NXP Semiconductors

Document Number:
LS1012A ASK RN ASK 1.1

Release Notes

LS1012A ASK 1.1

1. Introduction

This document provides Release Notes for the LS1012ASK Software Package.

1.1. Purpose and scope

This release allows building of the LS1012A ASK and loading of the LS1012A binaries on Freescale RDB platform.
This includes following:
Code release

- Sources downloaded from Open Source web sites
- LS1012A OpenWrt ASK source patches and Makefiles

Reference release binaries

- Linux BSP for LS1012A
- Reset Configuration Word (RCW).
- Boot loader code (uBoot)
- PPA Fit Image
- Ramfs file systems Integrated with kernel image (.itb).
- Roots fs Mounted on SD Card.
- JFFS2 file system bootable from QSPI Flash.
- UBIFS file system bootable from QSPI Flash.

Contents

Available for LS1012A RDB platfor.

1.2 Release Highlights

This is the 5th release (ASK 1.1) for ls1012a BHR & NAS ASK. The OpenWrt and Kernel versions used are as below:

- LS1012A BSP support on Kernel Version 3.19.3.
- Latest OpenWrt version used is Chaos Calmer

1.1.1. New in this release

1. Quantena PCIe based WiFi 11ac 4x4 driver support (Available under NDA).
2. WiFi Fast Path Support.

2. Release notes for boot loader

This section contains the release notes for boot loader.

2.1. U-Boot

The U-Boot code basis is v2016.01. The following LS1012A components are part of U-Boot:

- I2C
- QSPI
- SDHC-1
- SDHC-2
- PCIe
- SATA
- Ethernet Driver for PFE.
- USB 3.0
- USB 2.0
- Alternate Bank support
- Secure Boot
- Linux Boot using SD card, TFTP, Y-modem
- Linux boot from QSPI

3. Release notes for Linux BSP

The Linux code basis for this release is v3.19.3. The following LS1012A components are part of this release.

- BSP for Linux, with following support
  - PLL/Clock and board specific initializations.
  - Interrupt controller.
  - DUART Driver.
  - Ethernet Driver for PFE.
  - CMM, FCI, and PFE control driver support.
  - DSPI Driver.
  - SATA Driver.
  - USB 3.0 Host Driver
  - USB 3.0 Gadget Driver.
  - USB 2.0 Host Driver
  - PCIe Host Driver.
  - QSPI Driver
  - eSDHC-1, eSDHC-2 memory device support

- SDIO WiFi Driver support for Murata/Broadcom module for RDB (Rev-D)
- PCIe WiFi driver support (ath9k) for QCA Mini PCIe Module for RDB.
- PCIe WiFi driver support Quantena Mini PCIe Module for RDB.
- NFC Support.
- eDMA Support.
- I/O Expander (PCA9555) Driver.
- SPI-DUART Bridge(SC16IS752) Driver.
- Flextimer.
- Power Management Support with System Suspend & Resume.
- Jffs2 file system support.
- UBIFS file system support.
- Samba support with NAS Single Disk with performance optimizations.

4. Release notes for fast path

The following components are part of this release:

- CMM application for fast path control
- Fast path support for IPv4, IPv6, IPv4/NAT
- PPPoE
- PPPoE relay
- VLAN
- Multicast
- QoS for egress, ingress (ICC) and exception path
- PFE exception path rate limiter
- L2 Bridging (Automatic Mode)
- WiFi Fast Path

5. Release notes for OpenWrt ASK

The ASK is based on OpenWrt Chaos Calmer 15.05 branch, and is prepared with the following toolchain, library, and binutils:

- GCC 4.8-linaro arm
- Glibc 2.19
- Binutils 2.24.3

The following packages are part of the ASK:

- Busybox 1.23.2
- Cmm 2.01
- Dnsmasq 2.73 (DHCP and DNS server)
- Dropbear 2015.67
- e2fsprogs_1.42.12
- Ethtool 3.7
- Fci _2.00
- fdisk_2.25.2-4
- Fstools_2015-05-24
- haserl_0.9.32
- hostapd_2015-03-25-1
- i2c-tools 3.1.2
- ip 4.0

- Iptables 1.4.21
- Ip6tables 1.4.21
- jshn 2015-06-14
- jsonfilter 2014-06-19
- libcli 1.9.4
- libgcc_4.8-linaro
- libgdbm_1.10
- libip4tc_1.4.21
- libip6tc_1.4.21
- libjson-c_0.12
- libjson-script_2015-06-14
- libmnl_1.0.3-2
- libnetfilter-conntrack_1.0.4
- libnl-tiny_0.1
- libpcap_1.5.3
- libpthread_2.19
- librt_2.19
- libstdcpp_4.8-linaro
- libubox_2015-06-14
- libubus_2015-05-25
- libuci_2015-04-09
- libxml2_2.9.2
- libxtables_1.4.21
- mmiotool_1.00
- mtd-utils_1.5.0
- mount-utils
- net-tools-mii-tool_1.60
- Netifd 2015-06-08
- odhcp6c_2015-07-13
- odhcpd_2015-05-21
- perf_3.19.3
- pfe_0.0
- ppp_2.4.7
- procd_2015-08-16
- samba4-server
- sysstat_10.1.2
- strace_4.8-1
- tcpdump_4.5.1-4
- trace-cmd_v2.4.2-1
- uci_2015-04-09
- ubox_2015-07-14
- ubus_2015-05-25
- uhttpd_2015-08-17
- ubi-utils_1.5.1-2
- vsftpd_3.0.2
- web
- zlib_1.2.8

6. Building LS1012A OpenWrt ASK

6.1. LS1012A-RDB

To build the image using source released and the dl tar balls provided in the CR release directory, follow the below steps:

1. Checkout the release src and dl tar balls from CR folder in the release directory
2. Un-tar the src-openwrt-ls1012a_1.1.rc0.tar.bz2

```
tar -jxvf src-openwrt-ls1012a_1.1.rc0.tar.bz2
```

3. Un-tar the dl-openwrt-ls1012a_1.1.rc0.tar.bz2

```
tar -jxvf dl-openwrt-ls1012a_1.1.rc0.tar.bz2
```

4. Access the src directory src-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
5. If SDIO WiFi has to be used instead of default PCIe (QCA) WiFi, then follow these steps:
   - Copy "openwrt-ls1012a_ask_1.0_bcmdhd_sdio_wifi_enable_rdb_nas.patch" from "CR" dir to "src-openwrt-ls1012a_1.1.rc0-ls1012a-rdb" dir.
   - Apply Patch:

     ```
     patch -p1 < openwrt-ls1012a_ask_1.0_bcmdhd_sdio_wifi_enable_rdb_nas.patch
     ```

6. Create the soft link to the dl directory

   ```
   ln -s ../dl dl
   ```

7. Copy the RDB build config file `config-ls1012a-rdb` from config directory

   ```
   cp config/config-ls1012a-rdb .config
   ```

8. Execute the `make` command to compile the build to generate the image

   `make V=99` (to see the full compilation logs) or `make` (without compilation logs)

After successful compilation, you can find the following useful images

1. **openwrt-ls1012a-hgw-lsrdb.itb** is the ITB image for Linux in bin/ls1012a-glibc directory
2. **u-boot-qspi_swap.bin** is the u-boot image generated in bin/ls1012a-glibc/Uboot-layerscape-ls1012ardb
3. **rcw_800_default_swap.bin** is the rcw image generated in bin/ls1012a-glibc/rcw/ls1012ardb/R_SPNH_3508
4. **ppa_swap.itb** is the ppa image generated in bin/ls:1012a-glibc/ppa/ directory
5. **openwrt-ls1012a-root.ubi_qspi-nor** is the ubifs root filesystem image in bin/ls1012a-glibc directory
6. **openwrt-ls1012a-root.jffs2-256k** is the jffs2 root filesystem image in bin/ls1012a-glibc directory
7. **openwrt-ls1012a-hgw-lsrdb-uImage** is the Linux Kernel Image generated in bin/ls1012a-glibc directory
8. **openwrt-ls1012a-hgw-lsrdb.dtb** is the dtb image generated in bin/ls1012a-glibc directory

6.2. LS1012A-RDB-NAS

To build the image using src released and the dl tar balls provided in the CR release directory, follow the below steps:

1. Checkout the release src and dl tar balls from CR folder in the release directory
2. Un-tar the src-openwrt-ls1012a_nas_1.1.rc0.tar.bz2

```
tar -jxvf src-openwrt-ls1012a_nas_1.1.rc0.tar.bz2
```

3. Un-tar the `dl-openwrt-ls1012a_nas_1.1.rc0.tar.bz2`

   ```
   tar -jxvf dl-openwrt-ls1012a_nas_1.1.rc0.tar.bz2
   ```

4. Access the src directory src-openwrt-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas
5. If SDIO WiFi has to be used instead of default PCIe (QCA) WiFi, then follow these steps:
   - Copy “openwrt-ls1012a_ask_1.0_bcmdhd_sdio_wifi_enable_rdb_nas.patch” from “CR” dir to “src-openwrt-ls1012a_1.1.rc0-ls1012a-rdb” dir.
   - Apply Patch:

     `patch –p1 <` openwrt-ls1012a_ask_1.0_bcmdhd_sdio_wifi_enable_rdb_nas.patch
6. Create the soft link to the dl directory

   ```
   ln -s ../dl dl
   ```

7. Copy the RDB build config file `config-ls1012a-rdb-nas` from config directory

   ```
   cp config/config-ls1012a-rdb-nas .config
   ```

8. Execute the `make` command to compile the build to generate the image

   `make V=99` (to see the full compilation logs) or `make` (without compilation logs)

After successful compilation, you can find the following useful images

1. **openwrt-ls1012a-nas-lsrdb.itb** is the ITB image for Linux in bin/ls1012a-glibc directory
2. **u-boot-qspi_swap.bin** is the u-boot image generated in bin/ls1012a-glibc/Uboot-layerscape-ls1012ardb
3. **rcw_800_default_swap .bin** is the rcw image generated in bin/ls1012a-glibc/rcw/ls1012ardb/R_SPNH_3508
4. **ppa_swap.itb** is the ppa image generated in bin/ls1012a-glibc/ppa/ directory
5. **openwrt-ls1012a-root.ubi_qspi-nor** is the ubifs root filesystem image in bin/ls1012a-glibc directory
6. **openwrt-ls1012a-root.jffs2-256k** is the jffs2 root filesystem image in bin/ls1012a-glibc directory
7. **openwrt-ls1012a-nas-lsrdb-uImage** is the Linux Kernel Image generated in bin/ls1012a-glibc directory
8. **openwrt-ls1012a-nas-lsrdb.dtb** is the dtb image generated in bin/ls1012a-glibc directory

