THE OPEN SERVERS

DT4CS-Scale out
User Manual Guide

Revision: A1

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The Open Server

The Open server provides an established framework to demonstrate the accelrated communication process.It provide the solution for communication with higher network connectivity and powerful security using encryption methodology.It offering powerful unified communication using scale-out and storage option. The storage appliance is designed to provide features that include data compression, de-duplication and encryption.

VVDN Technologies

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Revision History:

Date	Rev No.	Description	By
13-March-2015	A0-01	User Manual -Initial Draft	VVDN
23-March-2015	A0-02	Updated BMC GUI Features	VVDN
27-March-2015	A0-03	Updated NOR booting Steps	VVDN

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1 Introduction

This document will describe in detail the procedures for SDK compilation, booting a Linux kernel and mounting a root file system on the Dual T4240MFCS. The Communication Server product will be built with Dual T4240 which is a communication processor from Freescale. The T4240 QorIQ multicore processor combines 12 dual-threaded e6500 Power Architecture® processor cores for a total of 24 threads with high-performance datapath acceleration logic and network and peripheral bus interfaces required for networking, telecom/datacom, data center, wireless infrastructure, and mil/aerospace applications.

A Dual T4240 based Communication server with Scale-out option, offering a powerful unified communication solution with up to 80G of external network connectivity, SRIO inter-chip and external connectivity. External SRIO interface helps to (scale-out) expand system with similar system through Internal SRIO switch.

2 Overview

The following files will be released with t4240mfcs.

1. U-boot, linux kernel and root files for T4240mfcs included in the below mentioned binaries:

QorIQ-SDK-V1.6-SOURCE-20140619-yocto.iso – ISO to build the SDK.

u-boot-with-spl-pbl.bin - U-boot Binary file that could be used to upgrade the U-boot with SD card.

u-boot.bin – U-boot binary file that could be used to upgrade the U-boot for NOR Flash.

fsl_fman_ucode_t4240_r2.0_106_4_10.bin – fman ucode binary to configure the fman interface.

fsl-image-core-t4240mfcs-20150304072707.rootfs.tar.gz - root file system for t4240 mfcs.

uImage - Linux kernel for t4240mfcs.

t4240mfcs.dtb – linux device tree blob (binaries) for t4240mfcs.

2.1 Prerequisites

2.1.1 Host requirement

To properly boot a board host machine must meet the following requirements:

1. Make sure that SDK1.6 is compiled as per the changes required in MFCS project.
2. Modern (latest) GNU/Linux Distribution.
   a. Ubuntu (Most recent release or LTS)

3. An internet connection on the Development Host.
4. Root or sudo permission on the Development Host.
5. A copy of the Linux Kernel (uImage) and Root File System (rootfs.tar.gz) for the Target Board that is compiled using *SDK* 1.6. These are found in the output directory of SDK build, or in the **directory *build_t4240mfcs_release/tmp/deploy/images/t4240mfcs*** on the command line.
6. An available serial port on your Development Host.

2.1.2 Target requirements

To boot the t4240mfcs board we need the following items:

- T4240MFCS Board
- Custom Console cables
- Ethernet Cable
- ScaleOut Add On card

Once we have all the above mentioned components proceed with the following steps:

1. Connect the serial console port of the board to the serial port of host using the custom console cables on both server1 and server2.
2. SD cards for booting the images.
3. Connect the power supply to the board.

2.1.2.1 Preparing the Target

1. Start minicom on your host machine in configuration mode. As root:

```
# sudo minicom -s -w
```

2. A menu of configuration should appear. Select the Serial port setup option, and press Enter.
3. Verify that the listed serial port is the same one that is connected to the target board. If it is not, press A, and enter the correct device. This is /dev/ttyS0 on most Linux distributions.
4. Set the Bps/Par/Bits option by pressing the letter E and using the next menu to set the appropriate values. You press the key that corresponds to the value **115200**, and then press Enter.
5. Set Hardware flow control to **No** using the F key.
6. Set Software flow control to **No** using the G key.
7. Press Enter to return to the main configuration menu, and then press Esc to exit this menu.
8. Reset the board, and wait for a moment. If you do not see output from the board, press Enter several times until you see the prompt. If you do not see any output from the board, and have verified that the serial terminal connection is setup correctly, contact your board vendor.

2.2 Configuring the Network Interface

2.2.1 Finding and Changing the MAC Address

The MAC address on the T4240MFCS is set by the ***ethaddr*** environment variable in U-Boot.

If ethaddr is not set, it can be set using the **setenv** command.

Example

```
 setenv ethaddr 00:11:22:33:44:55
```

The MAC Address can be found using the **printenv** command in U-Boot.

Example

```
printenv
baudrate=115200

bootargs=root=/dev/ram rw console=ttyS0, 115200 rio-scan.scan=0
fsl_fm_max_frm=9600

bootcmd=setenv bootargs root=/dev/mmcblk0p1 rw rootdelay=5 rio-
scan.scan=1 rapidio.hdid=-1
console=$consoledev,$baudrate;mmcinfo;ext2load mmc 0:1 $loadaddr
/boot/$bootfile;ext2load mmc 0:1 $fdtaddr /boot/$fdtfile;bootm
$loadaddr - $fdtaddr

bootdelay=10

bootfile=uImage

consoledev=ttyS0

eth10addr=00:10:F3:3A: BA:B0

eth11addr=00:10:F3:3A:BA:B1

eth12addr=00:10:F3:3A:BA:B2

eth13addr=00:10:F3:3A:BA:B3

eth14addr=00:10:F3:3A:BA:B4

eth15addr=00:10:F3:3A:BA:BC

eth1addr=00:10:F3:3A:BA:AB

eth2addr=00:10:F3:3A:BA:AC

eth3addr=00:10:F3:3A:BA:A1

eth4addr=00:10:F3:3A:BA:A0

eth5addr=00:10:F3:3A:BA:BF
```

```
eth6addr=00:10:F3:3A:BA:B8

eth7addr=00:10:F3:3A:BA:B9

eth8addr=00:10:F3:3A:BA:AA

ethact=FM1@DTSEC1

ethaddr=00:11:22:33:44:55

ethprime=FM1@DTSEC1

fdtaddr=0x00c00000

fdtfile=t4240mfcs.dtb

fman_ucode=7fb6b948

hwconfig=fsl_ddr:ctlr_intlv=3way_4KB,bank_intlv=auto;usb1:dr_mode=host
,phy_type=utmi

ipaddr=192.168.1.10

loadaddr=0x1000000

mdioreg1=mdio write FM1@DTSEC1 22 0x12

mdioreg2=mdio write FM1@DTSEC1 20 0x8001

mmcboot=setenv bootargs root=/dev/mmcblk0p1 rwrootdelay=5
console=$consoledev,$baudratefsl_fm_max_frm=9600 ;mmcinfo;ext2load mmc
0:1 $loadaddr /boot/$bootfile;ext2load

mmc 0:1 $fdtaddr /boot/$fdtfile;bootm $loadaddr - $fdtaddr

netdev=eth0

nfsboot=setenv bootargs root=/dev/nfs rw nfsroot=$serverip:$rootpath
ip=$ipaddr:$serverip:$gatewayip:$netmask:$hostname:$netdev:off
console=$consoledev,$baudrate $othbootargs;tftp $loadaddr
$bootfile;tftp $fdtaddr $fdtfile;bootm $loadaddr - $fdtaddr

othbootargs=rio-scan.scan=0

ramboot=setenv bootargs root=/dev/ram rw console=$consoledev,$baudrate
fsl_fm_max_frm=9600 $othbootargs;tftp $ramdiskaddr $ramdiskfile;tftp
$loadaddr $bootfile;tftp $fdtaddr $fdtfile;bootm $loadaddr
$ramdiskaddr $fdtaddr

ramdiskaddr=0x02000000

ramdiskfile=ramdisk.uboot

rootpath=/opt/nfsroot

serverip=192.168.1.251
```

```
setenv serverip 192.168.1.251; setenv ipaddr 192.168.1.10; setenv
ethaddr 00:11:22:33:44:55; bdev=sda3

stderr=serial

stdin=serial

stdout=serial

tftpflash=tftpboot $loadaddr $uboot && protect off $ubootaddr
+$filesize && erase $ubootaddr +$filesize && cp.b $loadaddr $ubootaddr
$filesize && protect on $ubootaddr+

$filesize && cmp.b $loadaddr $ubootaddr $filesize

uboot="u-boot.bin"

ubootaddr=0x00201000



Environment size: 2458/8188 bytes
```

NOTE: Once the MAC address has been set, it cannot be changed without destroying the entire U-Boot environment.

2.3 Setting up TFTP

1. Edit the xinetd.conf file
   - **On Ubuntu**, edit /etc/xinetd.conf and add the following lines just above the line that reads include dir /etc/xinetd.d.

```
service tftp
{
 socket_type = dgram
 protocol = udp
 wait = yes
 user = root
 server = /usr/sbin/in.tftpd
 server_args = -s /tftpboot
 disable = no
}
```

2. Create the /tftpboot folder if it does not exist:

```
mkdir /tftpboot
```

3. Copy the kernel image to the /tftpboot directory:

```
cp /path/to/kernel/image/uImage-t4240mfcs.bin /tftpboot
cp /path/to/kernel/image/uImage-t4240mfcs.dtb /tftpboot

cp /path/to/kernel/image/fsl-image-core-t4240mfcs.ext2.gz.u-boot
/tftpboot
```

4. Restart the xinetd server with the following command:

```
 /etc/init.d/xinetd restart
```

5. Test the TFTP server by setting the environment variables and run the following commands.

```
baudrate=115200

bootargs=root=/dev/ram rw console=ttyS0,115200 rio-scan.scan=0
fsl_fm_max_frm=9600

bootcmd=setenv bootargs root=/dev/mmcblk0p1 rw rootdelay=5 rio-
scan.scan=1 rapidio.hdid=-1
console=$consoledev,$baudrate;mmcinfo;ext2load mmc 0:1 $loadaddr
/boot/$bootfile;ext2load mmc 0:1 $fdtaddr /boot/$fdtfile;bootm
$loadaddr - $fdtaddr

bootdelay=10

bootfile=uImage

consoledev=ttyS0

fdtaddr=0x00c00000

fdtfile=t4240mfcs.dtb

loadaddr=0x1000000

othbootargs=rio-scan.scan=0

setenv ramboot=setenv bootargs root=/dev/ram rw
console=$consoledev,$baudrate fsl_fm_max_frm=9600 $othbootargs;tftp
$ramdiskaddr $ramdiskfile;tftp $loadaddr $bootfile;tftp $fdtaddr
$fdtfile;bootm $loadaddr $ramdiskaddr $fdtaddr

ramdiskaddr=0x02000000

ramdiskfile=ramdisk.uboot

rootpath=/opt/nfsroot
```

6. After setting the ramboot variables run the command.

```
run ramboot
```

3 BMC Interface

3.1 Preparing Board:

1. Attach an RS-232 cable between T4240 UART port and host computer.
2. Open a serial console tool on the host computer to communicate with MFCS.
3. Push the reset button for BMC and the following u-boot console messages appear on the host :

```
 BMC booting  Logs:

U-Boot 2009.01.ast(v0.62)-svn39 (Feb 07 2015 - 13:29:07)

I2C:   ready
DRAM:  64 MB
In:    serial
Out:   serial
Err:   serial
H/W:   AST2400 series chip Rev. 01
Net:   eth_initialize
faradaynic_initialize
Hit any key to stop autoboot:  0
## Booting kernel from Legacy Image at 20080000 ...
Image Name:   Linux-2.6.28.9
Image Type:   ARM Linux Kernel Image (uncompressed)
Data Size:    1842824 Bytes =  1.8 MB
Load Address: 40008000
Entry Point:  40008000
## Loading init Ramdisk from Legacy Image at 20300000 ...
Image Name:
Image Type:   ARM Linux RAMDisk Image (gzip compressed)
Data Size:    3894038 Bytes =  3.7 MB
Load Address: 40800000
Entry Point:  40800000
Loading Kernel Image ... OK
OK

Starting kernel ...

Uncompressing
Linux.................................................................
..................................................
sh: UHCI: unknown operand
sh: UHCI: unknown operand
Starting T4 initialization...
Power sequencing...
T4-power-sequence t4-power-sequence.0: ############# ALL POWERS FOR T4
ARE UP ##############
power sequence successful
Releasing Clock Generator Reset...
Starting clock generation for T4 processor...
```

```
Clock generator is configured Starting T4 reset sequences ...
```

3.2 Upgrading image on BMC

To get the images from server it is necessary to configure the server. This configuration involves

- Create the tftp server.
- Network configuration.

