SpaceChain Software Deployment Guide of Callisto Board

Release Table

Version	Date	Changes
V0.0	Sep 10, 2020	Chapter 1, 3 and 4 (Han)
V0.1	Sep 25, 2020	Chapter 2 and dual-OS deployment (DH)
V1.0	2020.09.27	Revised version

1 SPC Dual-OS and Space Node software

1.1 SPC Dual-OS introduction

1.1.1 SPC dual OS

SPC dual operating system consists of Linux OS and SpaceChain OS that are specially designed for the ZYNQ7000 hardware development board.

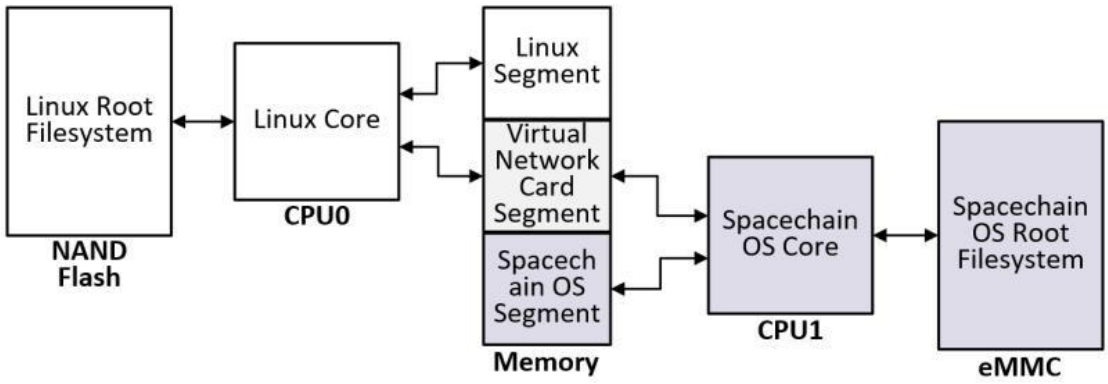
Linux and SpaceChain OS is embedded into the two Cortex-A9 cores, respectively. The two separate operating systems run with asymmetric multiprocessing (AMP) configuration. Generally, the master core (i.e. CPU0) with Linux OS boots first. The slave core (CPU1) with SpaceChain OS boots after the Linux OS boots.

SPC dual OS divides the memory into three parts: Linux OS, SpaceChain OS and virtual network interface card (NIC) that is used for communications between Linux OS and SpaceChain OS. The memory size and location of these three parts are fixed. The two operating systems can only access their own memory as well as the virtual NIC.

The file systems of Linux OS and SpaceChain OS are isolated by the hardware. The file systems of Linux OS are deployed on the SD card while that of SpaceChain OS are deployed on the NAND flash. The two operating systems cannot access each other's file systems.

