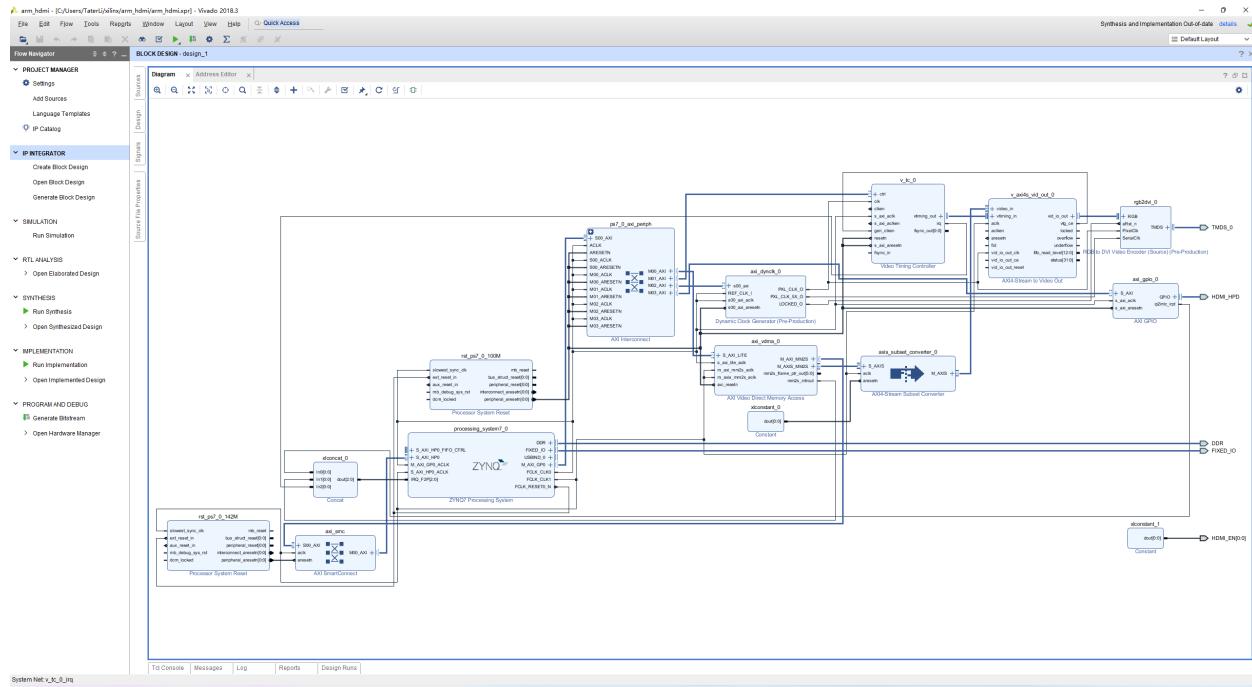
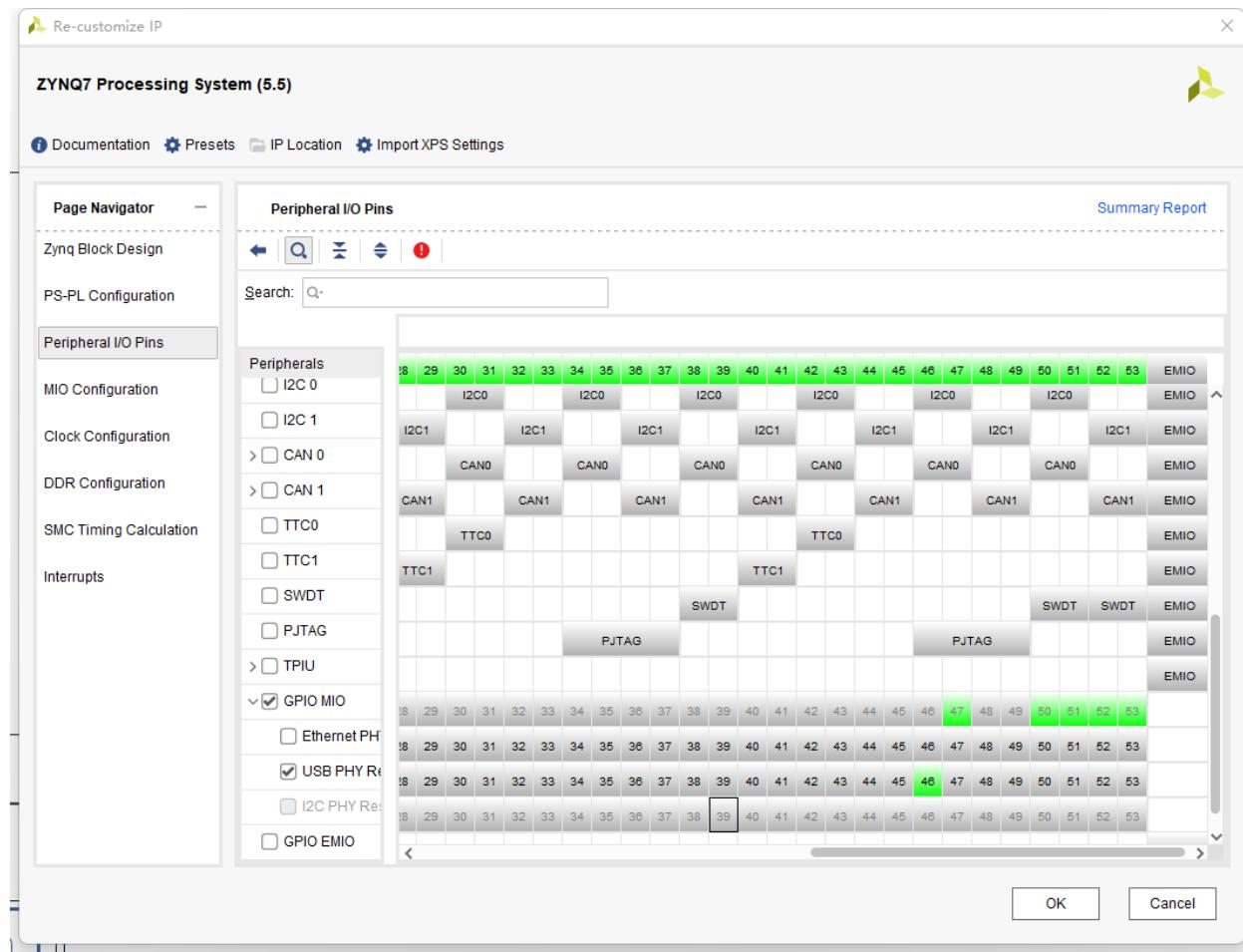