3.3 Steps to flash the image on BMC

1. Boot the BMC and let the kernel up.
2. Set the ip of the BMC by using ifconfig. For e.g.

```
ifconfig eth0 down
ifconfig eth0 192.168.0.45 up
```

3. Check whether the host is connected or not using ping command. To use tftp, host (e.g. laptop) and BMC should be in same domain. *(NOTE: Both server and BMC in same i.e. 192.168.0.x domain)*

```
Ping 192.168.0.81
```

4. If connection is done goto tmp directory. This can be done by

```
cd /tmp
```

5. Get the image from host by executing tftp command

```
tftp  -gr <image name> <host_ip>
```

The image should present in /tftpboot directory in host system.

6. Flash the image to onboard flash memory with the help of following command

```
flashcp -v <image_name> /dev/mtd0
```

Flashing will take some time for erasing, writing and verifying data.

7. Once the flash is done reboot the BMC.

3.4 BMC GUI Description for Dual T4 Server:

1. Connect BMC console.

2. Let BMC and kernel up. Default ip is 192.168.0.45. We can change the default ip by ifconfig eth0 <ip> up.

```
ifconfig eth0 down
ifconfig eth0 192.168.0.45 up
```

3. Now the server starts and opens the URL with the local host ip.
4. And the login page appears on the browser.

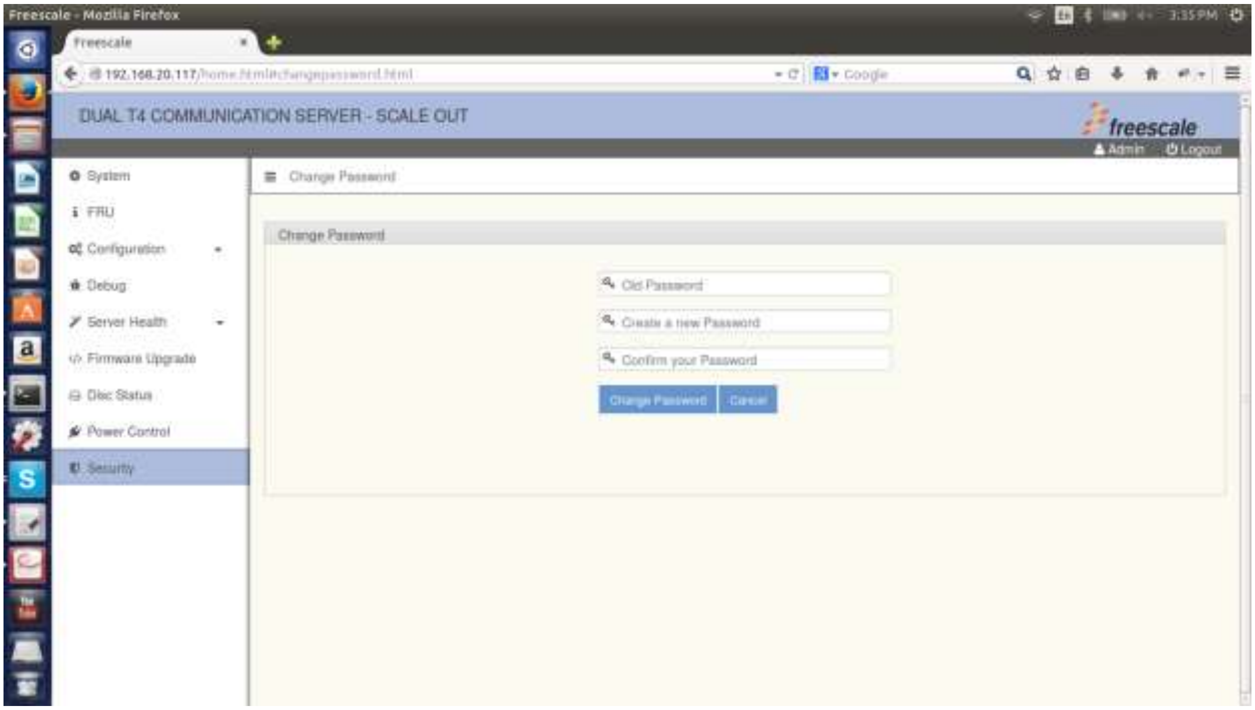
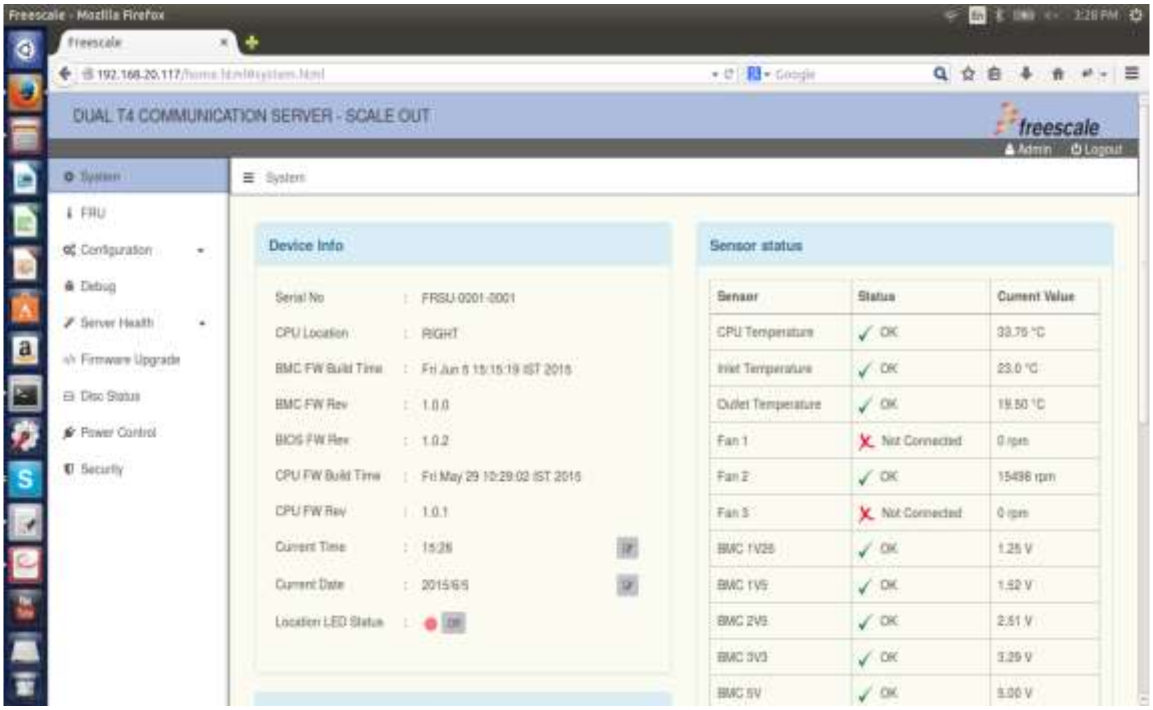


Figure 1 Login screen

5. Enter the user name and password.

```
Username : admin
Password : admin
```

6. On successful login system page will appear on the screen.



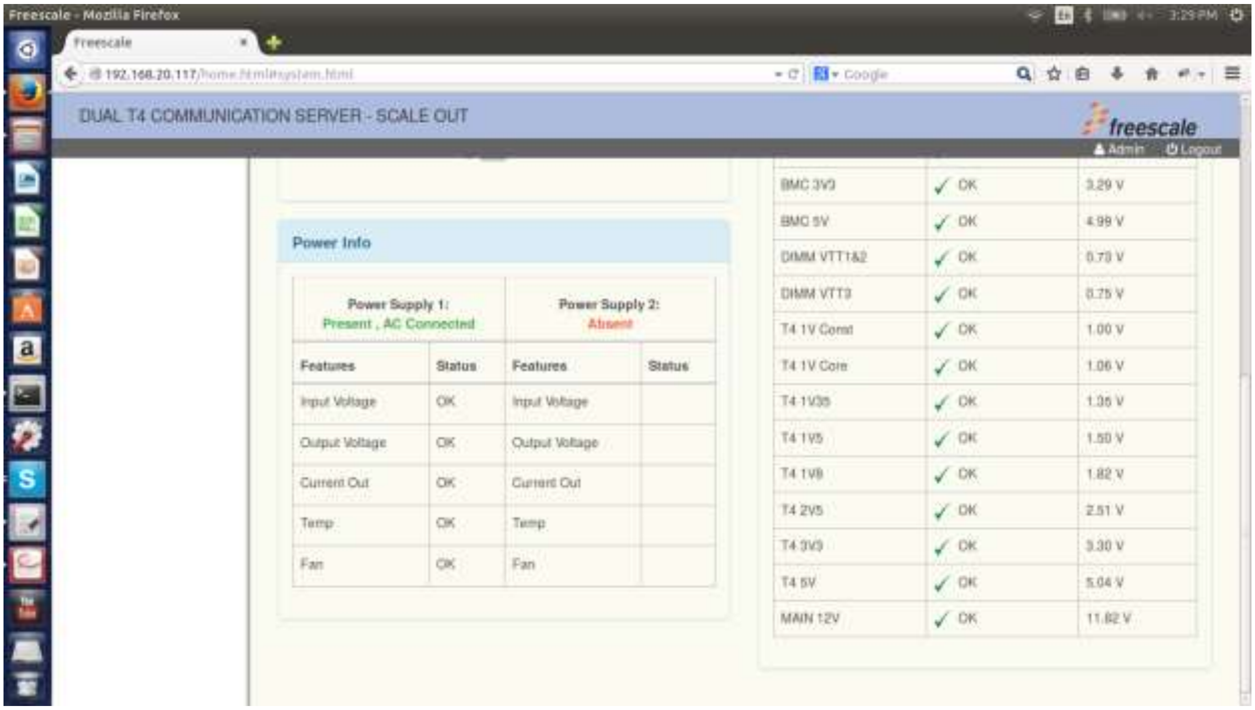
Device Info

Serial No : FRSU-0001-0001
CPU Location : RIGHT
BMC FW Build Time : Fri Jun 5 15:15:19 IST 2015
BMC FW Rev : 1.0.0
BIOS FW Rev : 1.0.2
CPU FW Build Time : Fri May 29 10:29:02 IST 2015
CPU FW Rev : 1.0.1
Current Time : 15:28
Current Date : 2015/6/5
Location LED Status : ● Off