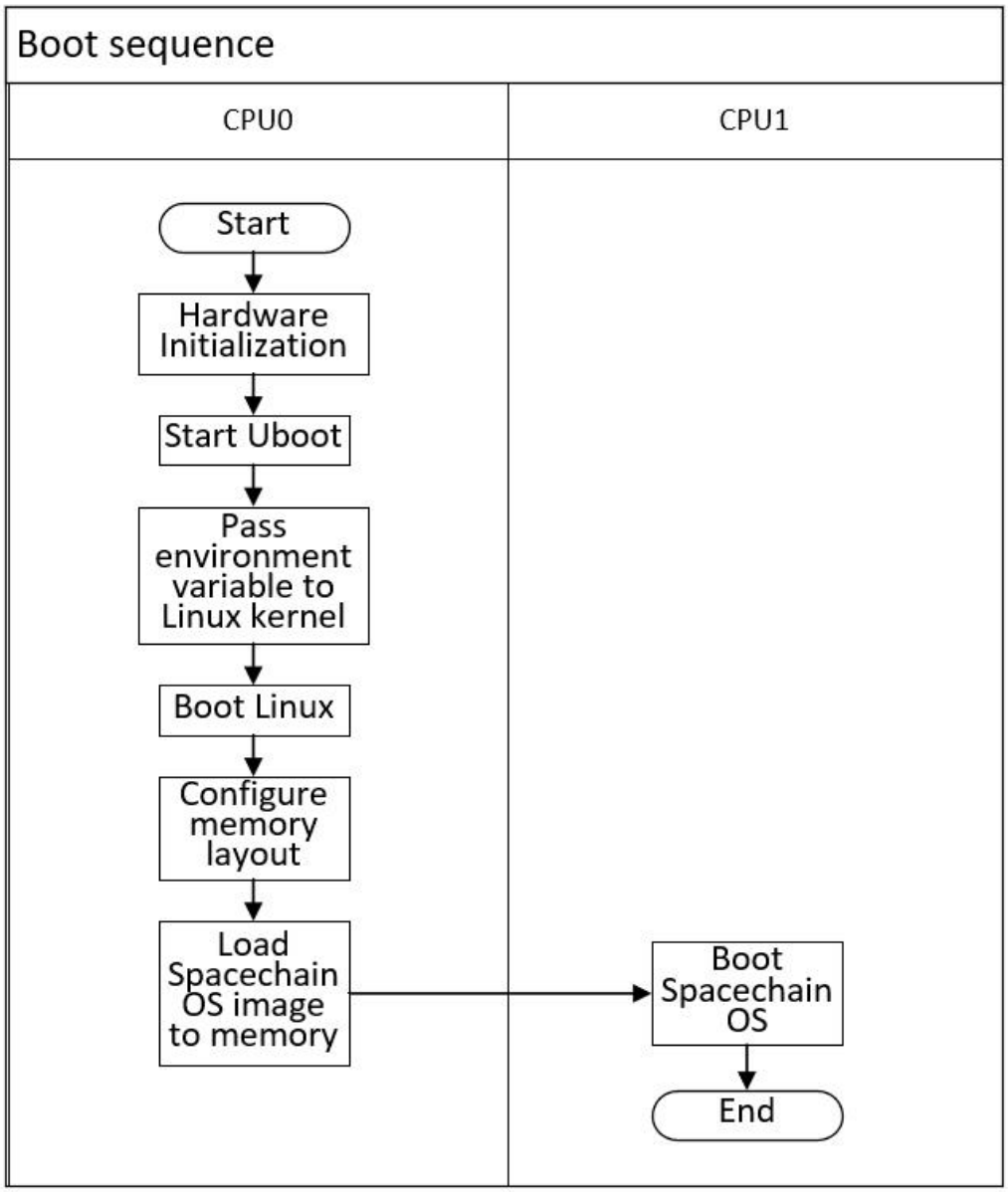
Linux OS and SpaceChain OS communicates via the virtual NIC. The data transfer between the two operating systems are via the virtual NIC.

The Linux OS is based on the Linux Kernel 4.14 in the SPC dual OS.



1.1.2 Booting process of SPC dual-OS

1）Power on and initialize ZYNQ development board
2）Start UBOOT.
3）UBOOT configures the memory layout. Meanwhile, the path of SpaceChain OS image files is transmitted to Linux kernel via boot parameters. UBOOT file boots the Linux Kernel in CPU0.
4）After booting the Linux Kernel, the image files of SpaceChain OS are loaded to the memory address of SpaceChain OS via boot parameters. The SpaceChain OS is booted in CPU1.
5）Linux OS executes the scripts to install the kernel module of network interface card.
6）SPC dual OS is successfully booted.



1.2 Space Node software introduction

Space Node software is designed to process on-orbit bitcoin multi-signature transactions.

There are two parts of Space Node software: 1) Linux OS operations and 2) SpaceChain OS operation.

The files related to the Space Node software operations in Linux OS is under Linux **/mnt/spcdata** directory. The files include executable files, scripts as well as the intermediate files during the software operations.

When using Space Node software, **/mnt/spcdata/upload/** is the directory of input files while **/mnt/spcdata/download/** is the directory of output files.