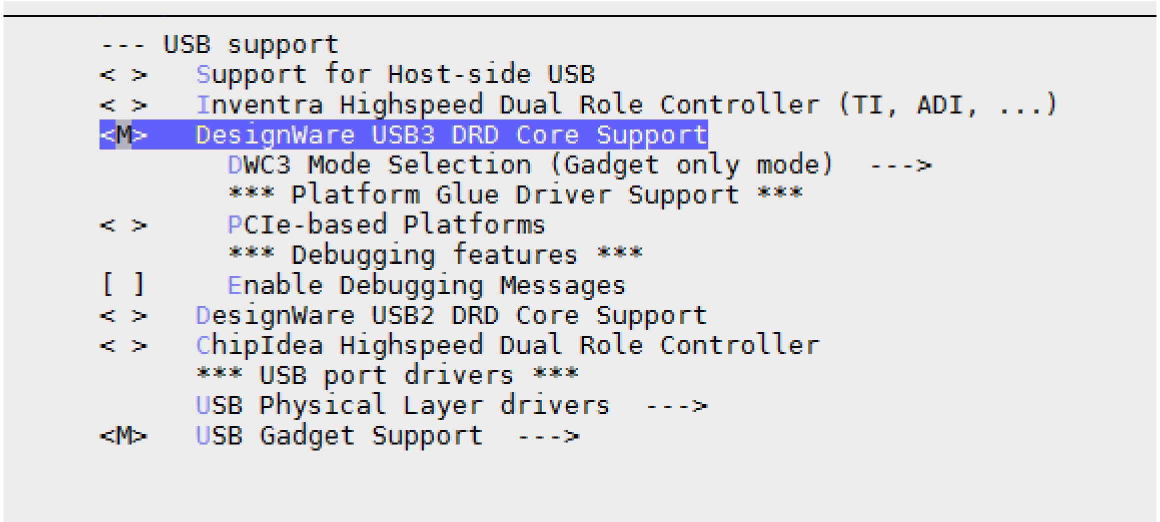
6.3. Build for USB gadget support

1. Refer sections 6.1 or 6.3 to build for RDB platform.

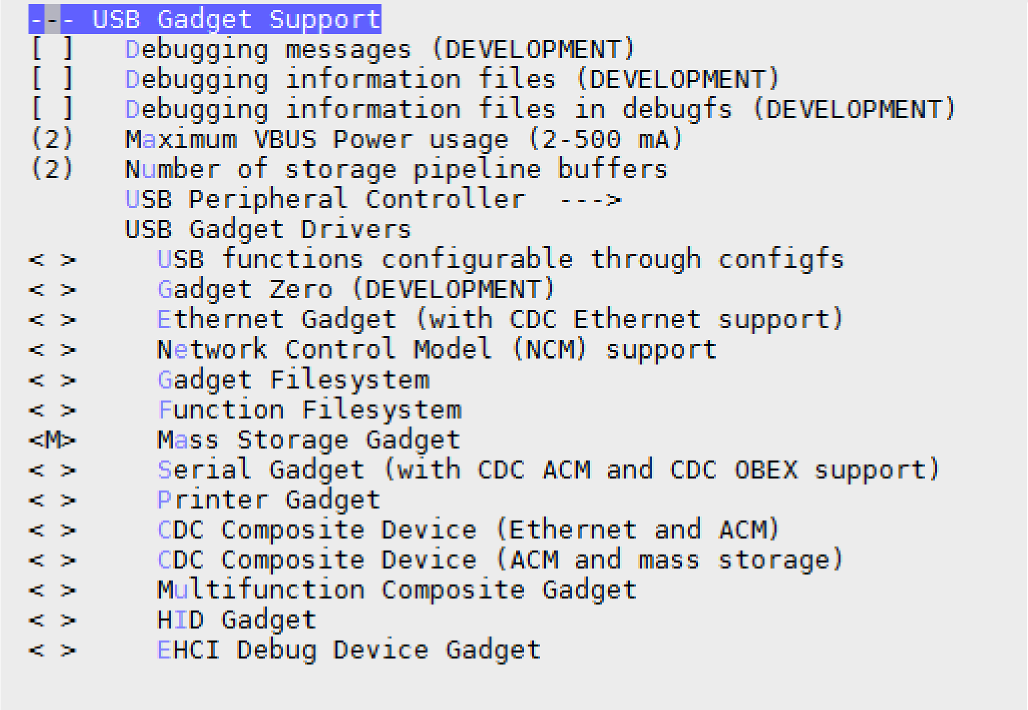
2. After compilation, open “kernel menuconfig” for platform

```
make CONFIG_TARGET=platform kernel_menuconfig
```

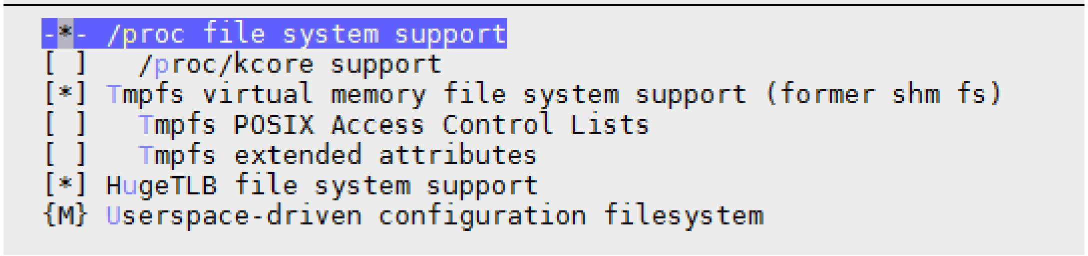
3. Enable the gadget support in Linux by enabling the following configurations.



```
--- USB support
< >   Support for Host-side USB
< >   Inventra Highspeed Dual Role Controller (TI, ADI, ...)
<M>   DesignWare USB3 DRD Core Support
        DWC3 Mode Selection (Gadget only mode)  --->
        *** Platform Glue Driver Support ***
< >     PCIe-based Platforms
        *** Debugging features ***
[ ]     Enable Debugging Messages
< >   DesignWare USB2 DRD Core Support
< >   ChipIdea Highspeed Dual Role Controller
      *** USB port drivers ***
      USB Physical Layer drivers  --->
<M>   USB Gadget Support  --->
```



```
--- USB Gadget Support
[ ]   Debugging messages (DEVELOPMENT)
[ ]   Debugging information files (DEVELOPMENT)
[ ]   Debugging information files in debugfs (DEVELOPMENT)
(2)   Maximum VBUS Power usage (2-500 mA)
(2)   Number of storage pipeline buffers
      USB Peripheral Controller  --->
      USB Gadget Drivers
< >     USB functions configurable through configfs
< >     Gadget Zero (DEVELOPMENT)
< >     Ethernet Gadget (with CDC Ethernet support)
< >     Network Control Model (NCM) support
< >     Gadget Filesystem
< >     Function Filesystem
<M>     Mass Storage Gadget
< >     Serial Gadget (with CDC ACM and CDC OBEX support)
< >     Printer Gadget
< >     CDC Composite Device (Ethernet and ACM)
< >     CDC Composite Device (ACM and mass storage)
< >     Multifunction Composite Gadget
< >     HID Gadget
< >     EHCI Debug Device Gadget
```



```
-*- /proc file system support
[ ]   /proc/kcore support
[*] Tmpfs virtual memory file system support (former shm fs)
[ ]   Tmpfs POSIX Access Control Lists
[ ]   Tmpfs extended attributes
[*] HugeTLB file system support
{M} Userspace-driven configuration filesystem
```

4. Execute the `make` command to compile the build to generate the image
   `make V=99` (to see the full compilation logs) or `make` (without compilation logs)

5. Use the generated ITB to boot kernel.

6. Copy the following files from the linux source directory to SD card.

```
fs/configfs/configfs.ko
drivers/usb/./common/usb-common.ko
drivers/usb/gadget/udc/udc-core.ko
drivers/usb/dwc3/dwc3.ko
drivers/usb/gadget/libcomposite.ko
drivers/usb/gadget/function/usb_f_mass_storage.ko
drivers/usb/gadget/legacy/g_mass_storage.ko
```

NOTE: *To test USB gadget mode follow the instructions in section 14.*

7. Release images

The release contains the following images.

7.1. LS1012ARDB

- CR contains the src and dl tar balls.
  - src-openwrt-ls1012a_1.1.rc0.tar.bz2
  - dl-openwrt-ls1012a_1.1.rc0.tar.bz2
- RSR contains the following release images:
  1. itb-openwrt-ls1012a_1.1.rc0-ls1012a-lsrdb
  2. openwrt-rootfs-ls1012a_1.1.rc0-ls1012a-rdb.cpio.gz
  3. openwrt-rootfs-ls1012a_1.1.rc0-ls1012a-rdb.tar.gz
  4. u-boot-2016.01-v201601.00.6-ls1012a-rdb-qspi_swap.bin
  5. uImage-openwrt-ls1012a_1.1-rc0-ls1012a-rdb
  6. dtb-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
  7. ubi-nor-openwrt-ls1012a_1.1-rc0-ls1012a-rdb
  8. jffs2-256k-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
  9. ppa_swap-ls1012a_1.1-rc0-ls1012a-rdb.itb
  10. In rcw directory inside ls1012ardb,inside R_SPNH_3508 directory rcw_800_default_swap.bin
  11. In rcw directory inside ls1012ardb,inside R_SPNH_3508 directory rcw_800_sdhc2_swap.bin(It is used only when Internal sdio wifi card is connected to SDHC2)
  12. In rcw directory inside ls1012ardb,inside R_SPNH_3508 directory rcw_800_nfc_swap.bin(It is used only when NFC PN7150S board is connected)

7.2. LS1012ARDB-NAS

- CR contains the src and dl tar balls.
  - src-openwrt-ls1012a_nas_1.1.rc0.tar.bz2
  - dl-openwrt-ls1012a_nas_1.1.rc0.tar.bz2
- RSR contains the following release images:
  1. itb-openwrt-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas
  2. openwrt-rootfs-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas.cpio.gz
  3. openwrt-rootfs-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas.tar.gz
  4. u-boot-2016.01-v201601.00.6-ls1012a-rdb-nas-qspi_swap.bin
  5. uImage-openwrt-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas
  6. dtb-openwrt-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas
  7. jffs2-256k-openwrt-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas
  8. ppa_swap-ls1012a_nas_1.1.rc0-ls1012a-rdb-nas.itb
  9. In rcw directory inside ls1012ardb,inside R_SPNH_3508 directory rcw_800_default_swap.bin
  10. In rcw directory inside ls1012ardb,inside R_SPNH_3508 directory rcw_800_sdhc2_swap.bin(It is used only when Internal sdio wifi card is connected to SDHC2)

11. In rcw directory inside ls1012ardb,inside R_SPNH_3508 directory rcw_800_nfc_swap.bin(It is used only when NFC PN7150S board is connected)

8. Guidelines for flashing or updating flash partitions

8.1. QSPI Flash Layout

Image	Size	Start Address
RCW+PBI	1 MB	0x4000_0000
U-boot boot loader + PPFE binary	1 MB	0x4010_0000
U-boot Env	1MB	0x4020_0000
PPA FIT Image	2 MB	0x4050_0000
Kernel ITB	59MB	0x40A0_0000

8.2. DDR memory reserved range

Following DDR address range is used by PFE, should not be used for other usage like tftp download etc.
PFE DDR memory range: **0x83800000 – 0x84400000**

8.3. Switch Settings

S.No.	Platform	Board Version	Switch Settings
1.	RDB	RevB	SW1: 1010_0110 SW2: 0000_0000