Sensor status

Sensor	Status	Current Value
CPU Temperature	✓ OK	33.75 °C
Inlet Temperature	✓ OK	23.0 °C
Outlet Temperature	✓ OK	19.50 °C
Fan 1	✗ Not Connected	0 rpm
Fan 2	✓ OK	15496 rpm
Fan 3	✗ Not Connected	0 rpm
BMC 1V25	✓ OK	1.25 V
BMC 1V5	✓ OK	1.52 V
BMC 2V5	✓ OK	2.51 V
BMC 3V3	✓ OK	3.29 V
BMC 5V	✓ OK	5.00 V

Figure 2 System Page 1


Freescale - Mozilla Firefox
Freescale
192.168.20.117/home.html#system.html
Google
3:29 PM
DUAL T4 COMMUNICATION SERVER - SCALE OUT
freescale
Admin
Logout

Power Info

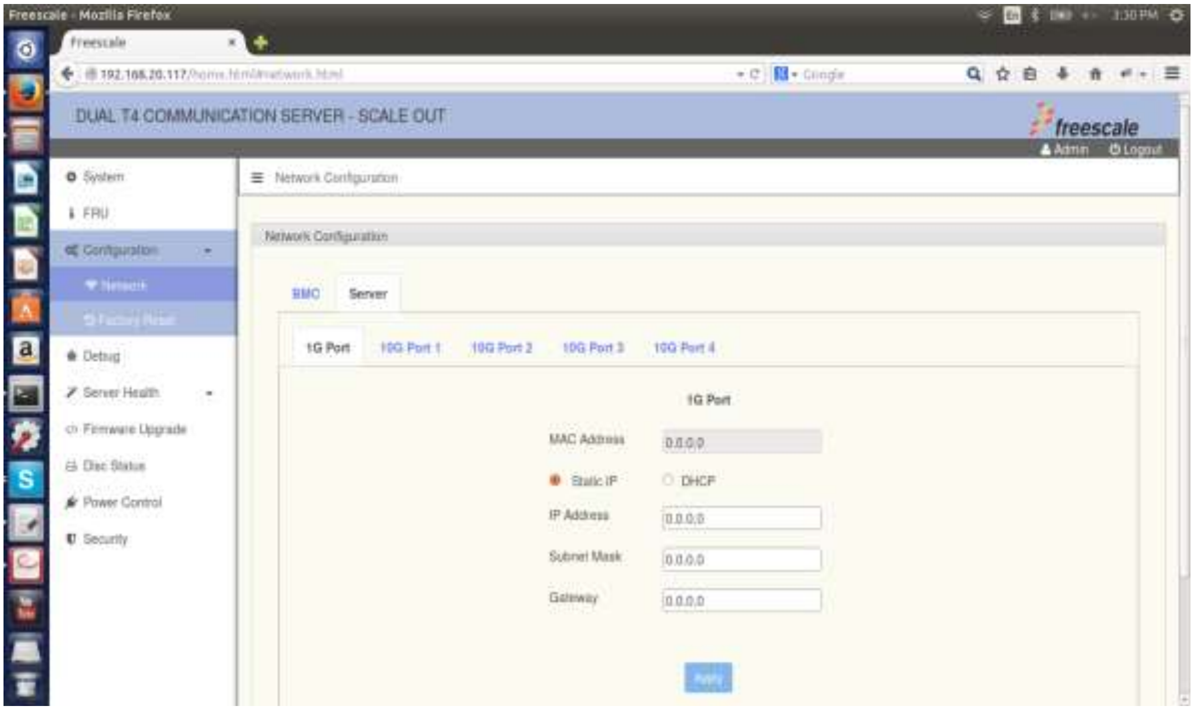
Power Supply 1: Present , AC Connected		Power Supply 2: Absent	
Features	Status	Features	Status
Input Voltage	OK	Input Voltage	
Output Voltage	OK	Output Voltage	
Current Out	OK	Current Out	
Temp	OK	Temp	
Fan	OK	Fan	

BMC 3V3	✓ OK	3.29 V
BMC 5V	✓ OK	4.99 V
DIMM VTT1&2	✓ OK	0.73 V
DIMM VTT3	✓ OK	0.75 V
T4 1V Const	✓ OK	1.00 V
T4 1V Core	✓ OK	1.06 V
T4 1V35	✓ OK	1.35 V
T4 1V5	✓ OK	1.50 V
T4 1V8	✓ OK	1.82 V
T4 2V5	✓ OK	2.51 V
T4 3V3	✓ OK	3.30 V
T4 5V	✓ OK	5.04 V
MAIN 12V	✓ OK	11.82 V

Figure 3 System Page 2

7. System page displays details of server and BMC like serial number, CPU location, BMC FW build time, CPU FW build time, software version of BMC & CPU etc, it displays status of voltage, temperature and power supply unit status.

8. Network Configuration for 1G and 10G ports: Displays the Mac address. IP, Subnet Mask, Gateway of the particular port. There is option to choose static and dynamic. If static, the MAC, IP, Subnet mask and gateway will be default. If dynamic, one can change it and click on apply to apply the changes.



Network Configuration

1G Port

MAC Address: 0.0.0.0

● Static IP ○ DHCP

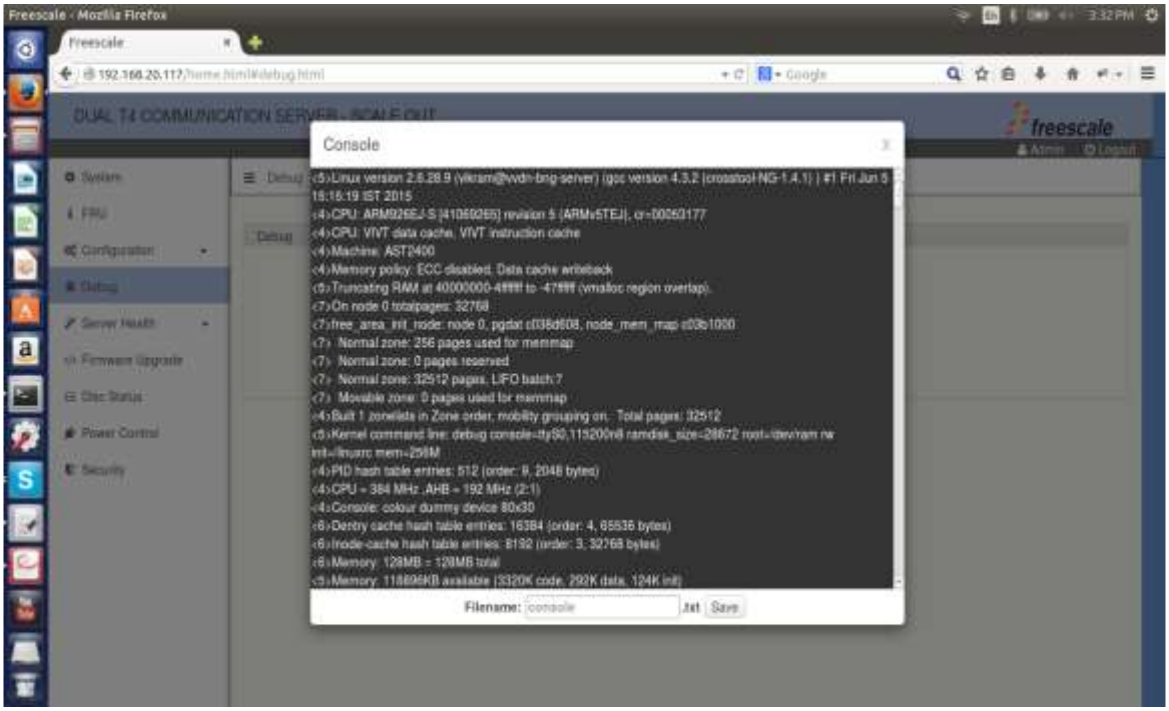
IP Address: 0.0.0.0

Subnet Mask: 0.0.0.0

Gateway: 0.0.0.0

Figure 4 Network Configuration

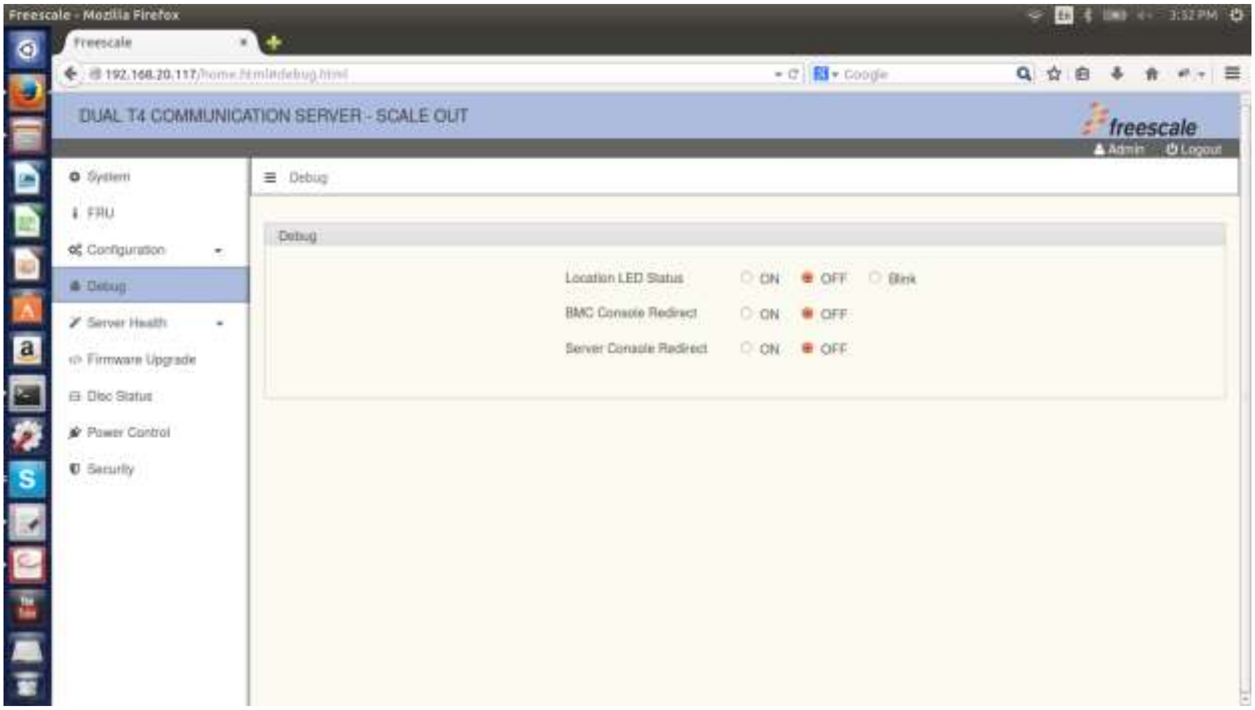
9. Debug console on BMC: Display the location led status (ON/OFF/Blink). Displays the console logs of BMC and Server. The server and BMC logs can be saved as text file. To save the logs click on ON button one prompt will be displayed just click on save.



```
<5>Linux version 2.6.28.9 (vikram@vvdn-bng-server) (gcc version 4.3.2 (crosstool-NG-1.4.1) ) #1 Fri Jun 5
15:16:19 IST 2015
<4>CPU: ARM926EJ-S [41069265] revision 5 (ARMv5TEJ), cr=00053177
<4>CPU: VIVT data cache, VIVT instruction cache
<4>Machine: AST2400
<4>Memory policy: ECC disabled, Data cache writeback
<5>Truncating RAM at 40000000-4fffffff to -47ffffff (vmalloc region overlap).
<7>On node 0 totalpages: 32768
<7>free_area_init_node: node 0, pgdat c038d608, node_mem_map c03b1000
<7>  Normal zone: 256 pages used for memmap
<7>  Normal zone: 0 pages reserved
<7>  Normal zone: 32512 pages, LIFO batch:7
<7>  Movable zone: 0 pages used for memmap
<4>Built 1 zonelists in Zone order, mobility grouping on.  Total pages: 32512
<5>Kernel command line: debug console=ttyS0,115200n8 ramdisk_size=28672 root=/dev/ram rw
init=/linuxrc mem=256M
<4>PID hash table entries: 512 (order: 9, 2048 bytes)
<4>CPU = 384 MHz ,AHB = 192 MHz (2:1)
<4>Console: colour dummy device 80x30
<6>Dentry cache hash table entries: 16384 (order: 4, 65536 bytes)
<6>Inode-cache hash table entries: 8192 (order: 3, 32768 bytes)
<6>Memory: 128MB = 128MB total
<5>Memory: 118696KB available (3320K code, 292K data, 124K init)
```