After software deployment, save the input files under **/mnt/spcdata/upload/** and start the Space Node software. The Space Node software will then save the output files to the directory **/mnt/spcdata/download/**.

2 SPC dual-OS deployment steps

2.1 Hardware preparation

The SpaceChain hardware board uses a TF card as an external storage. All the files are stored in the TF card. The below steps show steps of copying OS mirror to the TF card.

We will need the following items:

1. Win10, MacOS or Linux Computer
2. A SpaceChain hardware board
3. Type-C cable
4. 16 GB TF card
5. TF card reader

2.2 Download deployment files

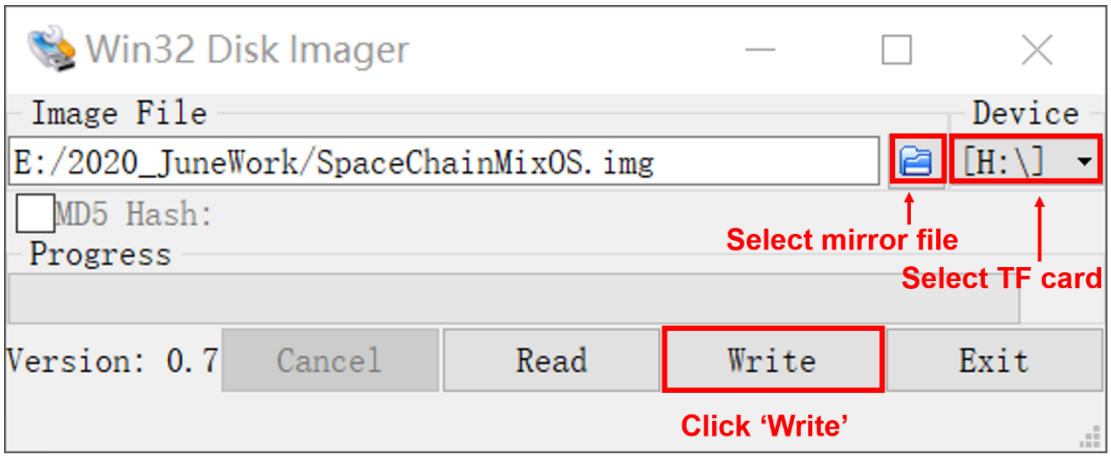
Baidu Wangpan：
Link:
https://pan.baidu.com/s/1Xl8lFhMVNRZ-UEwwza5Byw
Password:
wjec

Google Drive：
https://drive.google.com/file/d/1nZVEweYjDNeGtfk2_5h3RNRBrIul3ZHW/view?usp=sharing

2.3 Copy OS mirror file to TF card

Note: we recommend formatting the TF card before copying the mirror files.
Download Win32DiskImager from the below link.
https://sourceforge.net/projects/win32diskimager/?source=typ_redirect
Open Win32DiskImager, select the mirror files, Choose TF card as the file location,

and click ‘write’.



2.4 Boot the hardware board

Insert the TF card into the SpaceChain hardware board.

Connect the hardware board with the computer by a Type-C cable. If both red and green LED are on, the system is successfully initialized.

2.5 Log in the hardware board by TTY

The Type-C cable provides both power connections and TTY function to the hardware board. The driver is CH340 chip. If your Win10 computer is unable to automatically install the driver, please download the driver the below link and install the driver properly.

CH340 Windows version driver
Link: http://www.wch.cn/download/CH341SER_EXE.html
CH340 Linux version driver
Link: http://www.wch.cn/download/CH341SER_EXE.html
CH340 MacOS version driver
Link: http://www.wch.cn/download/CH341SER_MAC_ZIP.html

We recommend using MobaXterm for TTY related functions. Please download MobaXterm from the below address.

https://mobaxterm.mobatek.net/download.html

Install the free version.

Open MobaXterm and select the serial port number of SpaceChain hardware board. The Baud rate is 115200.