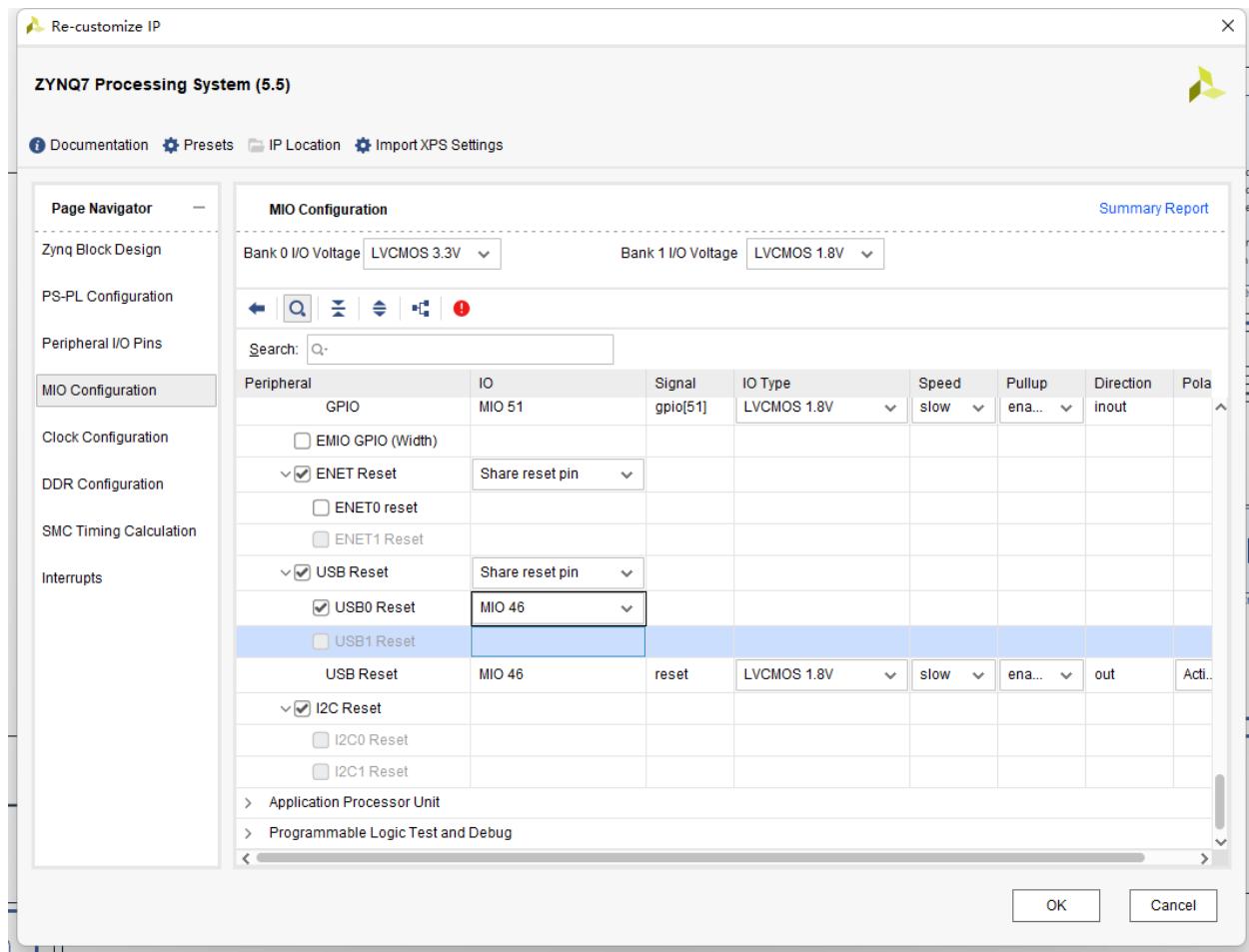
[L15]ZYNQ Linaro

HDMI不是一个ARM硬核外设,我们之前已经成功驱动他了,轮子就不必重做,回忆一下上次的配置.



新增一个USB PHY Reset





以太网不要忘记配置MDIO,上一节中已经讲到过这个.