Filename: console .txt

Figure 5 Debug Screen with prompt box to save the logs

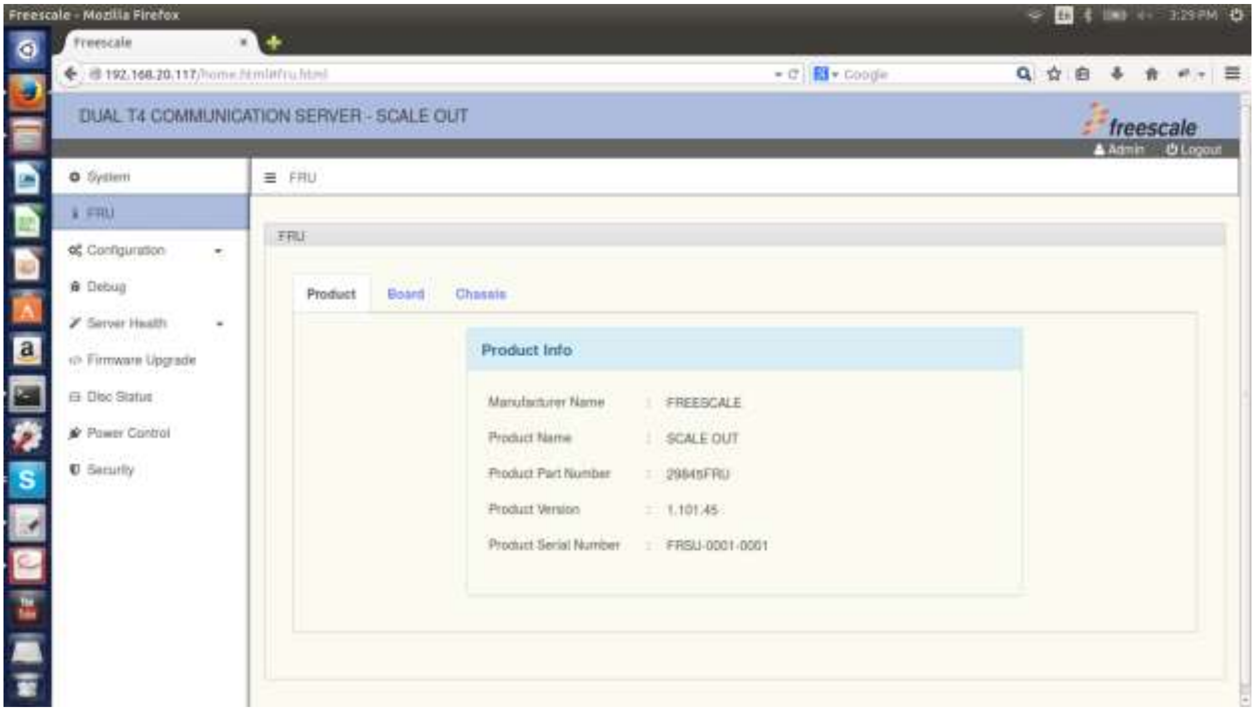


Location LED Status ○ ON ● OFF ○ Blink

BMC Console Redirect ○ ON ● OFF

Server Console Redirect ○ ON ● OFF

Figure 6 Debug Screen



Product Info

Manufacturer Name : FREESCALE

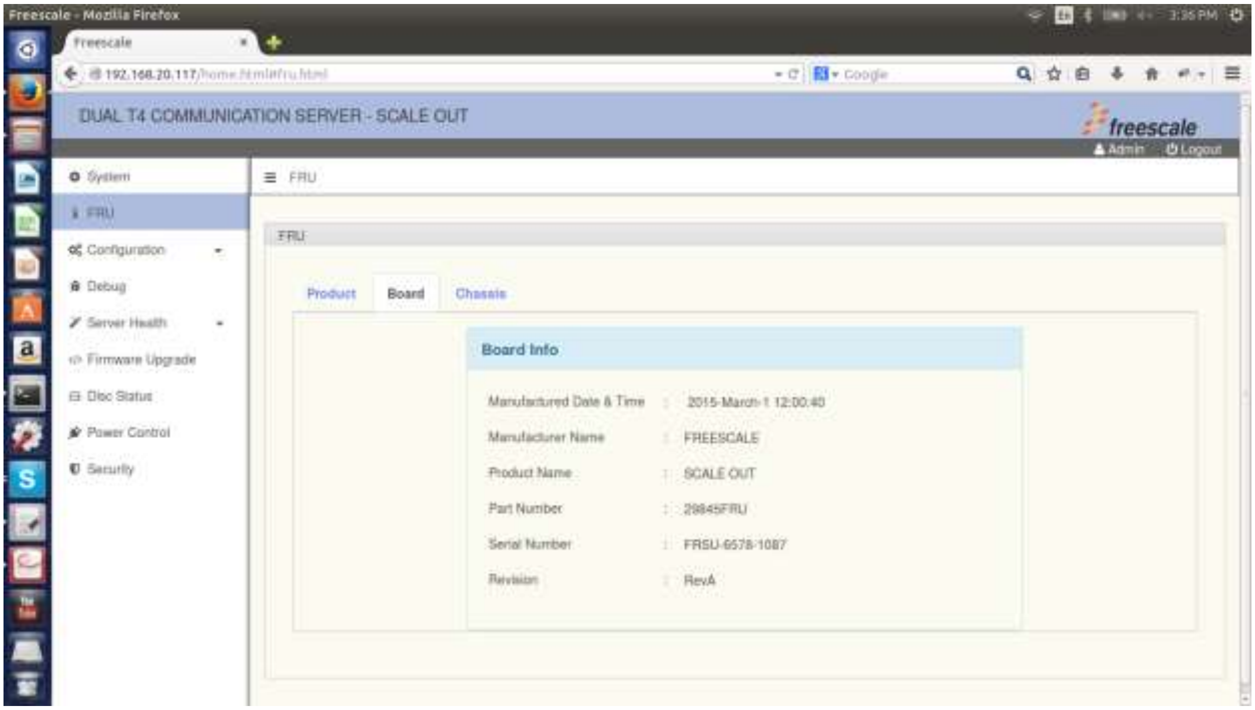
Product Name : SCALE OUT

Product Part Number : 29845FRU

Product Version : 1.101.45

Product Serial Number : FRSU-0001-0001

Figure 7 T4 Server: Product Details



Board Info

Manufactured Date & Time : 2015-March-1 12:00:40

Manufacturer Name : FREESCALE

Product Name : SCALE OUT

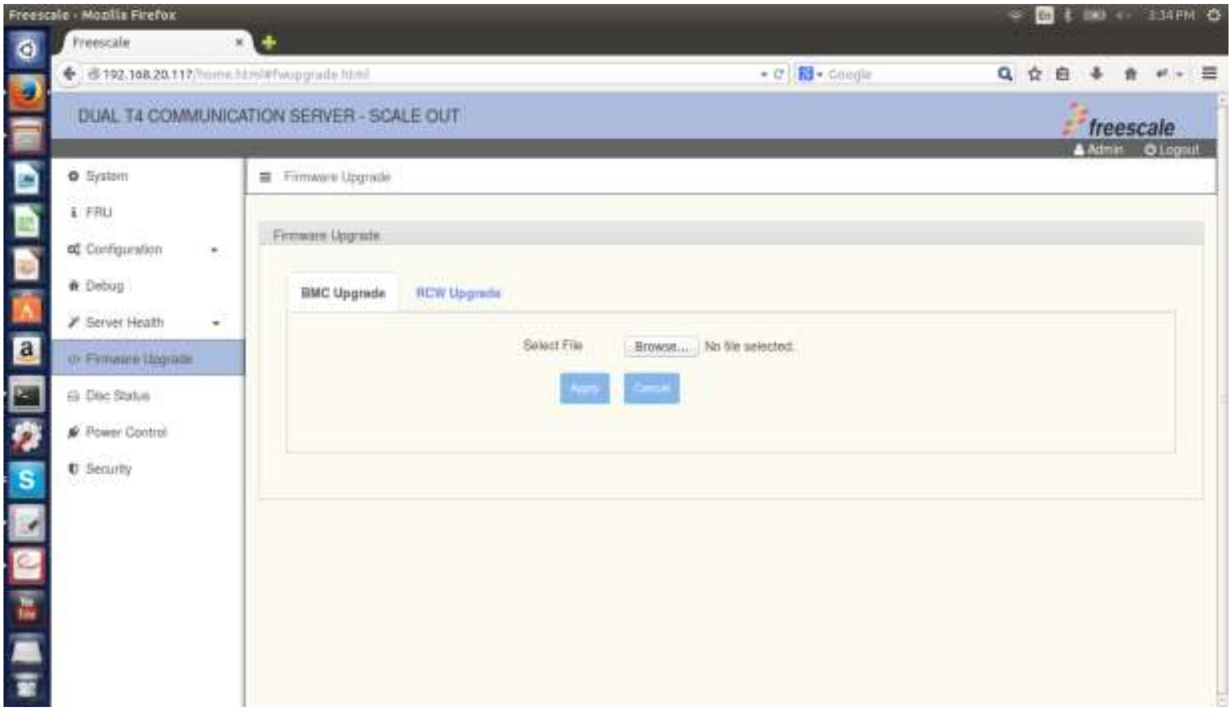
Part Number : 29845FRU

Serial Number : FRSU-6578-1087

Revision : RevA

Figure 8 Board Details

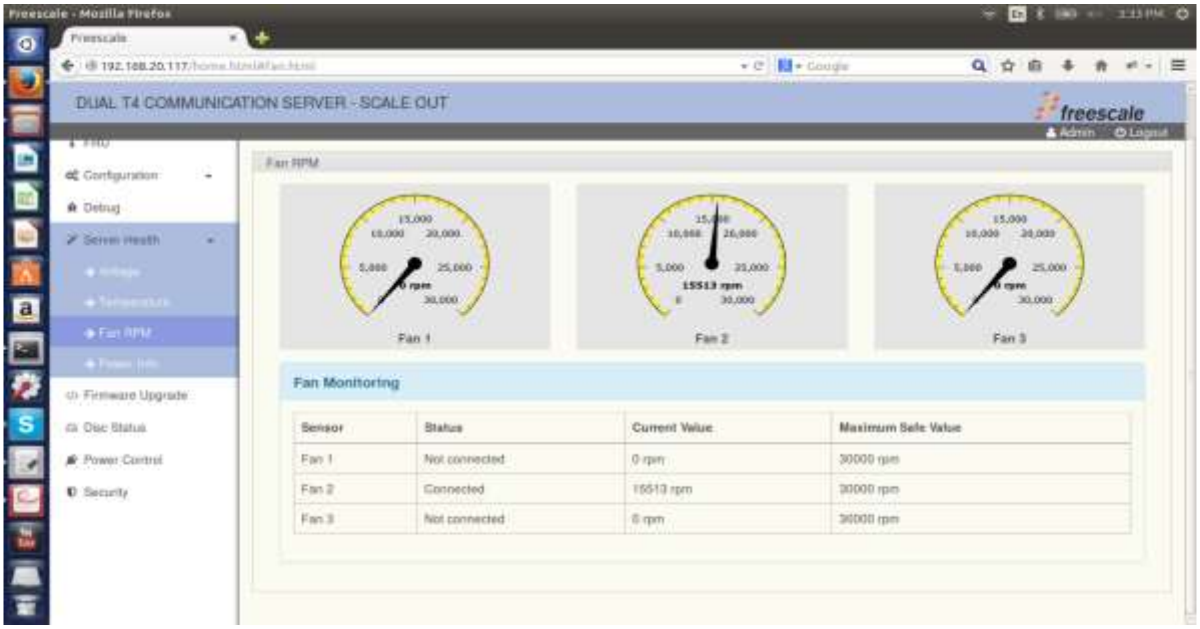
10. Firmware Upgrade: For upgrading BMC and RCW select the file and the loading symbol it will show. Upgrading will take some time.



Select File No file selected.

Figure 9 Firmware Upgrade

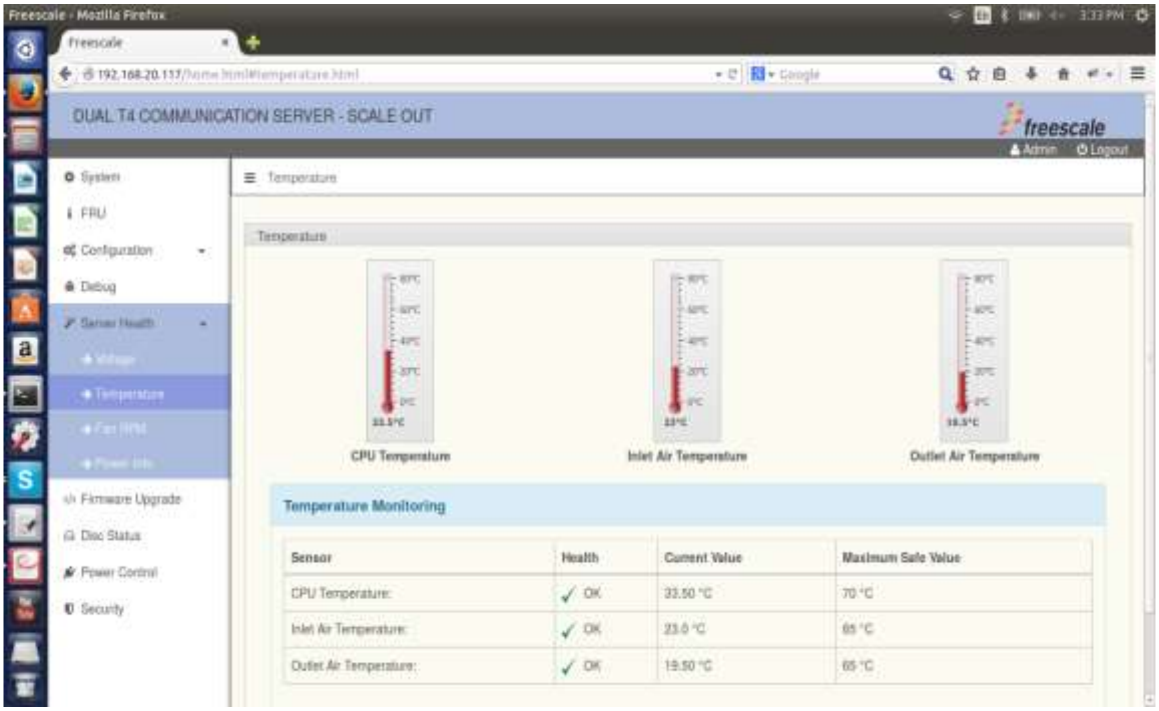