8.4. U-boot Environment Variables

The following is the **default u-boot** environment configuration

```
baudrate=115200
bootargs=console=ttyS0,115200 root=/dev/ram0 earlycon=uart8250,mmio,0x21c0500
bootcmd=pfe stop;sf probe 0:0; sf read $kernel_load $kernel_start $kernel_size && bootm $kernel_load
bootdelay=10
console=ttyAMA0,38400n8
eth1addr=00:11:22:33:44:55
eth2addr=00:15:2a:6e:3e:78
eth3addr=00:15:2a:6e:3e:79
ethact=pfe_eth0
ethaddr=00:11:22:33:44:55
fdt_high=0xffffffffffffffff
fdtcontroladdr=bfc78348
hwconfig=fsl_ddr:bank_intlv=auto
initrd_high=0xffffffffffffffff
ipaddr=192.168.1.2
kernel_addr=0x100000
```

```
kernel_load=0xa0000000
kernel_size=0x2800000
kernel_start=0xa00000
loadaddr=0x80100000
ramdisk_addr=0x800000
ramdisk_size=0x2000000
scsidevs=0
serverip=192.168.1.1
stderr=serial
stdin=serial
stdout=serial
verify=no
```

NOTE: *Default env setting sets bootargs for RAM based file system.*

8.4.1. Changing the Env Variable

Any env variable can be changed using following command:

```
setenv  <Variable Name>  <Variable Value>
```

Ex:

```
setenv bootargs ttyS0,115200 root=/dev/ram0 earlycon=uart8250,0x21c0500,115200
```

8.5. Set the IP address

Change the IP address (in environment variable) using following command:

```
=>setenv serverip 192.168.5.124; setenv ipaddr 192.168.5.136.setenv ethact  pfe_eth0
```

Connect the ethernet cable to eth1 port of LS1012A to your Local PC

8.6. Flashing & Booting pre-built RamDisk ASK Images using TFTP

NOTE-1: *This section only explains the example of flashing RAM based filesystem. For Flash Based file system, please refer section "8.8. JFFS2 Read-Write File System" & "8.9. Flashing & Booting pre-built JFFS2 ASK Images using TFTP or SD Card" & "8.10. UBIFS Read-Write File System" & "8.11. Flashing & Booting pre-built UBIFS ASK Images using TFTP or SD Card"*

NOTE-2: *For Image names in the below sections please refer "Section 7.1" for LS1012A-RDB, "Section 7.2" for LS1012ARDB-NAS.*

NOTE-3: -- *The steps in the sections 8.6.4 are to be followed only for LS1012A-RDB and LS1012ARDB-NAS.*

8.6.1. RCW Flashing

```
=> tftp 0xa0000000 rcw_800_default_swap.bin
```

```
            Speed detected 3e8
            Using pfe_eth0 device
            TFTP from server 192.168.1.1; our IP address is 192.168.1.2
            Filename 'rcw_800_default_swap.bin'.
            Load address: 0xa0000000
            Loading: #
                    1000 Bytes/s
            done
            Bytes transferred = 128 (80 hex)
=>sf probe 0:0
            SF: Detected S25FS512S_256K with page size 512 Bytes, erase size 128 KiB, total 64 MiB
=> sf erase 0x0 +$filesize
            SF: 1048576 bytes @ 0x0 Erased: OK
=> sf write 0xa0000000 0x0 $filesize
            device 0 offset 0x0, size 0x1000
            SF: 4096 bytes @ 0x0 Written: OK
```

Note:

- **rcw_800_sdhc2_swap.bin should be flashed only when internal sdio wifi card connected to SDHC2 is being used. (This is not applicable for RDB Rev-B & Rev-C boards).**
- **rcw_800_nfc_swap.bin should be flashed only when NFC PN7150S board is connected**

8.6.2. U-boot Flashing

```
=> tftp 0xa0000000 u-boot-2016.01-v201601.00.6-ls1012a-rdb-qspi_swap.bin
            Speed detected 3e8
            Using pfe_eth0 device
            TFTP from server 192.168.1.1; our IP address is 192.168.1.2
            Filename ‘u-boot-2016.01-v201601.00.5-ls1012a-rdb-qspi_swap.bin ‘.
            Load address: 0xa0000000
            Loading: #####################################
                    4.9 MiB/s
            Done
=> sf erase 0x100000 +$filesize
            SF: 1048576 bytes @ 0x100000 Erased: OK
=> sf write 0xa0000000 0x100000 $filesize
            device 0 offset 0x100000, size 0x7c450
            SF: 509008 bytes @ 0x100000 Written: OK
```

8.6.3. PPA FIT Image Flashing

```
=> tftp 0xa0000000 ppa_swap-ls1012a_1.1.rc0-ls1012a-rdb.itb
            Using pfe_eth0 device
            TFTP from server 192.168.1.1; our IP address is 192.168.1.2
            Filename ‘ppa_swap-ls1012a_1.0.rc0-ls1012a-rdb.itb '.
            Load address: 0xa0000000
            Loading: #####################################
                    4.9 MiB/s
            Done
=> sf erase 0x500000 +$filesize
            SF: 2097152 bytes @ 0x500000 Erased: OK
=> sf write 0xa0000000 0x500000 $filesize
            device 0 offset 0x500000, size 0x14bc8
```

```
        SF: 84936 bytes @ 0x500000 Written: OK
```

8.6.4. Linux Flashing

```
=> tftp 0xa0000000 itb-openwrt-ls1012a_1.1.rc0-ls1012a-lsrdb
        Speed detected 3e8
        Using pfe_eth0 device
        TFTP from server 192.168.1.1; our IP address is 192.168.1.2
        Filename ‘itb-openwrt-ls1012a_1.0.rc0-ls1012a-lsrdb.
        Load address: 0xa0000000
        Loading: #################################################################
                 #################################################################
                 #################################################################
                 #################################################################
                 #################################################################
                 #################################################################
                 #################################################################
                 #################################################################
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                 ###################################
                 6.2 MiB/s
        done
        Bytes transferred = 26269411 (190d6e3 hex)

=> sf erase 0xa00000 +$filesize
        SF: 22733663 bytes @ 0xa00000 Erased: OK
=> sf write 0xa0000000 0xa00000 $filesize
        device 0 offset 0xa00000, size 0x22733663
        SF: 22733663 bytes @ 0xa00000 Written: OK
```

8.6.5. Booting Linux with auto-boot

Follow following steps to boot using auto boot:

1. Make sure all required image are flashed on the board-using step 8.6.1 to 8.6.4.
2. Make sure following env setting is saved:
   bootargs=console=ttyS0,115200 root=/dev/ram0 earlycon=uart8250,mmio,0x21c0500
   bootcmd=pfe stop;sf probe 0:0; sf read $kernel_load $kernel_start $kernel_size && bootm $kernel_load
3. Power cycle the board to boot it until the boot prompt.

8.6.6. Booting Linux without auto-boot

Follow following steps to boot Linux manually (this will be required if user wants to change the itb image and boot):

1. Press enter at u-boot prompt to stop autoboot.
2. Make sure following env setting is saved:
   bootargs=console=ttyS0,115200 root=/dev/ram0 earlycon=uart8250,mmio,0x21c0500
   bootcmd=pfe stop;sf probe 0:0; sf read $kernel_load $kernel_start $kernel_size && bootm $kernel_load
3. Load new itb image to DDR using TFTP
   => tftp 0xa0000000 itb-openwrt-ls1012a_1.0.rc.0-ls1012a-rdb
4. or load the itb image to DDR from QSPI flash.
   => sf probe 0:0; sf read $kernel_load $kernel_start $kernel_size
5. Issue following command before booting Linux to get network support in Linux.
   =>pfe stop
6. Boot Linux
   =>bootm $kernel_load

8.7. Flashing & Booting pre-built Ramdisk ASK Images from SD Card

In this method, Instead of TFTP, loading of files can be performed using SD card.

NOTE-1: *This section only explains the example of flashing RAM based filesystem. For Flash Based file system, please refer section "8.8. JFFS2 Read-Write File System" & "8.9. Flashing & Booting pre-built JFFS2 ASK Images using TFTP or SD Card" & "8.10. UBIFS Read-Write File System" & "8.11. Flashing & Booting pre-built UBIFS ASK Images using TFTP or SD Card"*

NOTE-2: *For Image names in the below sections please refer "Section 7.1" for LS1012A-RDB, "Section 7.2" for LS1012ARDB-NAS.*

NOTE-3: -- *The steps in the sections 8.7.4 are to be followed only for LS1012A-RDB and LS1012ARDB-NAS.*

8.7.1. Loading Images on SD Card

Load all the images required for flashing on to SD card from Local PC using following procedure:

1. Put the SD card in SD card slot of LS1012

```
=> fatls mmc 0
            22733663   itb-openwrt-ls1012a_1.1.rc0-ls1012a-lsrdb
             560200   u-boot-2016.01-v201601.00.2-ls1012a-rdb.bin
                128   rcw_800_default_swap.bin
          3file(s), 0 dir(s)
```

2. Load to the DDR address the required image and from there same above steps can be followed to flash them on the QSPI flash

8.7.2. RCW Flashing

```
=> fatload mmc 0 0xa0000000 rcw_800_default_swap.bin
          reading rcw_800_swap.bin
          128 bytes read in 13 ms (8.8 KiB/s)
=>sf probe 0:0
          SF: Detected S25FS512S_256K with page size 512 Bytes, erase size 128 KiB, total 64 MiB
=> sf erase 0x0 +$filesize
```

```
        SF: 4096 bytes @ 0x0 Erased: OK
=> sf write 0xa0000000 0x0 $filesize
        device 0 offset 0x0, size 0x1000
        SF: 4096 bytes @ 0x0 Written: OK
```

rcw_800_sdhc2_swap.bin should be flashed only when Internal sdio wifi card connected to SDHC2 is being used)

8.7.3. U-boot Flashing

```
=> fatload mmc 0 0xa0000000 u-boot-2016.01-v201601.00.6-ls1012a-rdb-qspi_swap.bin
        reading u-boot-2016.01-v201601.00.5-ls1012a-rdb-qspi_swap.bin
        560200 bytes read in 44 ms (11 MiB/s)
=> sf erase 0x100000 +$filesize
        SF: 1048576 bytes @ 0x100000 Erased: OK
=> sf write 0xa0000000 0x100000 $filesize
        device 0 offset 0x100000, size 0x7c450
        SF: 560200 bytes @ 0x100000 Written: OK
```

8.7.4. PPA FIT Image Flashing

```
=> fatload mmc 0 0xa0000000 ppa_swap-ls1012a_1.1.rc0-ls1012a-rdb.itb
        reading ppa_swap.itb
        84936 bytes read in 25 ms (3.2 MiB/s)
=> sf erase 0x500000 +$filesize
        SF: 84936 bytes @ 0x500000 Erased: OK
=> sf write 0xa0000000 0x500000 $filesize
        device 0 offset 0x500000, size 0x14bc8
        SF: 84936 bytes @ 0x500000 Written: OK
```

8.7.5. LINUX

```
=> fatload mmc 0 0xa0000000 itb-openwrt-ls1012a_1.1.rc0-ls1012a-lsrdb
        reading itb-openwrt-ls1012a_1.0.rc0-ls1012a-lsrdb
        26269411 bytes read in 1349 ms (18.6 MiB/s)
=> sf erase 0xa00000 +$filesize
        SF: 22733663 bytes @ 0xa00000 Erased: OK
=> sf write 0xa0000000 0xa00000 $filesize
        device 0 offset 0xa00000, size 0x15AE35F
        SF: 22733663 bytes @ 0xa00000 Written: OK
```

8.7.6. Booting Linux with auto-boot

Follow following steps to boot using auto boot:

1. Make sure all required image are flashed on the board using step 8.6.1 to 8.6.4.
2. Make sure following env setting is saved:
   bootargs=console=ttyS0,115200 root=/dev/ram0 earlycon=uart8250,mmio,0x21c0500
   bootcmd=pfe stop;sf probe 0:0; sf read $kernel_load $kernel_start $kernel_size && bootm $kernel_load
3. Power cycle the board to boot it until the boot prompt.