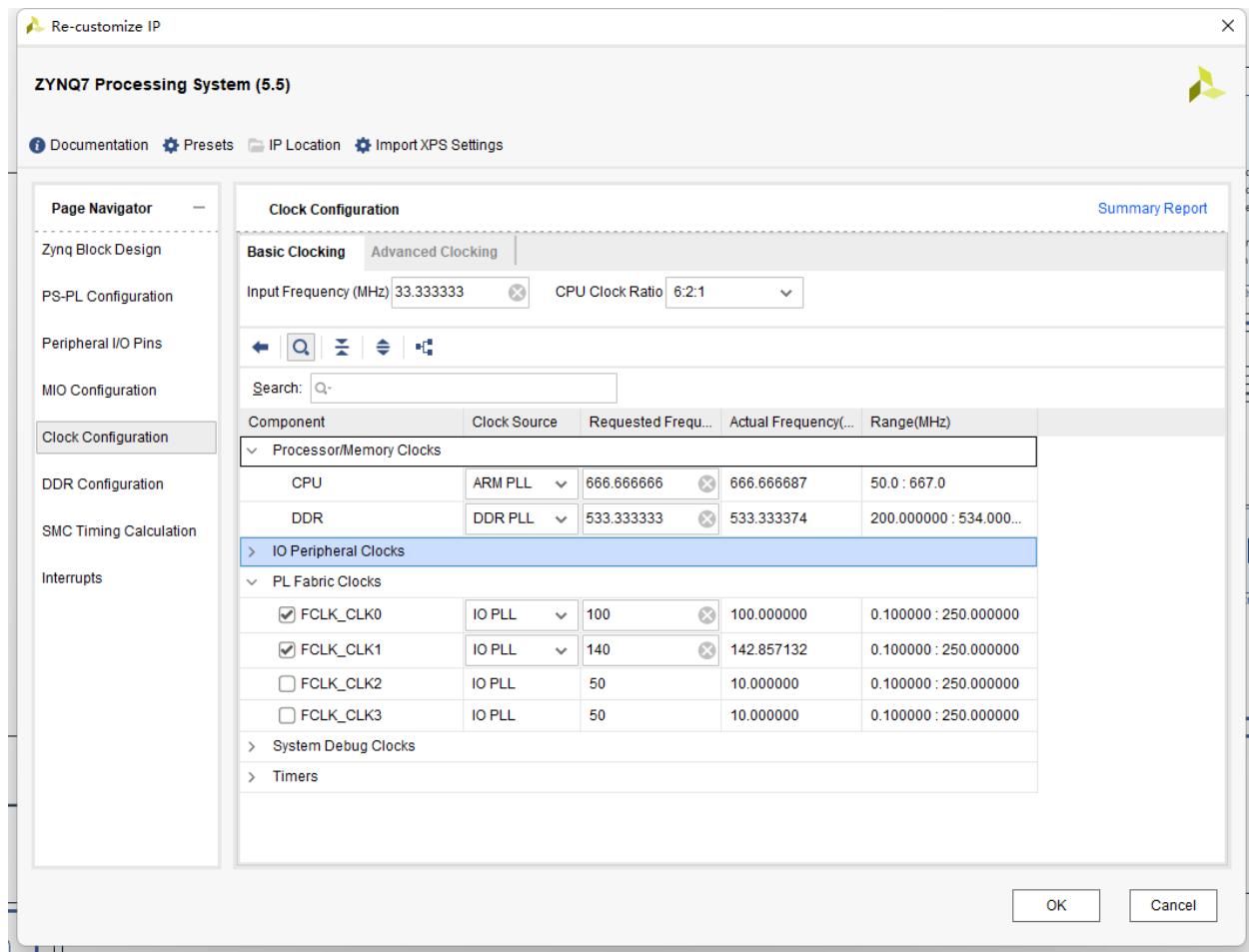
ZYNQ7 Processing System (5.5)