11. Fan, Voltage and temperature Monitoring for checking the BMC status Fan page has details of RPM & also status of RPM is within the specified range. Temperature page displays the server temperature, inlet temperature& outlet temperature and also displays the status as OK if it is within the range & fault if it exceeds range. Voltage will display all the current values.



Fan Monitoring

Sensor	Status	Current Value	Maximum Safe Value
Fan 1	Not connected	0 rpm	30000 rpm
Fan 2	Connected	15513 rpm	30000 rpm
Fan 3	Not connected	0 rpm	30000 rpm

Figure 10 Fan Monitoring



Temperature Monitoring

Sensor	Health	Current Value	Maximum Safe Value
CPU Temperature:	✓ OK	33.50 °C	70 °C
Inlet Air Temperature:	✓ OK	23.0 °C	65 °C
Outlet Air Temperature:	✓ OK	19.50 °C	65 °C

Figure 11 Temperature Monitoring

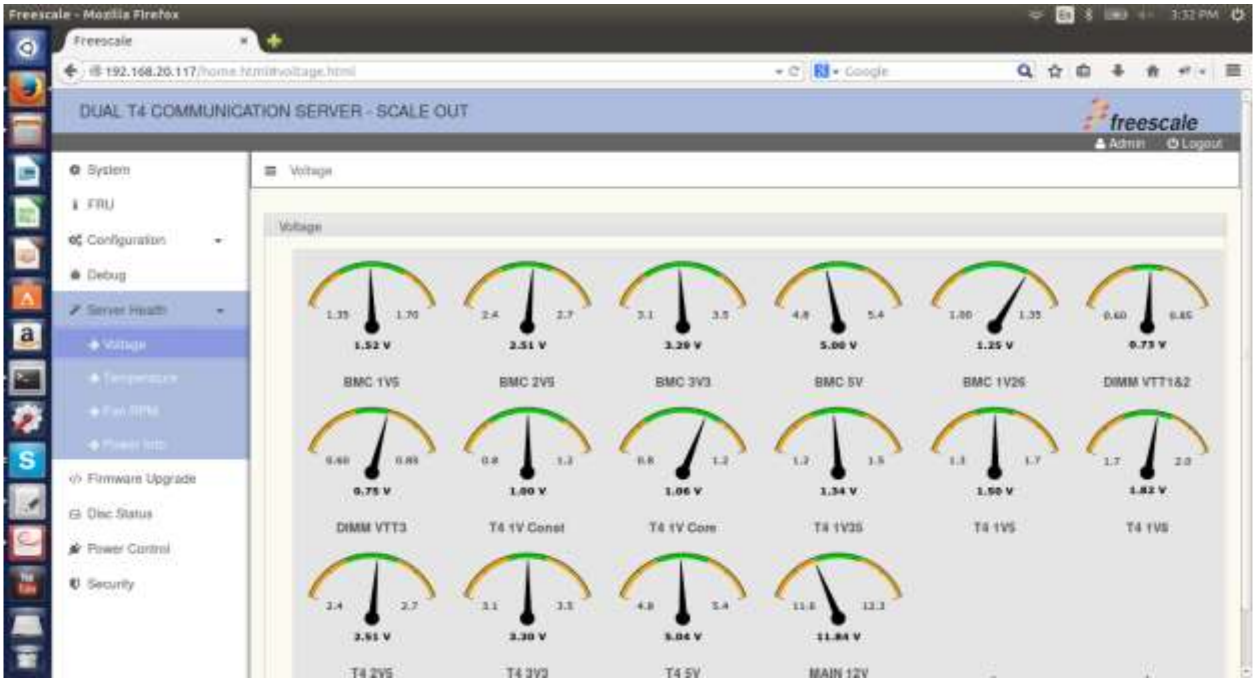


Figure 12 Voltage Monitoring

12. Power Control Mode: For power enabling or reset on server there is server power control showing on the GUI screen and for BMC reset there is a reset control button on BMC Power Control.

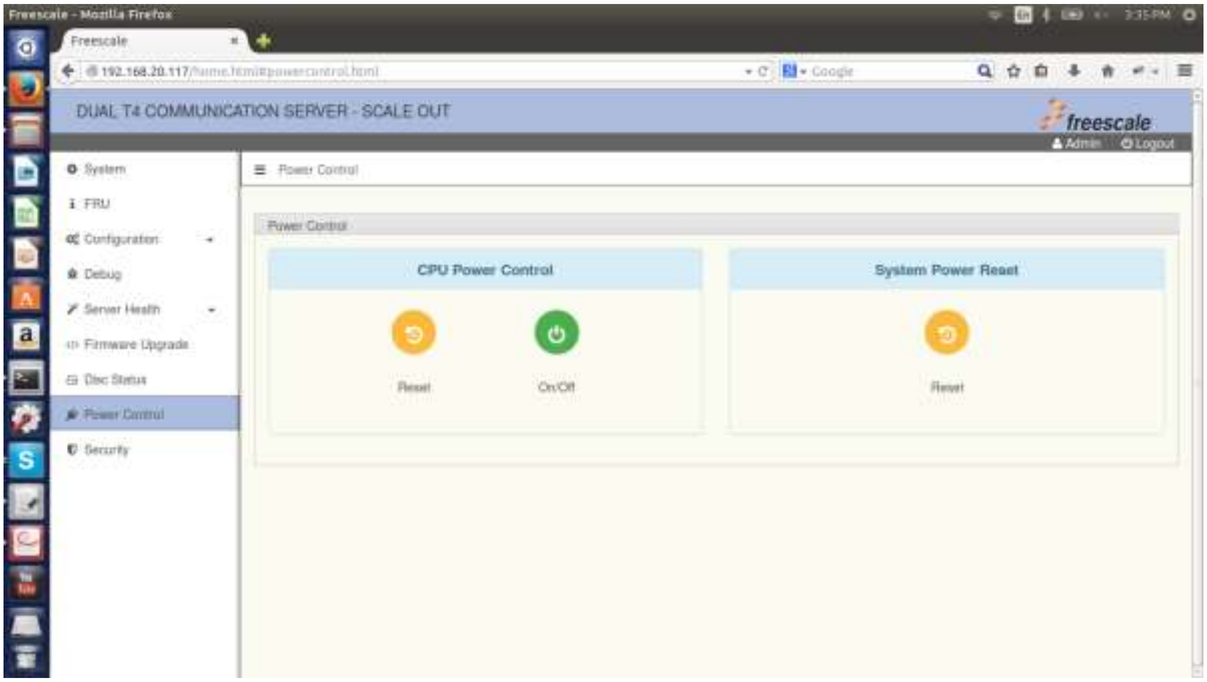
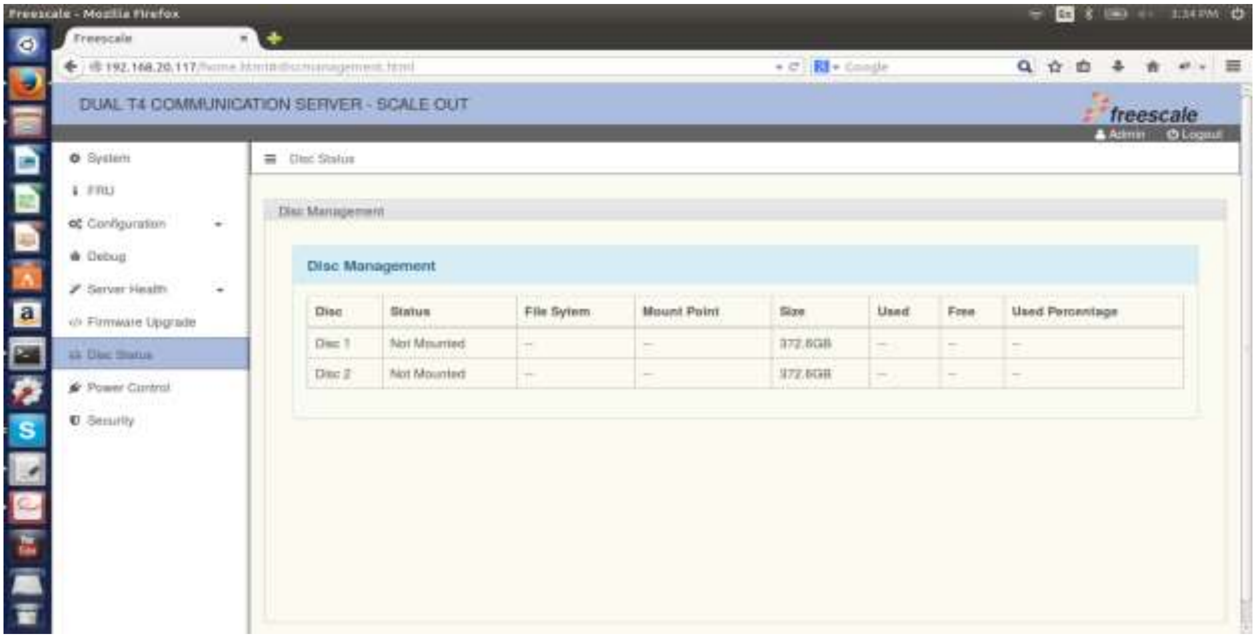