8.7.7. Booting Linux without auto-boot

Follow following steps to boot Linux manually (this will be required if user wants to change the itb image and boot):

1. Press enter at u-boot prompt to stop autoboot.

2. Make sure following env setting is saved:
   ```
   bootargs=console=ttyS0,115200 root=/dev/ram0 earlycon=uart8250,mmio,0x21c0500
   bootcmd=pfe stop;sf probe 0:0; sf read $kernel_load $kernel_start $kernel_size && bootm $kernel_load
   ```
3. Load new itb image to DDR from SD Card
   ```
   => fatload mmc 0 0xa0000000 itb-openwrt-ls1012a_1.0.rc.0-ls1012a-rdb
   ```
4. or load the itb image to DDR from QSPI flash.
   ```
   => sf probe 0:0; sf read $kernel_load $kernel_start $kernel_size
   ```
5. Issue following command before booting Linux to get network support in Linux.
   ```
   =>pfe stop
   ```
6. Boot Linux
   ```
   =>bootm $kernel_load
   ```

8.8. JFFS2 Read-Write File System

8.8.1. QSPI Flash Layout for JFFS2 File System

For the Usage of JFFS2 Filesystem,the following is the QSPI Flash Layout:

Image	Size	Start Address
RCW+PBI	1 MB	0x4000_0000
U-boot boot loader + PPFE binary	1 MB	0x4010_0000
U-boot Env	3MB	0x4020_0000
PPA FIT Image	2 MB	0x4050_0000
ROOT_FS	32MB	0x4070_0000
DTB	1MB	0x4270_0000
uImage	14MB	0x4280_0000

8.9. Flashing & Booting pre-built JFFS2 ASK Images using TFTP or SD Card

JFFS2 is the read/write file system that can used on QSPI Flash.

NOTE-1: *This section only explains the example of flashing JFFS2 based filesystem. For RAM Based file system, please refer "Section 8.6" & "Section 8.7"*

NOTE-2: *For Image names in the below sections please refer "Section 7.1" for LS1012A-RDB, "Section 7.2" for LS1012ARDB-NAS.*

8.9.1. RCW Flashing

Refer "Section 8.6.1. RCW Flashing" or "Section 8.7.2. RCW Flashing" for flashing RCW if not flashed already.

8.9.2. U-boot Flashing

Refer "Section 8.6.2. U-boot Flashing" or "Section 8.7.3. U-boot Flashing" for flashing u-boot if not flashed already.

8.9.3. PPA FIT Image Flashing

Refer "Section 8.6.3. PPA FIT Image Flashing" or "Section 8.7.4. PPA FIT Image Flashing" for flashing PPA FIT Image if not flashed already.

8.9.4. Rootfs Flashing

Any of the two alternative methods given below can be used to flash rootfs binary.

8.9.4.1. Using TFTP

```
=>sf probe 0:0
=>tftp 0xa0000000 jffs2-256k-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x700000 0x2000000
=>sf write 0xa0000000 0x700000 $filesize
```

8.9.4.2. Using SD Card

```
=>fatload mmc 0 0xa0000000 jffs2-256k-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x700000 0x2000000
=>sf write 0xa0000000 0x700000 $filesize
```

8.9.5. DTB Flashing

Any of the two alternative methods given below can be used to flash dtb binary.

8.9.5.1. Using TFTP

```
=>tftp 0xa0000000 dtb-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2700000 0x100000
=>sf write 0xa0000000 0x2700000 $filesize
```

8.9.5.2. Using SD Card

```
=>fatload mmc 0 0xa0000000 dtb-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2700000 0x100000
=>sf write 0xa0000000 0x2700000 $filesize
```

8.9.6. uImage Flashing

Any of the two alternative methods given below can be used to flash uImage binary.

8.9.6.1. Using TFTP

```
=>tftp 0xa0000000 uImage-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2800000 0xE00000
=>sf write 0xa0000000 0x2800000 $filesize
```

8.9.6.2. Using SD Card

```
=>sf probe 0:0
=>fatload mmc 0 0xa0000000 uImage-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2800000 0xE00000
=>sf write 0xa0000000 0x2800000 $filesize
```

8.9.7. U-boot Env Commands

For JFFS2 Filesystem to work, following are the UBOOT ENV Commands:

```
=>setenv bootargs 'console=ttyS0,115200 root=/dev/mtdblock4 rootdelay=5
mtdparts=1550000.quadspi:1M(RCW)ro,1M(u-boot)ro,3M(env),2M(PPA-FIT)ro,32M(rootfs),1M(dtb),14M(kernel)
rw rootfstype=jffs2 earlycon=uart8250,mmio,0x21c0500'

=>setenv bootcmd 'pfe stop;sf probe 0:0;sf read 0x8007ffc0 0x2800000 0x900000;sf read 0x82000000 0x2700000
0x100000;bootm 0x8007ffc0 - 0x82000000'

=>setenv mtdparts '1550000.quadspi:1M(RCW)ro,1M(u-boot)ro,3M(env),2M(PPA-
FIT)ro,32M(rootfs),1M(dtb),14M(kernel)'

=>setenv mtdids 'qspi0=1550000.quadspi'
=>save
```

8.9.8. Booting Linux with auto-boot

Follow the following steps to boot using auto boot:

1. Make sure all required image are flashed on the board-using step 8.6.1 to 8.6.4.
2. Make sure following env setting is saved:
   ```
   bootargs= console=ttyS0,115200 root=/dev/mtdblock4 rootdelay=5
   mtdparts=1550000.quadspi:1M(RCW)ro,1M(u-boot)ro,3M(env),2M(PPA-FIT)ro,32M(rootfs),1M(dtb),14M(kernel)
   rw rootfstype=jffs2 earlycon=uart8250,mmio,0x21c0500
   bootcmd= pfe stop;sf probe 0:0;sf read 0x8007ffc0 0x2800000 0x900000;sf read 0x82000000 0x2700000
   0x100000;bootm 0x8007ffc0 - 0x82000000
   ```
3. Power cycle the board to boot it until the boot prompt.

8.10. UBIFS Read-Write File System

8.10.1. QSPI Flash Layout for UBIFS File System

For the Usage of UBIFS Filesystem,the following is the QSPI Flash Layout:

Image	Size	Start Address
RCW+PBI	1 MB	0x4000_0000
U-boot boot loader + PPFE binary	1 MB	0x4010_0000
U-boot Env	3MB	0x4020_0000
PPA FIT Image	2 MB	0x4050_0000
ROOT_FS	32MB	0x4070_0000
DTB	1MB	0x4270_0000

uImage	14MB	0x4280_0000

8.11. Flashing & Booting pre-built UBIFS ASK Images using TFTP or SD Card

UBIFS is the read/write file system that can used on QSPI Flash.

NOTE-1: *This section only explains the example of flashing UBIFS. For RAM Based file system, please refer "Section 8.6" & "Section 8.7"*

NOTE-2: *For Image names in the below sections please refer "Section 7.1" for LS1012A-RDB, "Section 7.2" for LS1012ARDB-NAS.*

8.11.1. RCW Flashing

Refer "Section 8.6.1. RCW Flashing" or "Section 8.7.2. RCW Flashing" for flashing RCW if not flashed already.

8.11.2. U-boot Flashing

Refer "Section 8.6.2. U-boot Flashing" or "Section 8.7.3. U-boot Flashing" for flashing u-boot if not flashed already.

8.11.3. PPA FIT Image Flashing

Refer "Section 8.6.3. PPA FIT Image Flashing" or "Section 8.7.4. PPA FIT Image Flashing" for flashing PPA FIT Image if not flashed already.

8.11.4. Rootfs Flashing

Any of the two alternative methods given below can be used to flash rootfs binary.

8.11.4.1. Using TFTP

```
=>sf probe 0:0
=>tftp 0xa0000000 ubi-nor-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x700000 0x2000000
=>sf write 0xa0000000 0x700000 $filesize
```

8.11.4.2. Using SD Card

```
=>fatload mmc 0 0xa0000000 ubi-nor-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x700000 0x2000000
=>sf write 0xa0000000 0x700000 $filesize
```

8.11.5. DTB Flashing

Any of the two alternative methods given below can be used to flash dtb binary.

8.11.5.1. Using TFTP

```
=>tftp 0xa0000000 dtb-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2700000 0x100000
=>sf write 0xa0000000 0x2700000 $filesize
```

8.11.5.2. Using SD Card

```
=>fatload mmc 0 0xa0000000 dtb-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2700000 0x100000
=>sf write 0xa0000000 0x2700000 $filesize
```

8.11.6. uImage Flashing

Any of the two alternative methods given below can be used to flash uImage binary.

8.11.6.1. Using TFTP

```
=>tftp 0xa0000000 uImage-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2800000 0xE00000
=>sf write 0xa0000000 0x2800000 $filesize
```

8.11.6.2. Using SD Card

```
=>fatload mmc 0 0xa0000000 uImage-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2800000 0xE00000
=>sf write 0xa0000000 0x2800000 $filesize
```

8.11.7. U-boot Env Commands

For UBIFS Filesystem to work, following are the UBOOT ENV Commands:

```
=>setenv bootargs ‘console=ttyS0,115200 mtdparts=1550000.quadspi:1M(RCW)ro,1M(u-boot)ro,3M(env),2M(PPA-FIT)ro,32M(rootfs),1M(dtb),14M(kernel) rw rootfstype=ubifs root=ubi0:rootfs ubi.mtd=4 earlycon=uart8250,mmio,0x21c0500’

=>setenv bootcmd ‘pfe stop;sf probe 0:0;sf read 0x8007ffc0 0x2800000 0x900000;sf read 0x82000000 0x2700000 0x100000;bootm 0x8007ffc0 - 0x82000000’

=>setenv mtdparts ‘1550000.quadspi:1M(RCW)ro,1M(u-boot)ro,3M(env),2M(PPA-FIT)ro,32M(rootfs),1M(dtb),14M(kernel)’

=>setenv mtdids ‘qspi0=1550000.quadspi’
=>save
```

8.11.8. Booting Linux with auto-boot

Follow the following steps to boot using auto boot:

4. Make sure all required image are flashed on the board-using step 8.6.1 to 8.6.4.
5. Make sure following env setting is saved:
   bootargs= console=ttyS0,115200 mtdparts=1550000.quadspi:1M(RCW)ro,1M(u-boot)ro,3M(env),2M(PPA-FIT)ro,47M(rootfs),1M(dtb),9M(kernel) rw rootfstype=ubifs root=ubi0:rootfs ubi.mtd=4 earlycon=uart8250,mmio,0x21c0500

bootcmd= pfe stop;sf probe 0:0;sf read 0x8007ffc0 0x2800000 0x900000;sf read 0x82000000 0x2700000 0x100000;bootm 0x8007ffc0 - 0x82000000

6. Power cycle the board to boot it until the boot prompt.

8.12. Read-Write File System on SD-CARD

On Sd Card, to deploy the Read-write filesystem, Following is the procedure

NOTE-1: *For Image names in the below sections please refer "Section 7.1" for LS1012A-RDB, "Section 7.2" for LS1012ARDB-NAS.*

8.12.1. RCW Flashing

Refer "Section 8.6.1. RCW Flashing" or "Section 8.7.2. RCW Flashing" for flashing RCW if not flashed already.