MIO Configuration

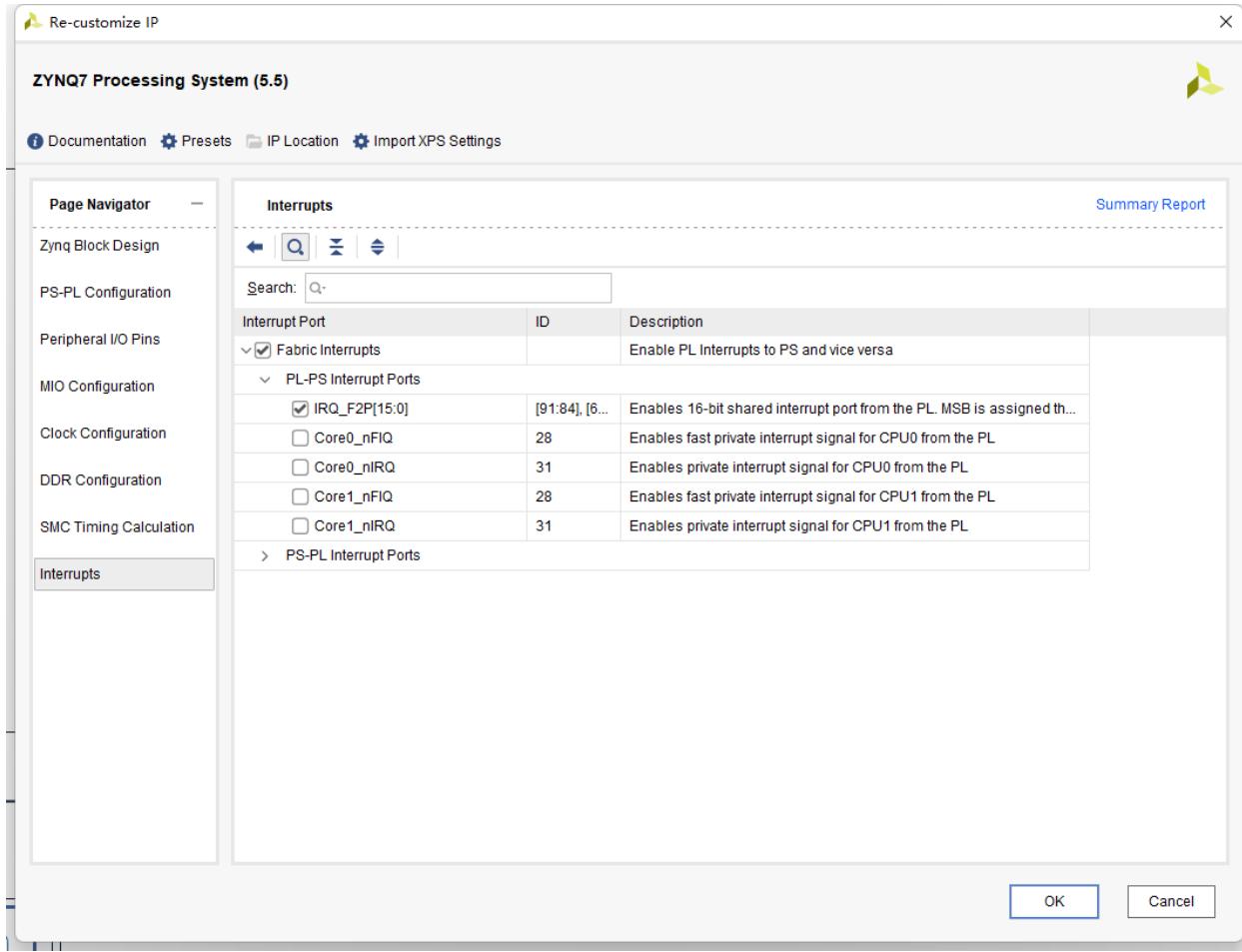
Peripheral	IO	Signal	IO Type	Speed	Pullup	Direction	Pol
Memory Interfaces							
> Quad SPI Flash							
> SRAM/NOR Flash							
> NAND Flash							
I/O Peripherals							
ENET 0	MIO 16 .. 27						
MDIO	MIO 52 .. 53						
Enet 0	MIO 52	mdc	LVC MOS 1.8V	fast	ena...	out	
Enet 0	MIO 53	mdio	LVC MOS 1.8V	fast	ena...	inout	
Enet 0	MIO 16	tx_clk	LVC MOS 1.8V	fast	ena...	out	
Enet 0	MIO 17	txd[0]	LVC MOS 1.8V	fast	ena...	out	
Enet 0	MIO 18	txd[1]	LVC MOS 1.8V	fast	ena...	out	
Enet 0	MIO 19	txd[2]	LVC MOS 1.8V	fast	ena...	out	
Enet 0	MIO 20	txd[3]	LVC MOS 1.8V	fast	ena...	out	

OK **Cancel**

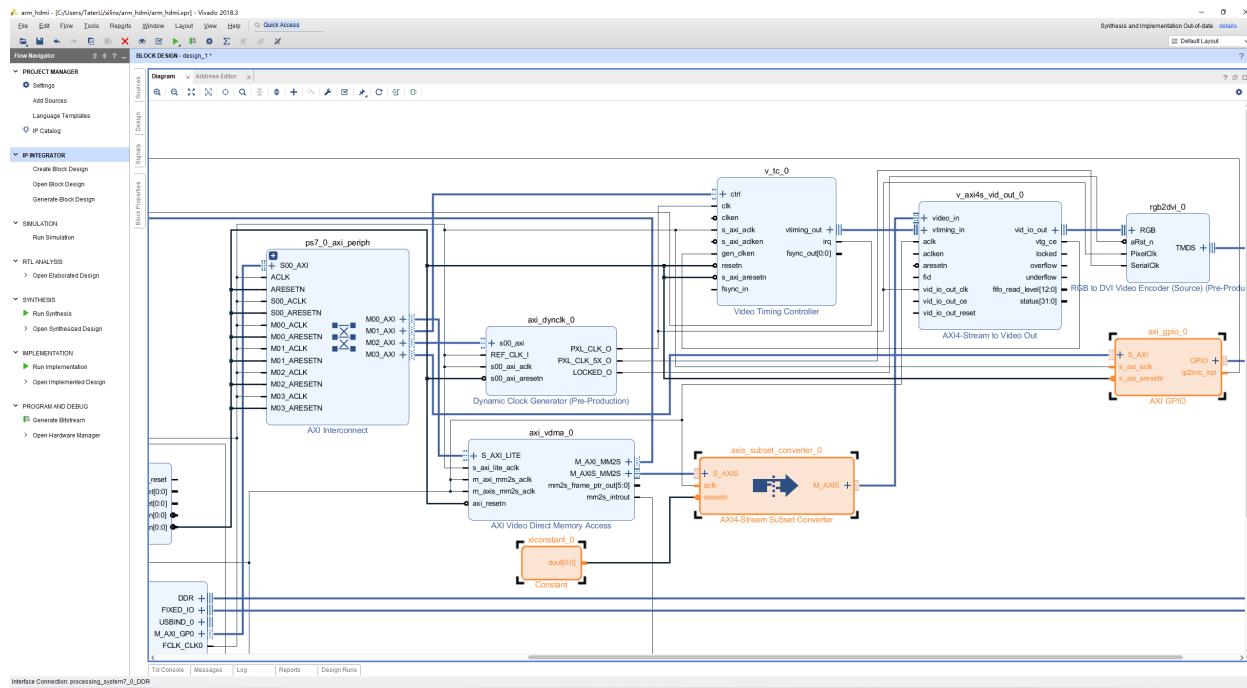
对外时钟检查一下,一般也没什么问题.