Figure 13 Power on/off and reset

13. Disc Management utility: For showing the disc utility on server.



Disc Management

Disc	Status	File Sytem	Mount Point	Size	Used	Free	Used Percentage
Disc 1	Not Mounted	--	--	372.6GB	--	--	--
Disc 2	Not Mounted	--	--	372.6GB	--	--	--

Figure 14 Disc Status

4 MFCS Booting Options

Multifunction Communication server booting options

- NOR Flash
- EEPROM Flash
- SD Card

4.1 NOR FLASH

MEMORY MAP for T4240 MFCS NOR Flash:

The addresses below are effective addresses as mapped by u-boot.

Range Start	Range End	Definition	Size(KB)
EC000000	EC01FFFF	RCW	112
EFF40000	EFFFFFFF	U-Boot	768
EFF00000	EFF1FFFF	FMAN	3167
EC020000	EC7FFFFF	uImage	5093
ED300000	EFDFFFFF	Rootfs	32368
EC800000	ED2FFFFF	DTB	629

Board can be boot from NOR Flash. Selections can be done by jumper settings. Commands for programming images in NOR flash:

```
# tftp 1000000 <Image>
# protect off   <start addr>   <end address>
# erase  <start addr>   <end address>
# cp.b 1000000 <start addr>   $filesize
```

4.2 Switch setting for server1 and server2 for NOR Flash

For server 1:

DIP Switch	**7**	**8**	**9**	**10**	**11**	**12**
SW7	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**
SW8	**Off**	**Off**	**Off**	**On**	**Off**	**On**

For server 2:

DIP Switch	7	8	9	10	11	12
SW5	Off	Off	Off	Off	Off	Off
SW6	Off	Off	Off	On	Off	On

4.3 NOR FLASH

When SD Card is used as a booting device NOR Flash can be tested at u-boot prompt with following commands. NOR Flash is the primary booting option which contains RCW,U-boot,U-boot env, fman code etc

To read nor flash

```
cp {source address} {target address} {count}
```

To write nor flash

```
mw {source address} {target address or data to be written} {count}
```

To erase NOR Flash

```
Erase {start address} {end address}
```

4.4 EEPROM FLASH

4.4.1 Switch setting for server1 and server2 for EEPROM Flash

For server 1:

DIP Switch	7	8	9	10	11	12
SW7	Off	Off	Off	Off	Off	Off
SW8	Off	On	On	Off	On	Off

For server 2:

DIP Switch	7	8	9	10	11	12
SW5	Off	Off	Off	Off	Off	Off
SW6	Off	On	On	Off	On	Off

5 Configuration and compilation

5.1 Compile u-boot for SD card

1. Goto SDK 1.6 and run the command on the following path:

```
home/root/sdk-path/build_t4240mfcs_release/tmp/work/t4240mfcs-fsl-
linux/u-boot/2014.01+fslgit-r0/git

make ARCH=powerpc CROSS_COMPILE =/home/root/sdk-path/
build_t4240mfcs_release/tmp/sysroots/x86_64-linux/usr /bin/ppce6500-
fsl-linux/powerpc-fsl-linux- T4240MFCS_SDCARD
```

2. If build is successful then for u-boot binary image goto the path:

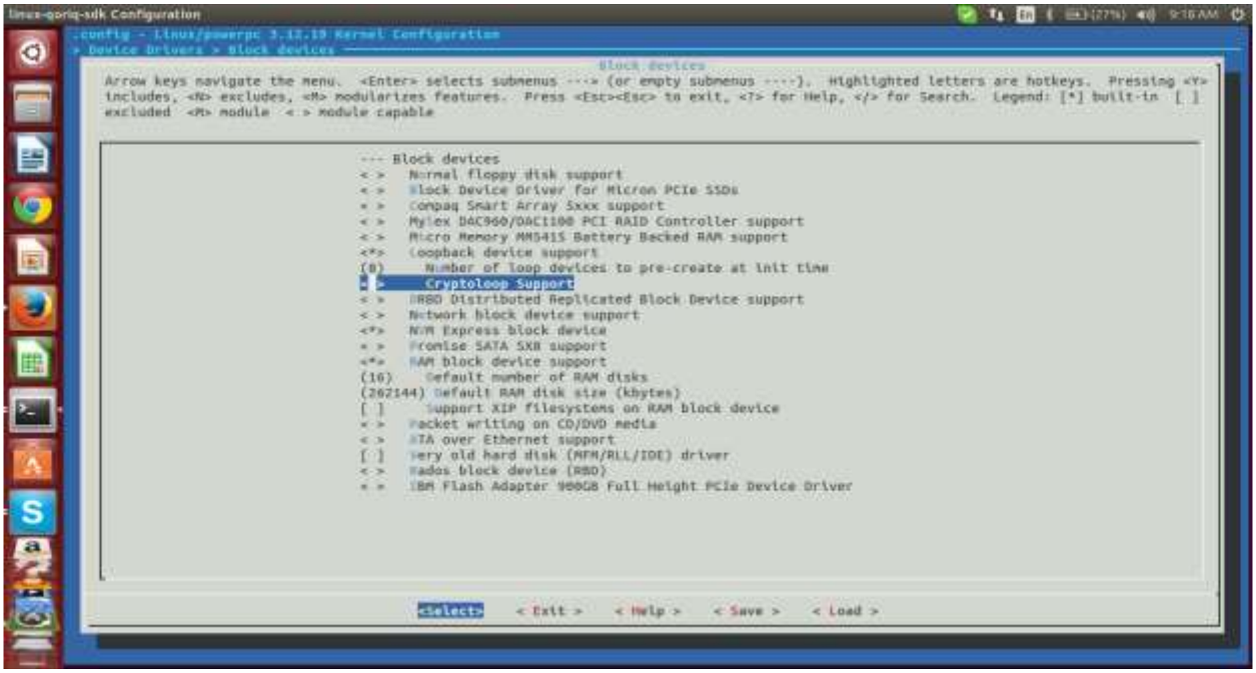
```
In home/root/sdk-path/build_t4240mfcs_release/tmp/work/t4240mfcs-fsl-
linux/u-boot/2014.01+fslgit-r0/git

we will get the following binary on the above mentioned path:
u-boot-with-spl-pbl.bin
```

5.2 Build Linux Kernel and device tree

Configure the Linux kernel with default setting:

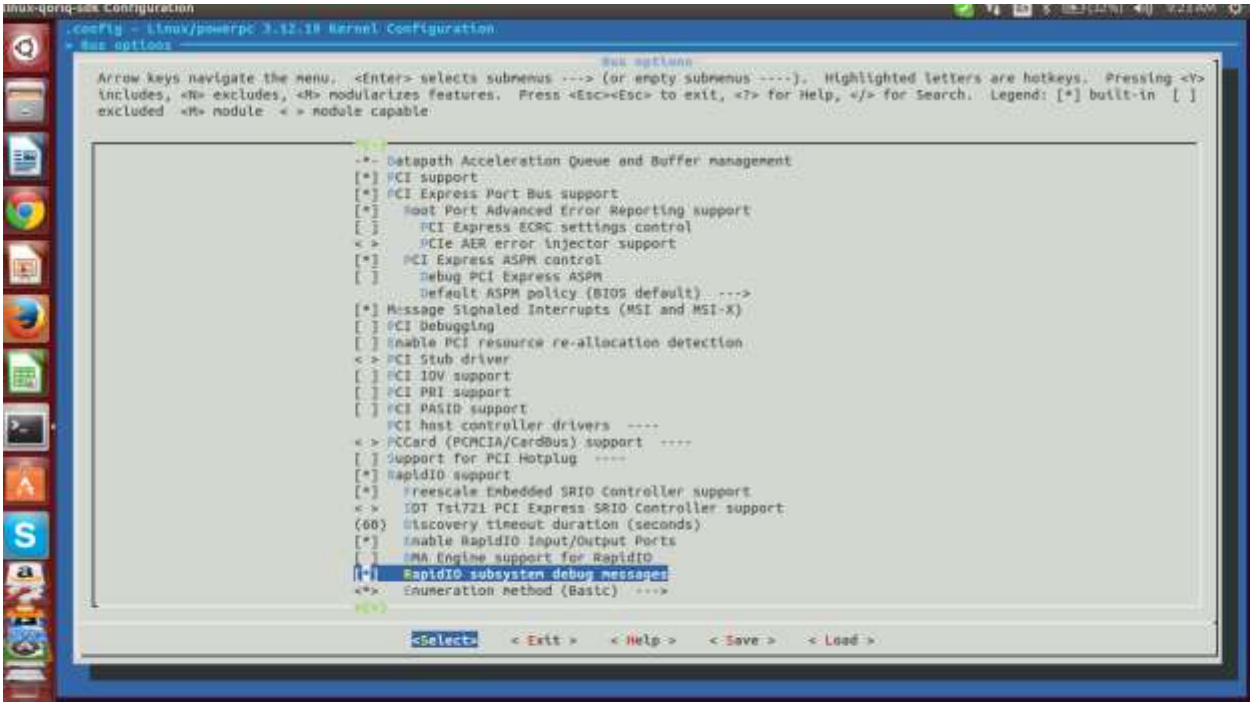
1. Run the config command on Linux kernel.