8.12.1. U-boot Flashing

Refer "Section 8.6.2. U-boot Flashing" or "Section 8.7.3. U-boot Flashing" for flashing u-boot if not flashed already.

8.12.1. PPA FIT Image Flashing

Refer "Section 8.6.3. PPA FIT Image Flashing" or "Section 8.7.4. PPA FIT Image Flashing" for flashing PPA FIT Image if not flashed already.

8.12.2. Flash Uimage and DTB on QSPI Flash

8.12.2.1. Flashing DTB:

```
=>sf probe 0:0
=>tftp 0xa0000000 dtb-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2700000 0x100000
=>sf write 0xa0000000 0x2700000 $filesize
```

8.12.2.2. Flashing uImage:

```
=>sf probe 0:0
=>tftp 0xa0000000 uImage-openwrt-ls1012a_1.1.rc0-ls1012a-rdb
=>sf erase 0x2800000 0xE00000
=>sf write 0xa0000000 0x2800000 $filesize
```

8.12.3. Procedure to ramboot:

- setenv bootargs 'console=ttyS0,115200 root=/dev/ram0 earlycon=uart8250,0x21c0500,115200'
- tftp 0xa0000000 openwrt-ls1012a-hgw-lsrdb.itb
- bootm 0xa0000000

This will boot the box.

8.12.4. Procedure to put rootfs on to SD card

1. Insert SD card into the LS1012A box
2. Use the "fdisk" command to repartition the SD card. ((This step is optional)/Need not perform if SD card size is 8 GB))

```
root@openwrt:fdisk /dev/mmcblk0
```

3. Use the mkfs.ext2 command to creat the filesystem.

```
root@openwrt:mkfs.ext2 /dev/mmcblk0
```

4. Create temp directory and mount the ext2 partition to the temp

```
root@openwrt:mkdir temp
root@openwrt:mount /dev/mmcblk0 /temp
```

5. Get the rootfs openwrt-ls1012a-hgw-lsrdb-rootfs.tar.gz on to the board by network through SCP or FTP
For SCP,
On Ls1012A board, create a new password by passwd command:

```
root@openwrt:passwd
Changing password for root
New password:root
Retype password: ****
```

Password is set for the board.
Connect the ethernet cable to eth2 port of LS1012A to your Local PC
Eth2 has default ip as 192.168.1.1
So configure PC ip address as 192.168.1.2
And Perform SCP from client side.
From Client side (PC), use the following credentials to connect to LS1012A
Username: root
Password :< *the password you just set above*>
And Transfer the file.

6.Copy the Root File System to the SD card partition.

```
root@openwrt: cp openwrt-ls1012a-hgw-lsrdb-rootfs.tar.gz /temp
root@openwrt: tar -xzfv openwrt-ls1012a-hgw-lsrdb-rootfs.tar.gz
root@openwrt: rm openwrt-ls1012a-hgw-lsrdb-rootfs.tar.gz
```

7.Umount the temp directory

```
root@openwrt:umount temp
```

8.12.5. Boot from MMC Card

```
=>setenv bootargs 'console=ttyS0,115200  root=/dev/mmcblk0 rootdelay=5 rw earlycon=uart8250,mmio,0x21c0500'

=>setenv bootcmd ‘pfe stop;sf probe 0:0;sf read 0x8007ffc0 0x2800000 0x900000;sf read 0x82000000 0x2700000 0x100000;bootm 0x8007ffc0 - 0x82000000’
=>save
```

To boot, run the following command:

```
=>boot
```

8.13. Board Recovery Steps

It is suggested that testing be conducted on bank 2 to avoid constant u-boot erase problem as it takes considerable effort to recover the board with both banks or bank 1 erased.

Please follow the following steps to use bank 2:

1. Connect to the board LS1012ARDB-11.
2. To check which bank you are in, give reset command or power-cycle the board and check the u-boot logs . You will get some prints like “Board: LS1012ARDB Version: RevB, boot from QSPI: bank1 “in the logs.
3. Now if you are in bank 1 give the following command to shift to bank 2 “ i2c mw 0x24 0x7 0xfc; i2c mw 0x24 0x3 0xf5 “. To check bank give “reset” command.
4. To move back to bank 1 from bank 2 , power on/off the board or use the following command “i2c mw 0x24 0x3 0xf4 “ and then give “reset” command.

Using bank 2 would ensure that the board is always operational. If bank 2 is erased use the following command in exact order to reprogram it:

1. If bank 2 is erased, power on/off the board. It will lead you back to bank 1.
2. Give the following commands in specified order:
    1. sf probe 0:0; sf read 80000000 0x0 0x40000; (it probes qspi and reads the rcw from 0x0 location on bank 1 and copies 0x40000 bytes of it to 0x80000000 location in DDR)
    2. i2c mw 0x24 0x7 0xfc; i2c mw 0x24 0x3 0xf5; (it switches from bank 1 to bank 2)
    3. sf probe 0:0; sf erase 0 40000; (probe qspi flash on bank 2 and erase 0x40000 bytes from 0x0 location)
    4. sf write 80000000 0 40000; (write 0x40000 bytes from 0x80000000 location in DDR to 0 location in QSPI bank 2).
    5. i2c mw 0x24 0x3 0xf4 (move back to bank 1)
    6. sf probe 0:0; sf read 0x80000000 0x100000 0x80000; (probe qspi flash in bank 1 and read uboot from 0x100000 offset in QSPI and copy 0x80000 bytes to 0x80000000 in DDR)
    7. i2c mw 0x24 0x7 0xfc; i2c mw 0x24 0x3 0xf5; (switch to bank 2)
    8. sf probe 0:0; sf erase 0x100000 0x80000; (probe QSPI flash of bank 2 and erase 0x80000 bytes from 0x100000 offset)
    9. sf write 80000000 0x100000 0x80000; (write 0x80000 bytes from 0x80000000 location in DDR to 0x100000 offset in QSPI)
    10. reset

9. Guideline for testing NAS

NOTE: *Use NAS Build images only to test this feature.*

Samba package is provide in this release for NAS. NAS can be tested from a Windows PC using robocopy command.

Following are the steps to run the samba:

1. Mount the hard drive
    e.g: mount /dev/sda1 /share1
2. Edit the /etc/samba/smb.conf to add the share :

```
[share_nas]
path = /share1
valid users = root
guest ok = Yes
read only = No
```

3. Start the samba

   ```
   smbd –D –s /etc/smb.conf
   ```

4. Enable LRO

   ```
   ethtool -K eth0 lro on
   ethtool -K eth2 lro on
   ```

5. From the Windows PC, map the samba share as the network drive (through windows explorer or use “net use” command), open the command line and run robocopy command to do read or write

   ```
   Read: robocopy z: . <file>
   Write: robocopy . z: <file>
   ```

10. Guideline for WiFi drivers

10.1. SDIO WiFi(RDB)

NOTE-1: *This is only applicable for Rev-D RDBs.*
NOTE-1: *This feature is by default disabled. To enable this please refer “Section-6 Building LS1012A OpenWrt ASK”. Refer “Section-6.1.5” for HGW build and “Section-6.2.5” for NAS build.*

1. Connect the Antenna to the module prescribed for SN8000.
2. Run following command to initialize on board SN8000 SDIO WiFi connected on SDHC-1 in AP mode:

   ```
   insmod lib/modules/3.19.3/bcmdhd.ko
   nvram_path=/lib/firmware/bcm/SN8000_BCM43362/bcmdhd.SN8000.SDIO.cal
   firmware_path=/lib/firmware/bcm/SN8000_BCM43362/fw_bcmdhd_apsta.bin
   ```

   Following print should be visible on the console:

   ```
   /SN8000_BCM43362/bcmdhd.SN8000.SDIO.cal firmware_path=/lib/firmware/bcm/SN8000_B
   CM43362/fw_bcmdhd_apsta.bin
   dhd_module_init in
   Power-up adapter 'DHD generic adapter'
   wifi_platform_bus_enumerate device present 1
   F1 signature OK, socitype:0x1 chip:0xa962 rev:0x1 pkg:0x9
   DHD: dongle ram size is set to 245760(orig 245760) at 0x0
   wifi_platform_get_mac_addr
   CFG80211-ERROR) wl_setup_wiphy : Registering Vendor80211)
   wl_create_event_handler(): thread:wl_event_handler:70d started
   CFG80211-ERROR) wl_event_handler : tsk Enter, tsk = 0xffffffc021241980
   dhd_attach(): thread:dhd_watchdog_thread:70e started
   dhd_attach(): thread:dhd_dpc:70f started
   ```

```
dhd_deferred_work_init: work queue initialized
dhdsdio_write_vars: Download, Upload and compare of NVRAM succeeded.
dhd_bus_init: enable 0x06, ready 0x06 (waited 0us)
wifi_platform_get_mac_addr
Firmware up: op_mode=0x0002, MAC=00:0b:6c:42:1f:6f
dhd_preinit_ioctls buf_key_b4_m4 set failed -23
Firmware version = wl0: Apr 30 2015 11:17:10 version 5.90.231 FWID 01-0
dhd_preinit_ioctls wl ampdu_hostreorder failed -23
dhd_wlfc_init(): successfully enabled bdcv2 tlv signaling, 79
dhd_wlfc_init(): wlfc_mode=0x0, ret=-23

Dongle Host Driver, version 1.141 (TOB) (r)
Compiled from
Register interface [wlan0]  MAC: 00:0b:6c:42:1f:6f
```

3. Run following command for interface UP:
   ```
   ifconfig wlan0 <ip address> netmask <ip mask> up e.g. "ifconfig wlan0 192.168.4.1 netmask 255.255.255.0 up"
   ```

4. Run following to configure AP:
   ```
   hostapd -B ./etc/hostapd.conf
   ```

   To change AP configuration, edit "*/etc/hostapd.conf* " as per the need. Following print should be visible on the console after running above command:

   ```
   Configuration file: ./etc/hostapd.conf
   CFG80211-ERROR) wl_cfg80211_del_station : Disconnect STA : ff:ff:ff:ff:ff:ff scb_val.val 3
   Using interface CFG80211-ERROR) wl_cfg80211_set_channel : wlan0 with hwaddr 00:0b:6c:42:1f:6f and ssid
   "ls1012a_ap"
   netdev_ifidx(4), chan_type(1) target channel(1)
   CFG80211-ERROR) wl_cfg80211_parse_ies : No WPSIE in beacon
   CFG80211-ERROR) wl_cfg80211_parse_ies : No WPSIE in beacon
   _dhd_wlfc_mac_entry_update():1649, entry(32)
   wlan0: interface state UNINITIALIZED->ENABLED
   wlan0: AP-ENABLED
   ```

5. After Step 4, AP should be visible to nearby STA devices with SSID "***ls1012a_ap***". A lap top can be connected and data transfer etc can be tested.