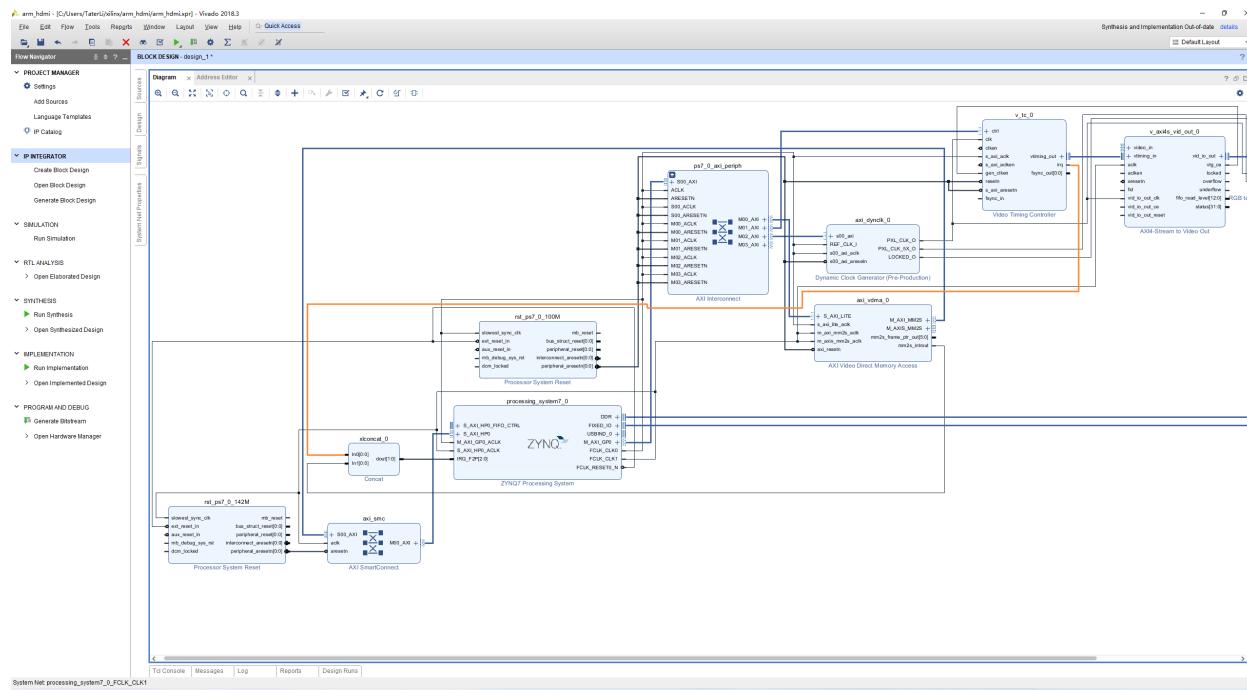
中断检查一下,一般也没什么问题.



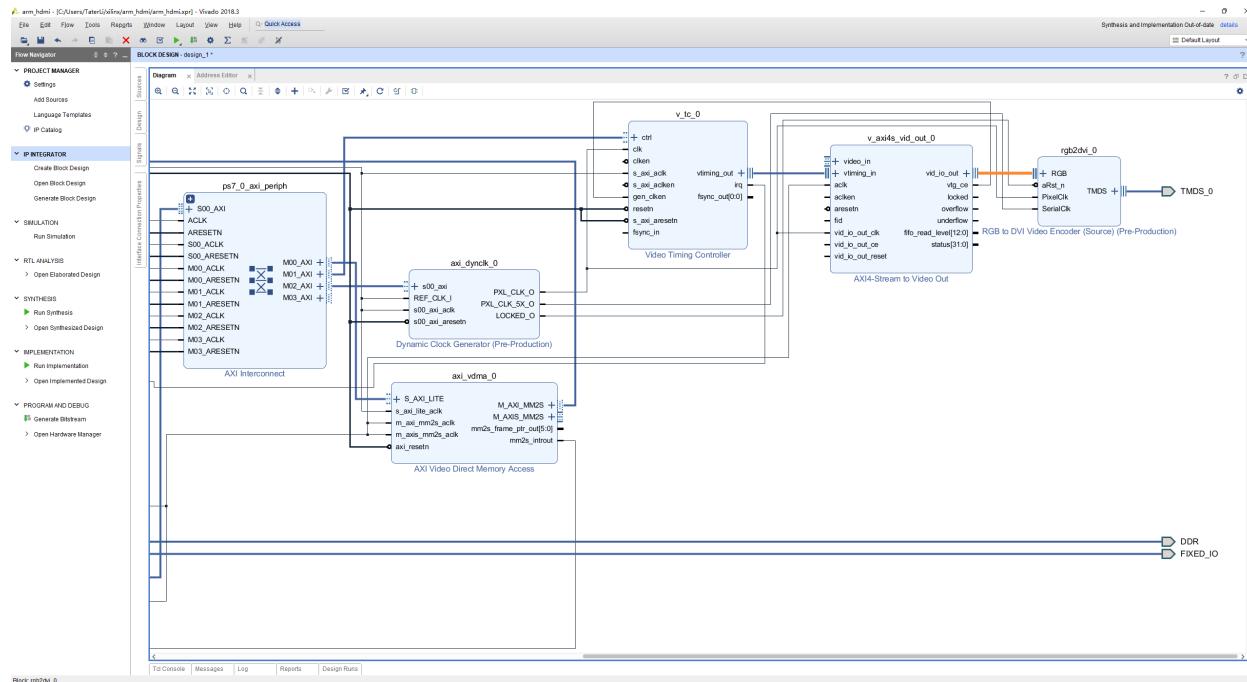
有三个模块现在不再使用,由ARM系统来配置,所以删掉.