3 Space Node software deployment steps

3.1 Space Node software deployment steps under Linux

The Space Node software under Linux OS has the following functions: 1) obtaining SPC data files, 2) analyzing data files, 3) data transfer between Linux and SpaceChain OS, and 4) uploading data files.

The Space Node script of Linux OS is saved under **SPC_Software/LinuxOS_part/**. The script contains executable files and scripts.

Copy **SPC_Software/LinuxOS_part/spcdata** folder to **/mnt** under Linux OS.

3.2 Space Node software deployment steps under SpaceChain OS

SpaceChain OS includes SpaceChain OS heartbeat monitoring software, SpaceChain OS upgrade software, encryption algorithms library and SpaceChain OS operating library.

In order to ensure the security, SpaceChain OS can only deployed through Linux. We need to upload the software of SpaceChain OS to Linux OS first and the deploy the software for to SpaceChain OS via virtual NIC.

Upload the software files to **Spacechain OS**
The software files of Spacechain OS is saved under **SPC_Software/SpacechainOS_part/**.
Copy this folder to /root under Linux OS.
Enter the below command in the terminal.

```
cd SPC_spcos_app_deploy
```

Press “Enter” to enter the deployment directory.

Enter the below command in the terminal.

```
ls
```

Press “**enter**” to check the software deployment directory and script.

```
[root@loft-adrv2 ~]# cd SPC_spcos_app_deploy/
[root@loft-adrv2 SPC_spcos_app_deploy]# ls
apps  etc  lib  sDeployFromLinux.sh  sbin  usr
[root@loft-adrv2 SPC_spcos_app_deploy]#
```

Execute the deployment script

Enter the below command in the Linux terminal.

```
source sDeployFromLinux.sh
```

Press “enter” to execute the script. The script will deploy the software to SpaceChain OS.

```
[root@loft-adrv2 SPC_spcos_app_deploy]# source sDeployFromLinux.sh
Hash mark printing on (1024 bytes/hash mark).
Interactive mode off.
drwxr-xr--  1     0     0           0 Jan 01 08:00 tmp
drwxr-xr--  1     0     0           0 Jan 01 08:00 var
drwxr-xr--  1     0     0           0 Jan 01 08:00 root
drwxr-xr--  1     0     0           0 Jan 01 08:00 home
drwxr-xr--  1     0     0           0 Jan 01 08:00 apps
drwxr-xr--  1     0     0           0 Jan 01 08:00 sbin
drwxr-xr--  1     0     0           0 Jan 01 08:00 bin
drwxr-xr--  1     0     0           0 Jan 01 08:00 usr
drwxr-xr--  1     0     0           0 Jan 01 08:00 lib
drwxr-xr--  1     0     0           0 Jan 01 08:00 qt
drwxr-xr--  1     0     0           0 Jan 01 08:00 ftk
drwxr-xr--  1     0     0           0 Jan 01 08:00 etc
drw-rw-rw-  1     0     0           0 Jan 01 08:00 boot
drwxr-xr--  1     0     0           0 Jan 01 08:00 usb
drw-r--r--  1     0     0           0 Jan 01 08:00 proc
drwxr-xr--  1     0     0           0 Jan 01 08:00 media
drwxr-xr--  1     0     0           0 Jan 01 08:00 mnt
drwxr-xr--  1     0     0           0 Jan 01 08:00 dev
#
Local directory now /root/SPC_spcos_app_deploy/apps/libsecp256k1
################################################################################################
###
```

```
Local directory now /root/SPC_spcos_app_deploy/usr/lib
Local directory now /root/SPC_spcos_app_deploy/usr/lib/ssl
###########
Local directory now /root/SPC_spcos_app_deploy/usr/lib/ssl/lib/engines
############
##########
#########
##
###############
#############
##
#######
##
################
############
[root@loft-adrv2 SPC_spcos_app_deploy]#
```

Space Node software deployment under SpaceChain OS is complete.

4 Notes on booting the hardware board

Connect the hardware board with a WIFI-router. The hardware board will be connected to SPC server by default. Obtaining data files and uploading the data files are automatically processed by the board.