10.2. QCA PCIe WiFi (Ath9k)

NOTE: *This is enabled by default in the release. If SDIO WiFi is enabled by applying patch "openwrt-ls1012a_ask_1.0_bcmdhd_sdio_wifi_enable_rdb_hgw.patch" for HGW and "openwrt-ls1012a_ask_1.0_bcmdhd_sdio_wifi_enable_rdb_hgw.patch" for NAS releases, then this feature will no longer be available.*

1. Connect QCA Mini PCIe WiFi module (which is compatible with ath9k driver) to the mini PCIe slot on the RDB.
2. Boot the system.
3. Drivers comes up with system boot. Print similar to given below should be visible on console:

```
cfg80211: Calling CRDA to update world regulatory domain
cfg80211: World regulatory domain updated:
cfg80211:  DFS Master region: unset
cfg80211:   (start_freq - end_freq @ bandwidth), (max_antenna_gain, max_eirp), (dfs_cac_time)
cfg80211:   (2402000 KHz - 2472000 KHz @ 40000 KHz), (N/A, 2000 mBm), (N/A)
cfg80211:   (2457000 KHz - 2482000 KHz @ 40000 KHz), (N/A, 2000 mBm), (N/A)
cfg80211:   (2474000 KHz - 2494000 KHz @ 20000 KHz), (N/A, 2000 mBm), (N/A)
cfg80211:   (5170000 KHz - 5250000 KHz @ 80000 KHz), (N/A, 2000 mBm), (N/A)
cfg80211:   (5250000 KHz - 5330000 KHz @ 80000 KHz, 160000 KHz AUTO), (N/A, 2000 mBm), (0 s)
cfg80211:   (5490000 KHz - 5730000 KHz @ 160000 KHz), (N/A, 2000 mBm), (0 s)
cfg80211:   (5735000 KHz - 5835000 KHz @ 80000 KHz), (N/A, 2000 mBm), (N/A)
cfg80211:   (57240000 KHz - 63720000 KHz @ 2160000 KHz), (N/A, 0 mBm), (N/A)
```

4. Run following command for interface UP:
   ifconfig wlan0 <ip address> netmask <ip mask> up e.g. "ifconfig wlan0 192.168.4.1 netmask 255.255.255.0 up"

5. Run following to configure AP:
   hostapd -B ./etc/hostapd.conf

   To change AP configuration, edit "*/etc/hostapd.conf*" as per the need. Following print should be visible on the console after running above command:

```
Configuration file: ./etc/hostapd.conf
CFG80211-ERROR) wl_cfg80211_del_station : Disconnect STA : ff:ff:ff:ff:ff:ff scb_val.val 3
Using interface CFG80211-ERROR) wl_cfg80211_set_channel : wlan0 with hwaddr 00:0b:6c:42:1f:6f and ssid
"ls1012a_ap"
netdev_ifidx(4), chan_type(1) target channel(1)
CFG80211-ERROR) wl_cfg80211_parse_ies : No WPSIE in beacon
CFG80211-ERROR) wl_cfg80211_parse_ies : No WPSIE in beacon
_dhd_wlfc_mac_entry_update():1649, entry(32)
wlan0: interface state UNINITIALIZED->ENABLED
wlan0: AP-ENABLED
```

6. After Step 4, AP should be visible to nearby STA devices with SSID "***ls1012a_ap***". A lap top can be connected and data transfer etc can be tested.

10.3. Quantenna PCIe 11ac 4x4

NOTE: *Quantenna PCIe 11ac 4x4 AP mode driver binary is available under NDA. Please contact support team to get the driver.*

1. Connect Quantenna Mini PCIe WiFi module to the mini PCIe slot on the RDB.
2. Boot the system with UBIFS/JFFS as rootfs.
3. Get the following ipk files from NDA folder and copy them to the rootfs.

   quantenna_37.4.0.62.1-2.00.1-1_ls1012a.ipk
   kmod-quantenna_3.19.3+37.4.0.62.1-2.00.1-1_ls1012a.ipk

4. Install both ipk files with following commands.

```
root@OpenWrt:/# opkg install quantenna_37.4.0.62.1-2.00.1-1_ls1012a.ipk
root@OpenWrt:/# kmod-quantenna_3.19.3+37.4.0.62.1-2.00.1-1_ls1012a.ipk
```

5. Reboot the system with the command "reboot"
6. Interface with name "host0" can be seen on successful loading of the driver.
7. Run following command for interface UP:
   ifconfig host0 <ip address> netmask <ip mask> up e.g. "ifconfig wlan0 192.168.2.1 netmask 255.255.255.0 up"
8. Refer quantenna documentation to configure AP and STA.

10.4. Setting up WiFi fast path

To enable WiFi fast path following steps needs to be done.

1. Configure/modify cmm config file to fast forward the wifi interface. Following lines should be present in /etc/config/fastforward file for the each wifi interface needs to be fast forward.

   ```
   #WiFi fastforward configuration for Quantenna driver
   config wifi_fastforward
           option ifname   host0
           option direct_path_rx 0
   ```

2. After modifying /etc/config/fastforward reboot the system.
3. For wifi fast-forwarding in bridge mode set following, default configuration is route mode.

   ```
   root@OpenWrt:/# echo 1 > /sys/devices/platform/90500000.pfe/vwd_bridge_hook_enable
   ```

4. For wifi fast-forwarding in route mode set following.

   ```
   root@OpenWrt:/# echo 1 > /sys/devices/platform/90500000.pfe/vwd_route_hook_enable
   ```

5. Now the wifi traffic will be fast-forwarded.

11. Guideline for testing System Suspend/Resume

1. Sleep and Wake up by FTM timer
   Start a FTM timer. It will trigger an interrupt to wake up the system in 5 seconds.

   ```
   echo 5 > /sys/devices/platform/29d0000.ftm0/ftm_alarm && echo mem > /sys/power/state
   ```

12. Guideline for testing IO expander

1. Export gpios 447 to 443

```
echo 447 > /sys/class/gpio/export
echo 446 > /sys/class/gpio/export
echo 445 > /sys/class/gpio/export
echo 444 > /sys/class/gpio/export
echo 443 > /sys/class/gpio/export
```

2. Verify direction of the gpios

```
cat  /sys/class/gpio/gpio447/direction
cat  /sys/class/gpio/gpio446/direction
cat  /sys/class/gpio/gpio445/direction
cat  /sys/class/gpio/gpio444/direction
cat  /sys/class/gpio/gpio443/direction
```

3. Read the gpios and verify

```
cat  /sys/class/gpio/gpio447/value
cat  /sys/class/gpio/gpio446/value
cat  /sys/class/gpio/gpio445/value
cat  /sys/class/gpio/gpio444/value
cat  /sys/class/gpio/gpio443/value
```

13. Guideline for testing USB host mode

1. Insert USB flash drive into USB 3.0 port.

   Print similar to below will appear as soon as the storage device is detected.

```
root@OpenWrt:/# usb 1-1: new high-speed USB device number 2 using xhci-hcd
usb-storage 1-1:1.0: USB Mass Storage device detected
scsi host1: usb-storage 1-1:1.0
scsi 1:0:0:0: Direct-Access     Netac    OnlyDisk        PMAP PQ: 0 ANSI: 4
sd 1:0:0:0: Attached scsi generic sg0 type 0
sd 1:0:0:0: [sda] 7823360 512-byte logical blocks: (4.00 GB/3.73 GiB)
sd 1:0:0:0: [sda] Write Protect is off
sd 1:0:0:0: [sda] No Caching mode page found
sd 1:0:0:0: [sda] Assuming drive cache: write through
 sda:
sd 1:0:0:0: [sda] Attached SCSI removable disk
```

2. Mount the drive and use.

```
root@OpenWrt:/# mount /dev/sda /mnt/
root@OpenWrt:/# cd /mnt/
```

14. Guideline for testing USB gadget mode

1. Refer section 6.4 to build USB gadget driver.

2. Boot to Linux prompt.
3. Mount the SD card to copy kernel objects that generated from the steps mentioned in section 6.4.

4. Insert the kernel objects in the mentioned order.

```
insmod usb/configfs.ko
insmod usb/usb-common.ko
insmod usb/udc-core.ko
insmod usb/dwc3.ko
insmod usb/libcomposite.ko
insmod usb/usb_f_mass_storage.ko
insmod usb/g_mass_storage.ko file=/dev/mmcblk0 stall=n
```

5. LS1012A platform is now ready to work as a mass storage device. Connect the cable to a windows host machine and use as a storage device.

6. Use the following commands to remove objects after use.

```
rmmod g_mass_storage.ko
rmmod usb_f_mass_storage.ko
rmmod libcomposite.ko
rmmod dwc3.ko
rmmod udc-core.ko
rmmod usb-common.ko
rmmod configfs.ko
```

15. Guideline for testing NFC board PN7150S

Connect PN7150S board to Arduino connectors (J16,J17,J18,J19,J20) on LS1012A-RDB. On PN7150S board solder a wire between pins corresponding to J16[2] and J17[8].

1. Power ON the board and from U-Boot, flash rcw_800_nfc_swap.bin. Refer section 8.6.1.
2. Reset the board and stop at U-Boot prompt.
3. Run the U-Boot command to set ioexpander GPIOs for NFC.
   ```
   i2c md 0x24 0x2; i2c mw 0x24 0x2 0xf7; 2c md 0x24 0x2;
   ```
4. Boot to Linux prompt.
5. Copy linux_libnfc-nci.tar.gz tarball from RSR/ls1012a-rdb/ directory to LS1012A-RDB filesystem.
6. SD card can be used to transfer files from PC to RDB.

Use the following commands to untar and copy files to their corresponding locations in the filesystem.

```
mount /dev/mmcblk0  /mnt/; cd /mnt/
tar -xvf linux_libnfc-nci.tar.gz
cd linux_libnfc-nci/
```

```
cp libnfc_nci_linux* /usr/lib/
export LD_LIBRARY_PATH=/

cp libnfc-nxp.conf /etc/.
mkdir -p /etc/conf/
cp libnfc-nxp.conf /etc/conf/.
mkdir -p /etc/conf/PN7150
cp libnfc-nxp.conf /etc/conf/PN7150/.
```

8. Insert the kernel object to enable NFC board.

```
insmod ./pn5xx_i2c.ko
```

9. Run the demo application to poll and detect the NFC card

```
./nfcDemoApp poll
```

10. Bring the NFC card near to the PN7150S board. This card comes along with PN7150S kit.
Upon detection of the card, the tag is read and displayed similar to the below prints.
Note: - The detection of spurious interrupts is a known issue, which will be resolved in the next release.