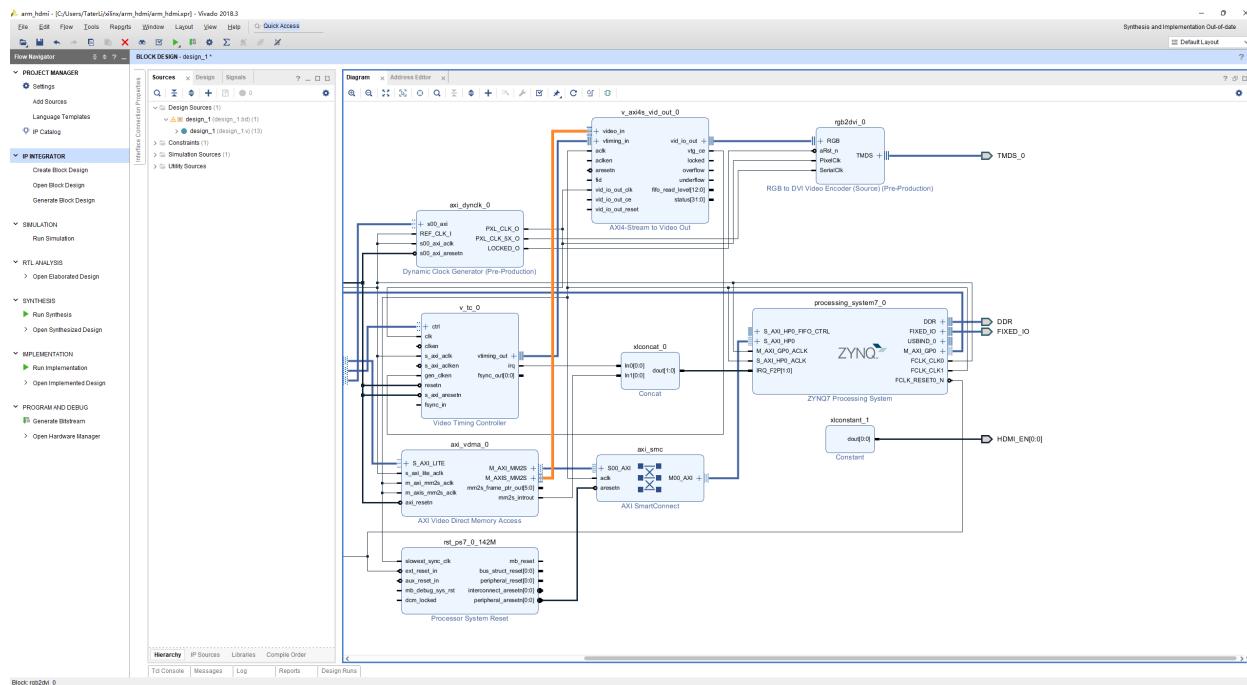
然后xlconcat_0模块也不需要3个信号了,只需要2个,并调整In0接入v_tc_0的irq.



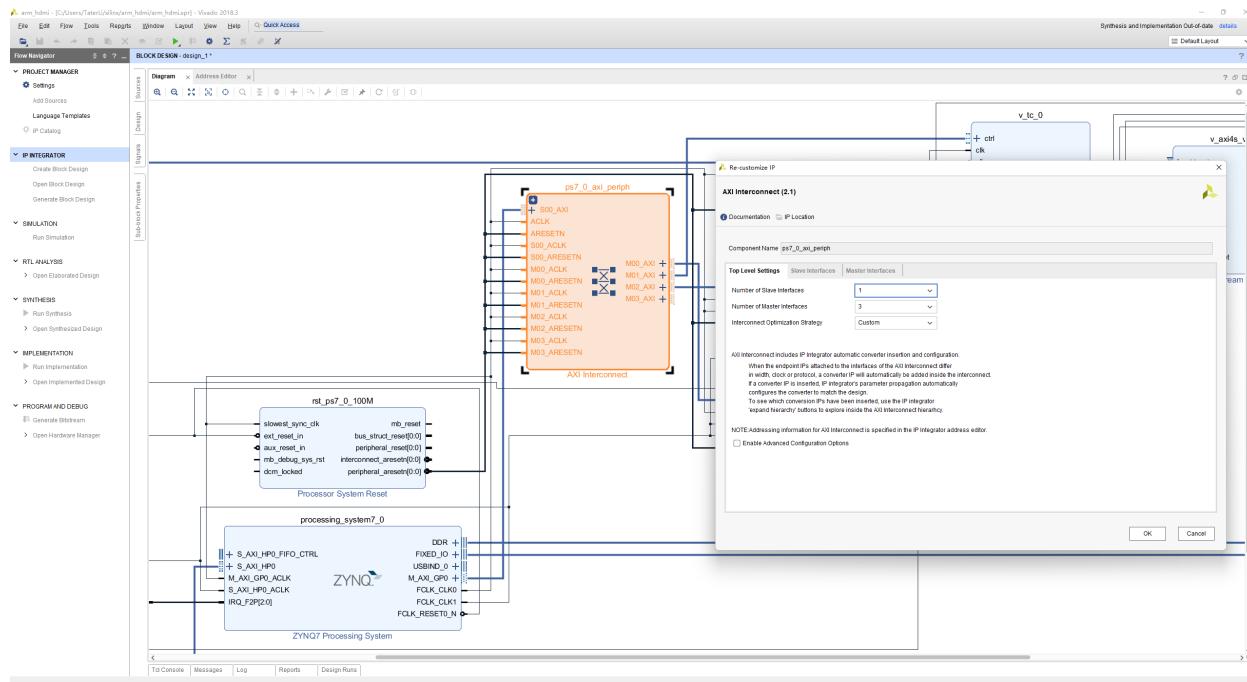
检查v_axis4s_vid_out_0输出已经连接到rgb2dvi_0输入.