Enable the following for NVME and Rapid IO support in device by following command:



```
linux-qoriq-sdk Configuration
.config - Linux/powerpc 3.12.19 Kernel Configuration
> Device Drivers > Block devices
                                   Block devices
  Arrow keys navigate the menu.  <Enter> selects submenus ---> (or empty submenus ----).  Highlighted letters are hotkeys.  Pressing <Y>
  includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for Search.  Legend: [*] built-in  [ ]
  excluded  <M> module  < > module capable

                    --- Block devices
                    < >   Normal floppy disk support
                    < >   Block Device Driver for Micron PCIe SSDs
                    < >   Compaq Smart Array 5xxx support
                    < >   Mylex DAC960/DAC1100 PCI RAID Controller support
                    < >   Micro Memory MM5415 Battery Backed RAM support
                    <*>   Loopback device support
                    (8)     Number of loop devices to pre-create at init time
                    < >     Cryptoloop Support
                    < >   DRBD Distributed Replicated Block Device support
                    < >   Network block device support
                    <*>   NVM Express block device
                    < >   Promise SATA SX8 support
                    <*>   RAM block device support
                    (16)    Default number of RAM disks
                    (262144) Default RAM disk size (kbytes)
                    [ ]     Support XIP filesystems on RAM block device
                    < >   Packet writing on CD/DVD media
                    < >   ATA over Ethernet support
                    [ ]   Very old hard disk (MFM/RLL/IDE) driver
                    < >   Rados block device (RBD)
                    < >   IBM Flash Adapter 900GB Full Height PCIe Device Driver

                 <Select>    < Exit >    < Help >    < Save >    < Load >
```

Figure 15 Configuration for NVME



```
linux-qoriq-sdk Configuration
.config - Linux/powerpc 3.12.19 Kernel Configuration
> Bus options
                                   Bus options
  Arrow keys navigate the menu.  <Enter> selects submenus ---> (or empty submenus ----).  Highlighted letters are hotkeys.  Pressing <Y>
  includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </> for Search.  Legend: [*] built-in  [ ]
  excluded  <M> module  < > module capable

                    -*- Datapath Acceleration Queue and Buffer management
                    [*] PCI support
                    [*] PCI Express Port Bus support
                    [*]   Root Port Advanced Error Reporting support
                    [ ]     PCI Express ECRC settings control
                    < >     PCIe AER error injector support
                    [*]   PCI Express ASPM control
                    [ ]     Debug PCI Express ASPM
                            Default ASPM policy (BIOS default)  --->
                    [*] Message Signaled Interrupts (MSI and MSI-X)
                    [ ] PCI Debugging
                    [ ] Enable PCI resource re-allocation detection
                    < > PCI Stub driver
                    [ ] PCI IOV support
                    [ ] PCI PRI support
                    [ ] PCI PASID support
                        PCI host controller drivers  ----
                    < > PCCard (PCMCIA/CardBus) support  ----
                    [ ] Support for PCI Hotplug  ----
                    [*] RapidIO support
                    [*]   Freescale Embedded SRIO Controller support
                    < >   IDT Tsi721 PCI Express SRIO Controller support
                    (60)  Discovery timeout duration (seconds)
                    [*]   Enable RapidIO Input/Output Ports
                    [ ]   DMA Engine support for RapidIO
                    [*]   RapidIO subsystem debug messages
                    <*>   Enumeration method (Basic)  --->

                 <Select>    < Exit >    < Help >    < Save >    < Load >
```

Figure 16 Configuration For RapidIO Support

```
bitbake -f -c menuconfig virtual/kernel

To compile Linux kernel run the command:

bitbake -f -c compile virtual/kernel

bitbake virtual/kernel
```

5.3 Build Root File System

1. Run the following command to build the root file system:

```
bitbake fsl-image-core
```

5.4 Switch Setting on T4240mfcs board for server1 and server2 for SD Card

For server 1:

DIP Switch	**1**	**2**	**3**	**4**	**5**	**6**
SW7	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**
SW8	**Off**	**On**	**On**	**On**	**On**	**On**

For server 2:

DIP Switch	**1**	**2**	**3**	**4**	**5**	**6**
SW5	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**
SW6	**Off**	**On**	**On**	**On**	**On**	**On**

6 Startup u-boot

6.1 Program SD Card

1. Create one ext2 (/dev/sdb1) partition in SD card.
2. Flash u-boot image into SD Card.

```
sudo dd if=u-boot-with-spl-pbl.bin of=/dev/sdb seek=8 count=1560
bs=512
```

3. Flash fman code into SD card

```
sudo dd if=fsl_fman_ucode_t4240_r2.0_106_4_10.bin of=/dev/sdb
seek=3000  bs=512
```

4. Flash rootfs into SD card
5. Copy fsl-image-core-t4240rdb-20141031084308.rootfs.tar.gz into SD card partition (/dev/sdb1)
6. Extract rootfs by using following command

```
sudo tar –xvf   fsl-image-core-t4240rdb-20141031084308.rootfs.tar.gz
```

7. Flash uImage into SD card

   Copy **uImage** into /boot directory of rootfs

8. Flash dtb file into SD card

   Copy **t4240mfcs.dtb** into /boot directory of rootfs

9. Plug SD card into mmc slot of board
10. Boot the board and catch u-boot prompt
11. Command line parameter to be set at u-boot prompt

```
setenv bootcmd 'setenv bootargs root=/dev/mmcblk0p1 rw rootdelay=5
console=$consoledev, $baudrate; mmcinfo; ext2load mmc 0:1 $loadaddr
/boot/$bootfile; ext2load mmc 0:1 $fdtaddr /boot/$fdtfile; bootm
$loadaddr - $fdtaddr'
```

12. Set environment variables on Server 1 and Server 2.
13. Run following command to load uImage ,t4240mfcs.dtb and rootfs

```
  # run bootcmd
```

6.2 Startup u-boot from SD card

```
T4240MFCS SD BOOT

U-Boot 2014.01QorIQ-SDK-V1.6+gfe1d4f5 (May 27 2015 - 14:18:15)
```

```
CPU0:  T4240E, Version: 2.0, (0x82480020)
Core:  e6500, Version: 2.0, (0x80400120)
Clock Configuration:
    CPU0:1666.667 MHz, CPU1:1666.667 MHz, CPU2:1666.667 MHz,
CPU3:1666.667 M
    CPU4:1666.667 MHz, CPU5:1666.667 MHz, CPU6:1666.667 MHz,
CPU7:1666.667 M
    CPU8:1666.667 MHz, CPU9:1666.667 MHz, CPU10:1666.667 MHz,
CPU11:1666.667
       CCB:733.333 MHz,
    DDR:933.333 MHz (1866.667 MT/s data rate) (Asynchronous),
IFC:183.333 MHz
       FMAN1: 733.333 MHz
       FMAN2: 733.333 MHz
       QMAN:  366.667 MHz
       PME:   533.333 MHz
L1:    D-cache 32 KiB enabled
       I-cache 32 KiB enabled
Reset Configuration Word (RCW):
       00000000: 16070019 18101916 00000000 00000000
       00000010: 70702828 40555200 0c020000 f5000000
       00000020: 00000000 ee0000ee 00000000 000287fe
       00000030: 00000440 10000009 00000000 00000028
Board: T4240MFCS, SERDES Reference Clocks:
       SERDES1=100MHz SERDES2=156.25MHz
       SERDES3=(PLL1=125MHz,PLL2=156.2MHz)
SERDES4=(PLL1=125,PLL2=100MHz)
I2C:   ready
SPI:   ready
DRAM:  Detected UDIMM D3-66JK118SV-13
Detected UDIMM D3-66JK118SV-13
Detected UDIMM D3-66JK118SV-13
10 GiB left unmapped
12 GiB (DDR3, 64-bit, CL=13, ECC on)
       DDR Controller Interleaving Mode: 3-way 4KB
       DDR Chip-Select Interleaving Mode: CS0+CS1
Flash: Flash_Init
128 MiB
L2:    2 MiB enabled
enable l2 for cluster 1 fec60000
enable l2 for cluster 2 feca0000
Corenet Platform Cache: 1.5 MiB enabled
Using SERDES1 Protocol: 28 (0x1c)
Using SERDES2 Protocol: 56 (0x38)
Using SERDES3 Protocol: 5 (0x5)
Using SERDES4 Protocol: 5 (0x5)
SRIO1: enabled
SRIO2: enabled
EC1 FM2 DTSEC5NAND:  0 MiB
MMC:  FSL_SDHC: 0
Backplane Configuration
Check SerDes Configuration for PCIe 1
Setting LAW BAR
PCIe1: Root Complex,
@@ LTSSM1=0x00.

@@ 0xfe240f14=0x90000000.
no link, regs @ 0xfe240000
PCIe1: Bus 00 - 00
PCIe1: busno 1
```

```
Check SerDes Configuration for PCIe 3
Setting LAW BAR
PCIe3: Root Complex,
@@ LTSSM1=0x11.

@@ 0xfe240f14=0x90000000.
x4 gen2, regs @ 0xfe260000
  02:00.0     - 10b5:8724 - Bridge device
   03:01.0    - 10b5:8724 - Bridge device
    04:00.0   - 10b5:87b0 - Bridge device
   03:02.0    - 10b5:8724 - Bridge device
    05:00.0   - 8086:0953 - Mass storage controller
   03:03.0    - 10b5:8724 - Bridge device
    06:00.0   - 8086:0953 - Mass storage controller
   03:08.0    - 10b5:8724 - Bridge device
   03:09.0    - 10b5:8724 - Bridge device
   03:0a.0    - 10b5:8724 - Bridge device
PCIe3: Bus 01 - 09
PCIe3: busno 10
PCIe4: disabled
PCIe4: busno
In:    serial
Out:   serial
Err:   serial
Net:   Fman1: Uploading microcode version 106.4.14
PHY reset timed out
PHY reset timed out
Fman2: Uploading microcode version 106.4.14
PHY reset timed out
PHY reset timed out

FM1@DTSEC1 [PRIME], FM1@TGEC1, FM1@TGEC2, FM2@TGEC1, FM2@TGEC2

Hit any key to stop autoboot:  0
```

The system auto boots and shows the following Linux login screens.

```
t4240mfcs login: root
root@t4240mfcs:~#
```

6.3 U-boot Prompt Commands:

Following commands are used to check the interfaces or load the addresses on the u-boot prompt. If we want to set the environment variables we can use different commands like editenv, setenv etc.
For booting the kernel from memory we can use bootm, boot etc.

```
=> help
boot - boot default, i.e., run 'bootcmd'
bootd - boot default, i.e., run 'bootcmd'
bootm - boot application image from memory
echo - echo args to console
editenv - edit environment variable
exit - exit script
ext2load- load binary file from a Ext2 filesystem
fdt - flattened device tree utility commands
func - execute func
i2c - I2C sub-system
interrupts- enable or disable interrupts
Irqinfo - print information about IRQs
itest - return true/false on integer compare
loadb - load binary file over serial line (kermit mode)
loady - load binary file over serial line (ymodem mode)
mac - display and program the system ID and MAC addresses in EEPROM
md - memory display
mii - MII utility commands
mm - memory modify (auto-incrementing address)
mmc - MMC sub system
mmcinfo - mmcinfo <dev num>-- display MMC info
mtest - simple RAM read/write test
mw - memory write (fill)
nfs - boot image via network using NFS protocol
nm - memory modify (constant address)
pci - list and access PCI Configuration Space
ping - send ICMP ECHO_REQUEST to network host
printenv- print environment variables
rarpboot- boot image via network using RARP/TFTP protocol
reset - Perform RESET of the CPU
run - run commands in an environment variable
saveenv - save environment variables to persistent storage
setenv - set environment variables
```

```
source - run script from memory
test - minimal test like /bin/sh
tftpboot- boot image via netw
usbboot - boot from USB device
```

6.4 I2C Interface

1. Chip Probe

```
i2c dev 0
Setting bus to 0

i2c probe
Valid chip addresses:
i2c dev 1
Setting bus to 1

i2c probe
Valid chip addresses: 1A 1B 1C 32 33 34 52 53 54 68 70

i2c dev 2
Setting bus to 2

i2c probe
Valid chip addresses: 1B 24 33 53 60 62

70 – I2c multiplex
68 – RTC
60 & 62 – PCI retimer
24 – GPIO Expander
```

6.5 DDR3 SPD

1. Chip Probe:

   The DDR3 SPD address is 52h,53h,54h (8-bit), and it can be accessed at I2C#2.