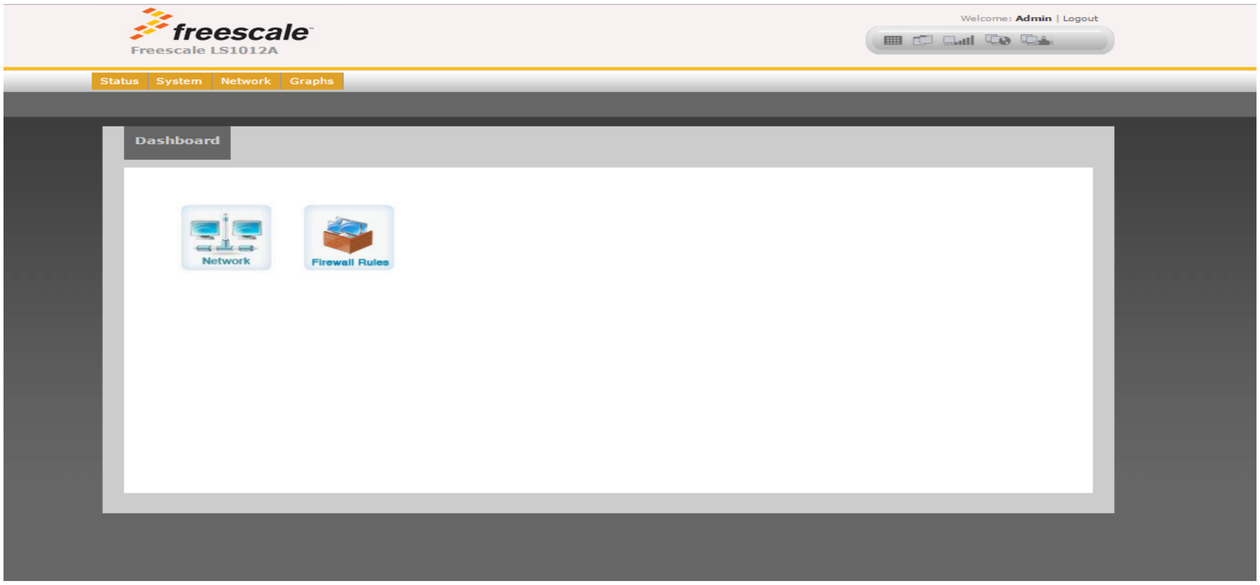
```
Waiting for a Tag/Device...

    NFC Tag Foundpn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq 508


        Type :          'Type A - Mifare Ul'
        NFCID1 :        '04 5C 47 D2 9C 39 80 '
pn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq 508
pn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq 508
pn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq 508
pn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq 508
pn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq 508
        Record Found :
                NDEF Content Max size :     '868 bytes'
                NDEF Actual Content size :  '29 bytes'
                ReadOnly :                  'FALpn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq
508
SE'
pn54x_dev_read: SPURIOUS INTERRUPTS DETECTED for irq 508
                Type :                  'URI'
                URI :                   'http://www.nxp.com/demoboard/OM5578'


        29 bytes of NDEF data received :
        D1 01 19 55 01 6E 78 70 2E 63 6F 6D 2F 64 65 6D 6F 62 6F 61 72 64 2F 4F 4D 35 35 37 38
```

16. Guideline for testing SPI-DUART (SC16IS752) Bridge

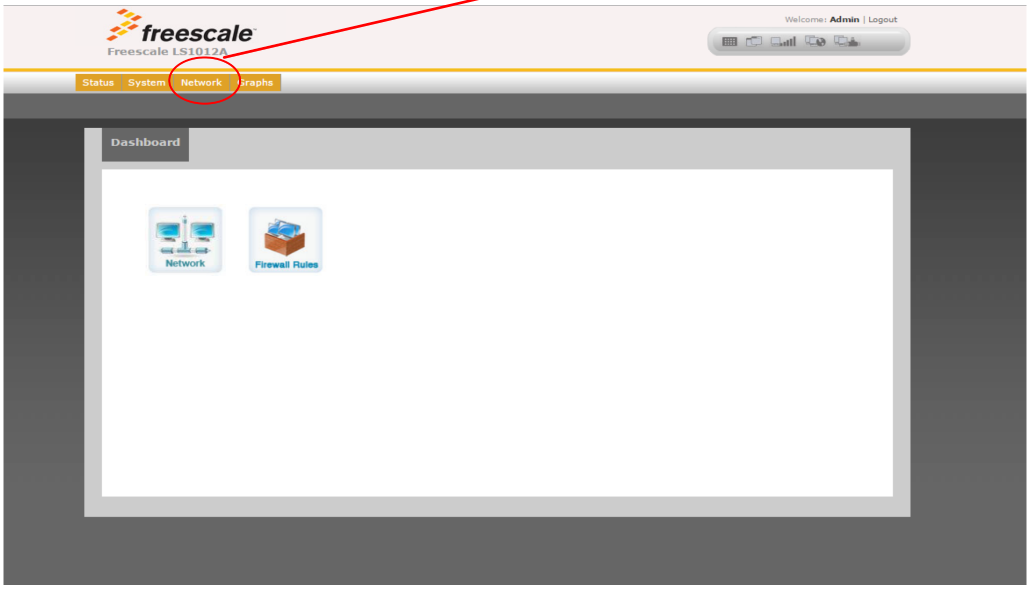
The two UARTs are registered as serial devices /dev/ttySC0 and /dev/ttySC1.
This can be tested with KW41 and this section will be updated when KW41 is enabled.

17. OpenWrt GUI for JFFS2 Filesystem

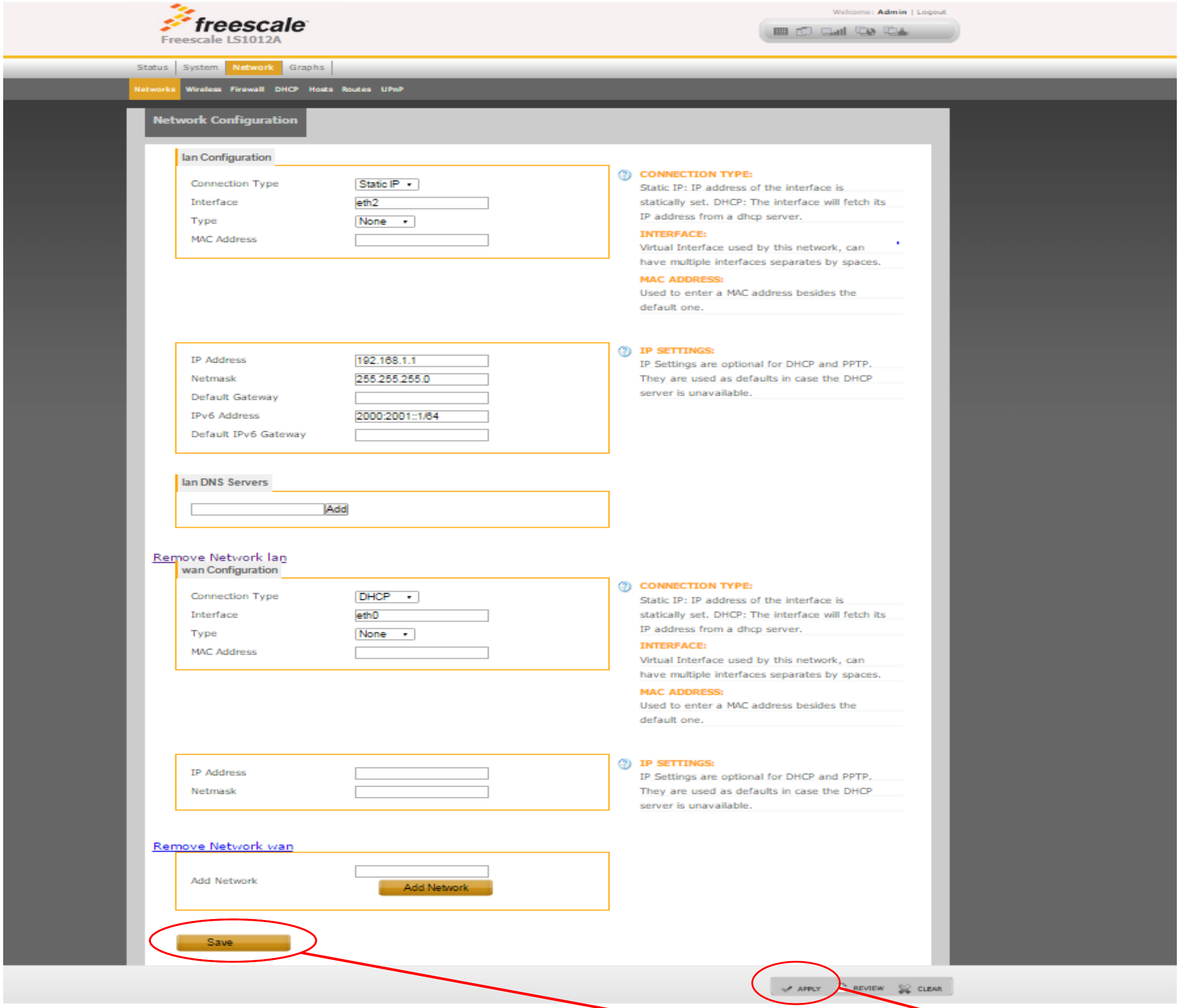
Give the ip address of the eth2 192.168.1.1 in the browser
The following screen appears



To change the Network configuration, click on Network



The following page appears


freescale
Freescale LS1012A
Welcome: Admin | Logout
Status | System | Network | Graphs
Networks Wireless Firewall DHCP Hosts Routes UPnP
Add
Add Network
Save
APPLY
REVIEW
CLEAR

Network Configuration

lan Configuration

Connection Type	Static IP
Interface	eth2
Type	None
MAC Address	

CONNECTION TYPE:
Static IP: IP address of the interface is statically set. DHCP: The interface will fetch its IP address from a dhcp server.
INTERFACE:
Virtual Interface used by this network, can have multiple interfaces separates by spaces.
MAC ADDRESS:
Used to enter a MAC address besides the default one.

IP Address	192.168.1.1
Netmask	255.255.255.0
Default Gateway	
IPv6 Address	2000:2001::1/64
Default IPv6 Gateway	

IP SETTINGS:
IP Settings are optional for DHCP and PPTP. They are used as defaults in case the DHCP server is unavailable.

lan DNS Servers

Remove Network lan

wan Configuration

Connection Type	DHCP
Interface	eth0
Type	None
MAC Address	

CONNECTION TYPE:
Static IP: IP address of the interface is statically set. DHCP: The interface will fetch its IP address from a dhcp server.
INTERFACE:
Virtual Interface used by this network, can have multiple interfaces separates by spaces.
MAC ADDRESS:
Used to enter a MAC address besides the default one.