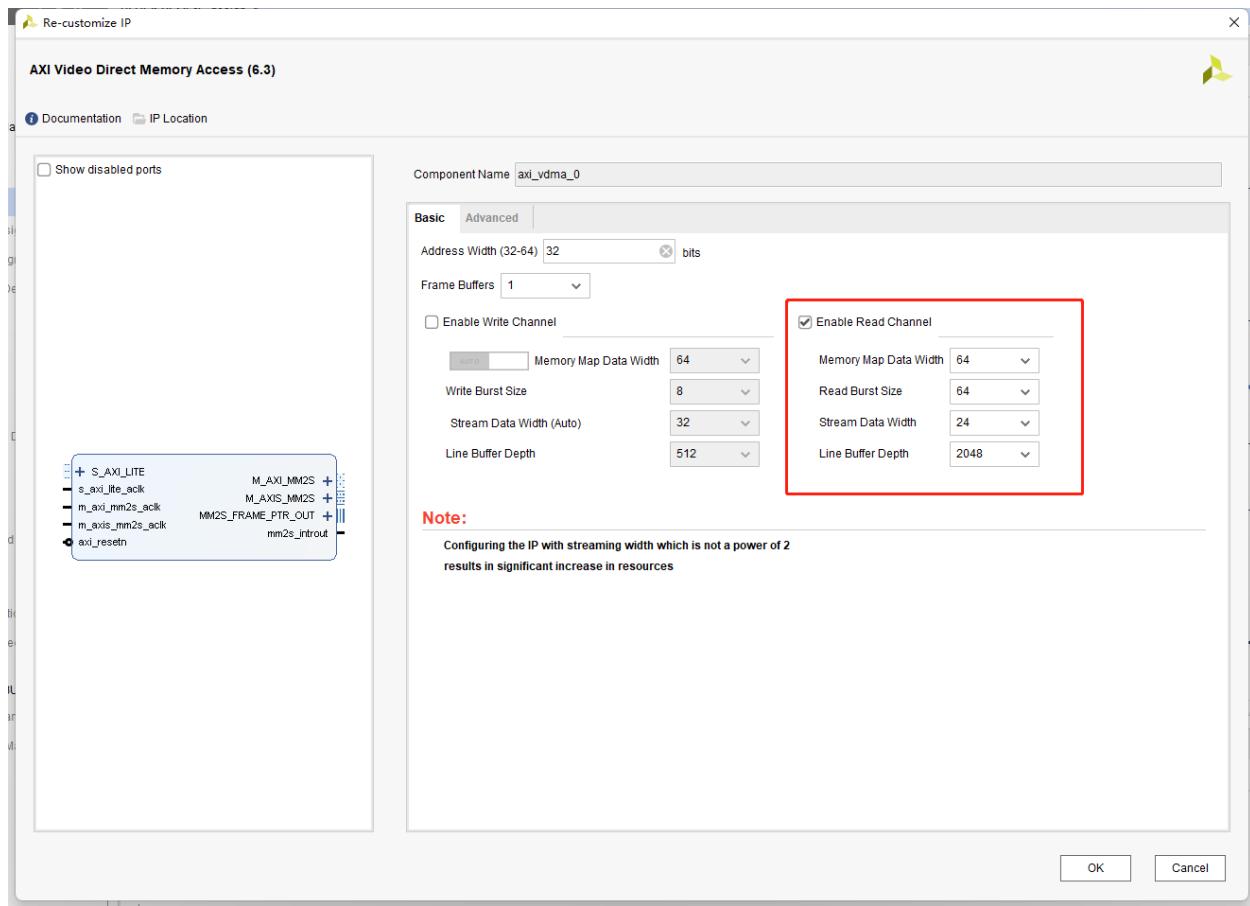
检查v_axis4s_vid_out0的video_in是否由axi_vdma_0的M_AXIS_MM2S提供.