2. Read SPD

   If we want to check the SPD information or DDR information we can use the following command to check or read we will get the output as mentioned:

```
 i2c md 52 0 100

0000: 92 13 0b 02 03 19 00 09 0b 11 01 08 09 00 fc 02
0010: 69 78 69 28 69 11 10 79 00 05 3c 3c 00 d8 83 01
0020: 80 00 ca 00 00 00 00 00 00 00 00 00 00 00 00 00
0030: 00 00 00 00 00 00 00 00 00 00 00 00 04 11 29 01
0040: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0050: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

```
0070: 00 00 00 00 00 85 43 00 0f 02 00 00 00 00 64 18
0080: 44 33 2d 36 36 4a 4b 31 31 38 53 56 2d 31 33 00 D3-66JK118SV-13.
0090: 00 00 00 00 80 ce 00 00 00 00 00 00 00 00 00 00
00a0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00b0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00c0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00d0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00e0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00f0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

6.6 USB Interface

For USB Interface Testing you can use following u-boot commands. These commands will give you detailed information of the USB controller and devices connected to the USB.

The objective of bring up of USB interface
1. Successful Scanning, reading and writing all USB Devices of T4240

U-boot commands

```
=> usb reset
(Re)start USB...
USB0:   USB EHCI 1.00
scanning bus 0 for devices... 2 USB Device(s) found
USB1:   USB EHCI 1.00
scanning bus 1 for devices... 1 USB Device(s) found
       scanning usb for storage devices... 1 Storage Device(s) found

=> usb tree
USB device tree:
  1  Hub (480 Mb/s, 0mA)
  |  u-boot EHCI Host Controller
  |
  +-2  Mass Storage (480 Mb/s, 200mA)
       SanDisk Cruzer Blade 200421032111ADD2A0C5
       3  Hub (480 Mb/s, 0mA)
     u-boot EHCI Host Controller


=> usb info
1: Hub,  USB Revision 2.0
 - u-boot EHCI Host Controller
 - Class: Hub
 - PacketSize: 64  Configurations: 1
 - Vendor: 0x0000  Product 0x0000 Version 1.0
   Configuration: 1
   - Interfaces: 1 Self Powered 0mA
```

```
     Interface: 0
     - Alternate Setting 0, Endpoints: 1
     - Class Hub
     - Endpoint 1 In Interrupt MaxPacket 2048 Interval 255ms
```

6.7 SD Card Interface

U-boot provides the standard command "mmc" to check, read, erase and write SD Card.

```
=>help mmc
mmc - MMC sub system
Usage:
mmc read <device num> addr blk# cnt
mmc write <device num> addr blk# cnt
mmc rescan <device num>
mmc list - lists available devices
```

6.8 PCIe Interface

PCIe Interface Testing can be done from u-boot level. PCI commands will show you the device ids of the devices connected to pci bus.

The objective of bring up of PCIe interface
1. Successful Scanning, reading and writing all PCI Devices connected to pci bus of T4240.

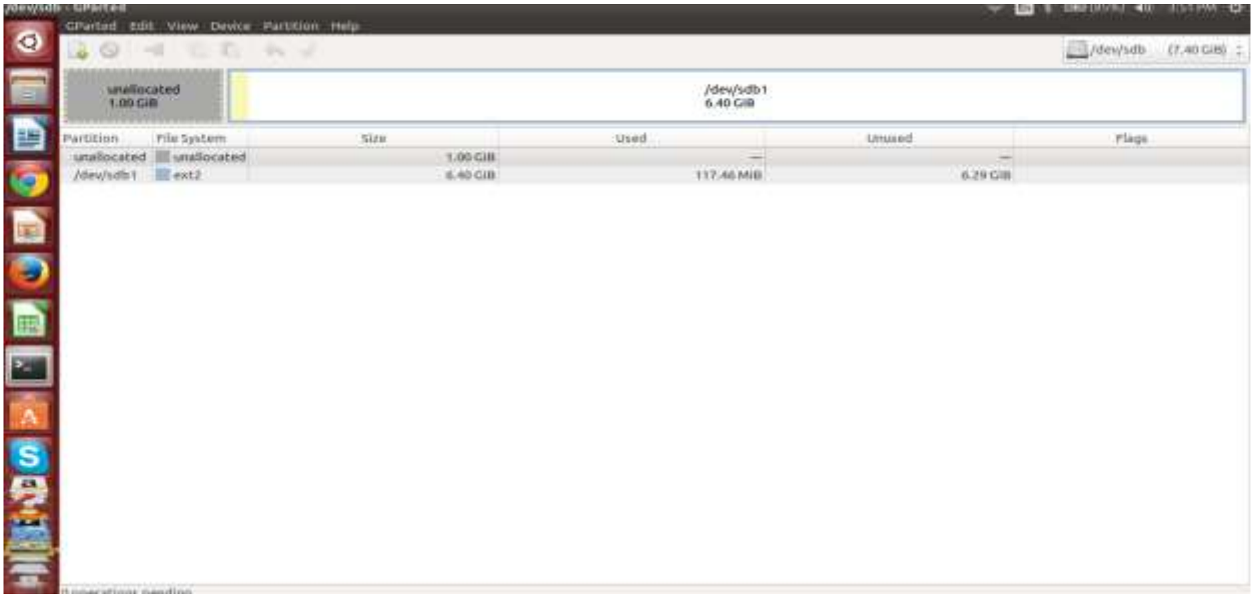
Following are the u-boot commands

```
pci [bus] [long] - short or long list of PCI devices on bus 'bus'

pci header b.d.f - show header of PCI device 'bus.device.function'

pci display[.b, .w, .l] b.d.f [address] [# of objects]
- display PCI configuration space (CFG)

pci next[.b, .w, .l] b.d.f address - modify, read and keep CFG address

pci modify[.b, .w, .l] b.d.f address  -  modify, auto increment CFG
address

pci write[.b, .w, .l] b.d.f address value - write to CFG address
```

```
Examples:

=> pci 0
Scanning PCI devices on bus 0
BusDevFun  VendorId   DeviceId   Device Class       Sub-Class
_____________________________________________________________
00.00.00   0x1957     0x0440     Processor               0x20

=> pci 1
Scanning PCI devices on bus 1
BusDevFun  VendorId   DeviceId   Device Class       Sub-Class
_____________________________________________________________
01.00.00   0x1957     0x0800     Processor               0x2

=> pci display 0
00000000: 04401957 00100006 0b200010 00810008
00000010: df000000 00000000 00010100 00000111
00000020: e010e000 00011001 00000000 00000000
00000030: 00000000 00000040 00000000 000001ff

From the linux terminal we can scan pci devices and read write memory
and I/O Space allocated
to it using SYSFS and lspci.

=> lspci
00:00.0 Host bridge: Intel Corporation Haswell-ULT DRAM Controller
(rev 0b)
00:14.0 USB controller: Intel Corporation Lynx Point-LP USB xHCI HC
(rev 04)
00:1c.0 PCI bridge: Intel Corporation Lynx Point-LP PCI Express Root
Port 1 (rev e4)
00:1c.2 PCI bridge: Intel Corporation Lynx Point-LP PCI Express Root
Port 3 (rev e4)
00:1c.3 PCI bridge: Intel Corporation Lynx Point-LP PCI Express Root
Port 4 (rev e4)
00:1c.4 PCI bridge: Intel Corporation Lynx Point-LP PCI Express Root
Port 5 (rev e4)
00:1d.0 USB controller: Intel Corporation Lynx Point-LP USB EHCI #1
(rev 04)
00:1f.2 SATA controller: Intel Corporation Lynx Point-LP SATA
Controller 1 [AHCI mode] (rev 04)
```

7 Starting Linux from SD Card

The Linux kernel and file system can be copied to the SD card for production deployment. As such the SD card included in the t4240mfcs kit will contain the different images for linux kernel, root filesystem and the device tree binaries in the /dev/sdb partition as mentioned in the figure.



Partition	File System	Size	Used	Unused	Flags
unallocated	unallocated	1.00 GiB	---	---	
/dev/sdb1	ext2	6.40 GiB	117.46 MiB	6.29 GiB	

Figure 17 Table for SD card partition

7.1 Steps for Ethernet port setting

a. Connect Ethernet cable between server1/server2, where need to upgrade images and Linux PC
b. Ethernet port setting required at server1/server2 for upgrading the images in SD card, Catch kernel prompt and run following command

```
 sudo ifconfig fm1-mac1 192.168.1.10 up
```

c. Ethernet port setting at Linux PC side

```
 sudo  ifconfig eth0 192.168.1.20 up
```

7.2 Upgrade u-boot on SD card

a. Go to the directory where “ *u-boot-with-spl-pbl.bin*” file is present in Linux PC
b. Copy image into SD card by using scp

```
scp u-boot-with-spl-pbl.bin root@192.168.1.10:
```

Now Copy this binary into /dev/mmcblk0 partition of SD card

```
sudo dd if=u-boot-with-spl-pbl.bin of=/dev/mmcblk0 seek=8 count=1560 bs=512
```

c. Reboot the board

7.3 Upgrade uImage and t4240mfcs.dtb on SD card

a. Go to the directory where *“ uImage and t4240mfcs.dtb*” file is present in Linux PC
b. Mount directory.

```
mkdir mount
mount -t ext2 /dev/mmcblk0p1 mount/
```

c. Copy image into SD card by using scp

```
scp uImage root@<board ip>:/home/root/mount/boot/

scp t4240mfcs.dtb root@<board ip>:/home/root/mount/boot/

umount /home/root/mount
```

d. Reboot the board.

Reboot the Right T4240 Board (Server 1)

Press Reset button, for right t4240 reset release reset button when power led is blinking fast (3-6 seconds).

Reboot the left T4240 Board (Server 2)

Press Reset button, for left t4240 reset release reset button when power led is blinking slow (9-12 seconds).

Button	**0-3 sec**	**3-6 sec (Fast blink power led)**	**6-9 sec**	**9-12 sec (Slow blink power led)**
Reset	No Action	Right T4240 Reset	No Action	left T4240 Reset