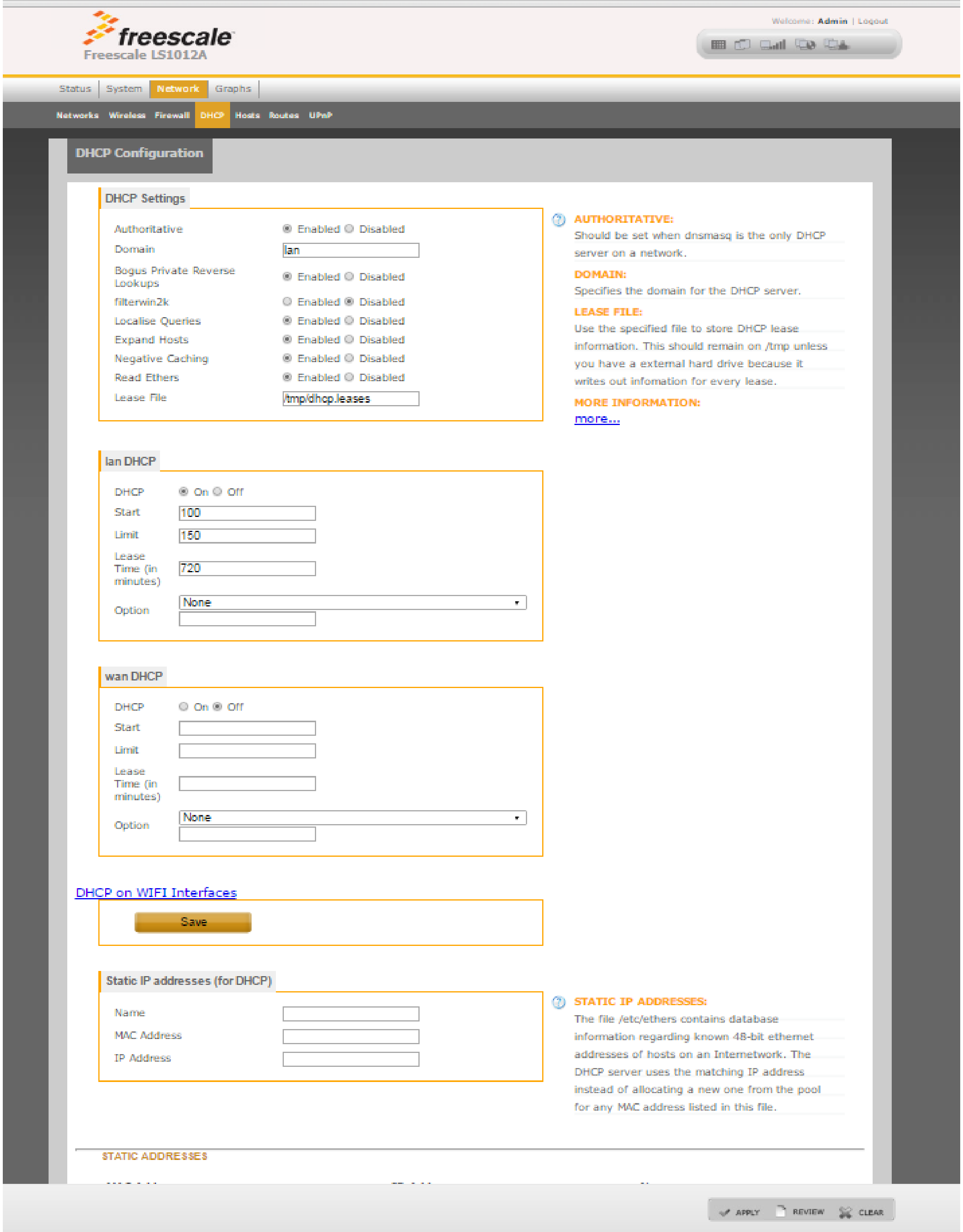
IP Address	
Netmask	

IP SETTINGS:
IP Settings are optional for DHCP and PPTP. They are used as defaults in case the DHCP server is unavailable.

Remove Network wan

Add Network

Make the corresponding changes in the respective fields and click on **save and click on apply**



DHCP Configuration

DHCP Settings

Authoritative	● Enabled ○ Disabled
Domain	lan
Bogus Private Reverse Lookups	● Enabled ○ Disabled
filterwin2k	○ Enabled ● Disabled
Localise Queries	● Enabled ○ Disabled
Expand Hosts	● Enabled ○ Disabled
Negative Caching	● Enabled ○ Disabled
Read Ethers	● Enabled ○ Disabled
Lease File	/tmp/dhcp.leases

AUTHORITATIVE:
Should be set when dnsmasq is the only DHCP server on a network.

DOMAIN:
Specifies the domain for the DHCP server.

LEASE FILE:
Use the specified file to store DHCP lease information. This should remain on /tmp unless you have a external hard drive because it writes out infomation for every lease.

MORE INFORMATION:
more...

lan DHCP

DHCP	● On ○ Off
Start	100
Limit	150
Lease Time (in minutes)	720
Option	None

wan DHCP

DHCP	○ On ● Off
Start	
Limit	
Lease Time (in minutes)	
Option	None

Static IP addresses (for DHCP)

Name	
MAC Address	
IP Address	

STATIC IP ADDRESSES:
The file /etc/ethers contains database information regarding known 48-bit ethernet addresses of hosts on an Internetwork. The DHCP server uses the matching IP address instead of allocating a new one from the pool for any MAC address listed in this file.

STATIC ADDRESSES

The above is the dhcp page in the network section.

18. Firewall Configuration

In the current release by default no firewall rules are configured including NAT. To enable NAT following firewall rules needs to be configured.

```
iptables -P INPUT DROP
iptables -A INPUT –i eth2 -j ACCEPT
iptables -P FORWARD DROP
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
iptables -A FORWARD -i eth0 -o eth2 -m state --state RELATED,ESTABLISHED -j ACCEPT
iptables -A FORWARD -i eth2 -o eth0 -j ACCEPT
```

19. Known issues

Know issues in this release are:

1. UDP Slow Path (self traffic) Rx performance is low.
2. NAS Stability issue, at times network interface goes down. A reboot will be needed to recover.
3. SDIO WiFi is not supported in default release images and build. Support for this is provided in a separate patch. Please refer "*Section-10*" of this document for the details.
4. GUI support is only available for JFFS2, UBIFS and SD Card based file system. It is not supported for RAM based filesystem.
5. QoS in exception path (Ethernet to Host) doesn't works for certain values.
6. PPPoE relay connection is not expiring.
7. pfe.ko kernel module unload is not working.
8. Some buffalo USB flashes does not work consistently.
9. Quantenna 11ac driver crashes while rebooting the system.
10. Occasional Kernel crash in auto bridge module.

20. Appendix A (Performance Numbers)

20.1. Fast Path Performance

Following tests are done with Spirent Test center.
WAN => eth0@1G
LAN => eth2@1G

20.1.1. IPv4 UDP Routing (Uni-Directional)

LAN to WAN		
Frame Size	**Fps**	**Mbps**
64	1488004	1,000
128	844595	1,000
256	452899	1,000
390	304878	1,000
512	234962	1,000
1024	119732	1,000
1280	96154	1,000
1518	81274	1,000

WAN to LAN		
Frame Size	**Fps**	**Mbps**
64	1488095	1,000
128	844595	1,000
256	452899	1,000
390	304878	1,000
512	234962	1,000
1024	119732	1,000
1280	96154	1,000
1518	81274	1,000

20.1.2. IPv4 UDP Routing (Bi-Directional)

Frame Size	Fps	Mbps
64	2976189	2,000
128	1689089	2,000
256	905797	2,000
390	609756	2,000
512	469925	2,000
1024	239464	2,000
1280	192308	2,000
1518	162549	2,000

20.1.3. IPv4 UDP Bridging(Bi-Directional)

Frame Size	Fps	Mbps
64	2976193	2,000
128	1689188	2,000
256	905797	2,000
390	609757	2,000
512	469925	2,000
1024	239464	2,000
1280	192308	2,000
1518	162549	2,000

20.1.4. IPv4 UDP Routing (Uni-Directional)

LAN to WAN		
Frame Size	Fps	Mbps
68	1420426	1,000
128	844595	1,000
256	452899	1,000
390	304878	1,000
512	234962	1,000
1024	119732	1,000
1280	96154	1,000
1518	81274	1,000

20.1.5. IPv4 VLAN UDP Bridging(Bi-Directional)

Frame Size	Fps	Mbps
68	2311477	1,627
128	1689188	2,000
256	905797	2,000
390	609757	2,000
512	469925	2,000
1024	239464	2,000
1280	192308	2,000
1518	162549	2,000

20.1.6. IPv6 UDP Routing (Uni-Directional)

LAN to WAN		
Frame Size	**Fps**	**Mbps**
86	1179245	1,000
128	844595	1,000
256	452899	1,000
390	304878	1,000
512	234962	1,000
1024	119732	1,000
1280	96154	1,000
1518	81274	1,000

WAN to LAN		
Frame Size	**Fps**	**Mbps**
86	1179245	1,000
128	844595	1,000
256	452899	1,000
390	304878	1,000
512	234962	1,000
1024	119732	1,000
1280	96154	1,000
1518	81274	1,000

20.1.7. IPv6 UDP Routing (Bi-Directional)

Frame Size	Fps	Mbps
86	2358493	2000
128	1689189	2,000
256	905797	2,000
390	609756	2,000
512	469925	2,000
1024	239464	2,000
1280	192308	2,000
1518	162549	2,000

20.1.8. IPv6 UDP Bridging(Bi-Directional)

Frame Size	Fps	Mbps
86	2358493	2000
128	1689193	2,000

256	905797	2,000
390	609756	2,000
512	469925	2,000
1024	239464	2,000
1280	192308	2,000
1518	162549	2,000

20.1.9. IPv6 VLAN UDP Routing (Uni-Directional)

LAN to WAN		
Frame Size	**Fps**	**Mbps**
128	844595	1,000
256	452899	1,000
390	304878	1,000
512	234962	1,000
1024	119732	1,000
1280	96154	1,000
1518	81274	1,000

20.1.10. IPv6 VLAN UDP Routing (Bi-Directional)

Frame Size	Fps	Mbps
128	1689193	2,000
256	905797	2,000
390	609756	2,000
512	469925	2,000
1024	239464	2,000
1280	192308	2,000
1518	162549	2,000

20.2. Slow Path (To the board) performance

Slow path performance measured with iperf3 tool between PC and DUT on LAN interface.

20.2.1. IPv4 TCP performance.

On DUT following TCP tuning parameter is configured.

```
# echo 212992 > /proc/sys/net/ipv4/tcp_limit_output_bytes
```

Iperf3 command used on sender side.

```
#iperf3 -c IP_address -i1-t 10 -w 100000
```

Iperf3 command used on receiver side.

```
#iperf3 -s -i1
```

TCP	Mbps
Tx	940
Rx	564

20.2.2. IPv4 UDP Performance

Iperf3 command used on sender side.

```
#iperf3 -u -c IP_address -i1-t 10 -b1000M
```

Iperf3 command used on receiver side.

```
#iperf3 -s -i1
```

UDP	Mbps
Tx	937
Rx	195

20.2.3. Quantenna mPCIe 11ac 4x4 WiFi Performance with WiFi offload.

Tests are done with IXA setup using dual ethernets ports pumping 600Mbps on each interface.

Transport Protocol	WiFi Receiver		WiFi Transmitter	
	Mbps	CPU%	Mbps	CPU%
UDP	1240	88	1120	67

How to Reach Us:
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nxp.com

Web Support:
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