

Click on the Documentation tab to download PDFs. Registration is usually required.

## 7.4 Glossary

Here are some acronyms and abbreviations which you will encounter when dealing with the SDK and NXP's Layerscape processors.

|       |   |
|-------|---|
| ATF   | Arm Trusted Firmware. Now more accurately known as TF-A (Trusted Firmware-A). See <a href="https://developer.arm.com/">https://developer.arm.com/</a>                 |
| DPAA  | Data Path Acceleration Architecture (first generation) used in LS1043A and LS1046A  |
| DPAA2 | Data Path Acceleration Architecture (second generation) used in LS1088A and LX2160A   |
| DPC   | Data Path Configuration file. Needed for DPAA2  |
| DPL   | Data Path Layout. Needed for DPAA2  |
| DTB   | Device Tree Blob. The binary representation of device trees.  |
| FMan  | Frame Manager. A DPAA hardware block.   |
| FSL   | Freescale (were acquired by NXP Semiconductors in Dec 2015)   |
| ITB   | Image Tree Binary. A file containing kernel(s) and device tree(s)   |
| MC    | Management Complex. A DPAA2 hardware block.   |
| PBL   | Pre-Boot Loader. Can be optionally loaded after RCW.  |
| PPA   | Primary Protected Application. A secure monitor running in TrustZone which provides boot and runtime software services such as PSCI and Arm's SMC calling convention. |
| PSCI  | Power State Coordination Interface. An Arm standard interface.  |
| RCW   | Reset Configuration Word. The first data the processor loads to configure various interfaces and internal frequencies.  |

## 7.5 Document History

| Date       | Version    | Change Description                                     |
|------------|------------|--|
| 2018-08-22 | <b>0.1</b> | Initial Release for 4.14 kernel                        |
| 2018-09-11 | <b>0.2</b> | Minor improvements                                     |
| 2018-12-19 | <b>0.3</b> | Added comments on FMC                                  |
| 2021-10-11 | <b>1.0</b> | Update to LSDK 20.12                                   |
| 2021-11-18 | <b>2.0</b> | Update to LSDK 21.08 and added support for SBC-LX2160A |
| 2021-12-01 | <b>2.1</b> | Added support for AIP-LX2160A                          |
| 2022-04-26 | <b>2.2</b> | Update link to curl tool                               |
| 2024-03-07 | <b>2.3</b> | Update to LSDK Kirkstone                               |

*Table 7-1 Document history*