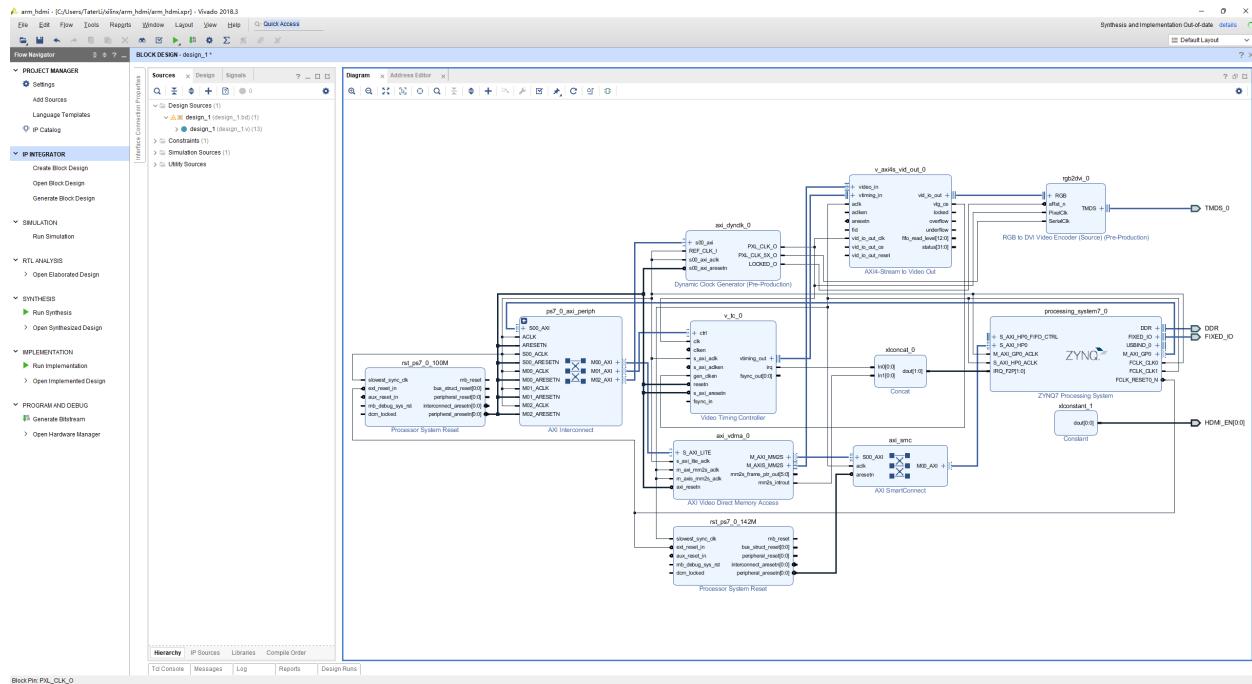
由于ps7_0_axi_periph多了一只接口,因此配置他,改成3个接口(即减少1个).



AXI Video Direct Memory Access也要稍微调整.



现在输出图成这样了.



然后可以生成约束做bitstream和hdf文件了,由于之前都做过很多次这种动作了,就不再啰嗦了,这里准备一下Linux镜像,我们这次就试试.

网址:<https://releases.linaro.org/debian/images/alip-armhf/latest/>

The screenshot shows a web browser displaying the Linaro Releases page. The URL in the address bar is <https://releases.linaro.org/debian/images/alip-armhf/latest/>. The page has a dark header with links for Looking for, Linaro.org, Careers, Blog, Wiki, Linaro Connect, Ask Linaro, and Planet Linaro. A green button on the right says "Linaro Releases". The main content area shows a table of files:

Name	Last modified	Size	License
Parent Directory			
linaro-jessie-alip-20161117-32.build-log.txt	13-Jan-2018 10:16	361.0K	open
linaro-jessie-alip-20161117-32.config.tar.bz2	13-Jan-2018 10:16	7.6K	open
linaro-jessie-alip-20161117-32.contents	13-Jan-2018 10:16	2.9M	open
linaro-jessie-alip-20161117-32.md5sums.txt	13-Jan-2018 10:16	379	open
linaro-jessie-alip-20161117-32.packages	13-Jan-2018 10:16	23.7K	open
linaro-jessie-alip-20161117-32.sha1sums.txt	13-Jan-2018 10:16	419	open
linaro-jessie-alip-20161117-32.tar.gz	27-Feb-2018 01:28	597.7M	open

At the bottom of the page, a message says "Running linaro-license-protection c43b8fd."

文件名可能不同,我这里是linaro-jessie-alip-20161117-32.tar.gz,有好一段时间没更新了,当然如果不麻烦也可以自己debootstarp,我现在下载并把它放在以下位置:

```
/home/taterli/linaro-jessie-alip-20161117-32.tar.gz
```

另外这个工程需要定制化内核,Yocto推荐的发布方式是补丁,但是由于很不方便调试,所以Xilinx也提供了外置内核模式,当然,如果处于团队合作中,需要合并自己的修改,还是建议使用补丁方式.先找到内核源码本身.

路径:~/petalinux/components/yocto/source/microblaze_full/layers/meta-xilinx/meta-xilinx-bsp/recipes-kernel/linux/linux-xlnx_2018.3.bb

在我的配置中,他使用版本是eeab73d1207d6fc2082776c954eb19fd7290bfbe,托管路径是git://github.com/Xilinx/linux-xlnx.git

实际代码预览:<https://github.com/Xilinx/linux-xlnx/tree/eeab73d1207d6fc2082776c954eb19fd7290bfbe>

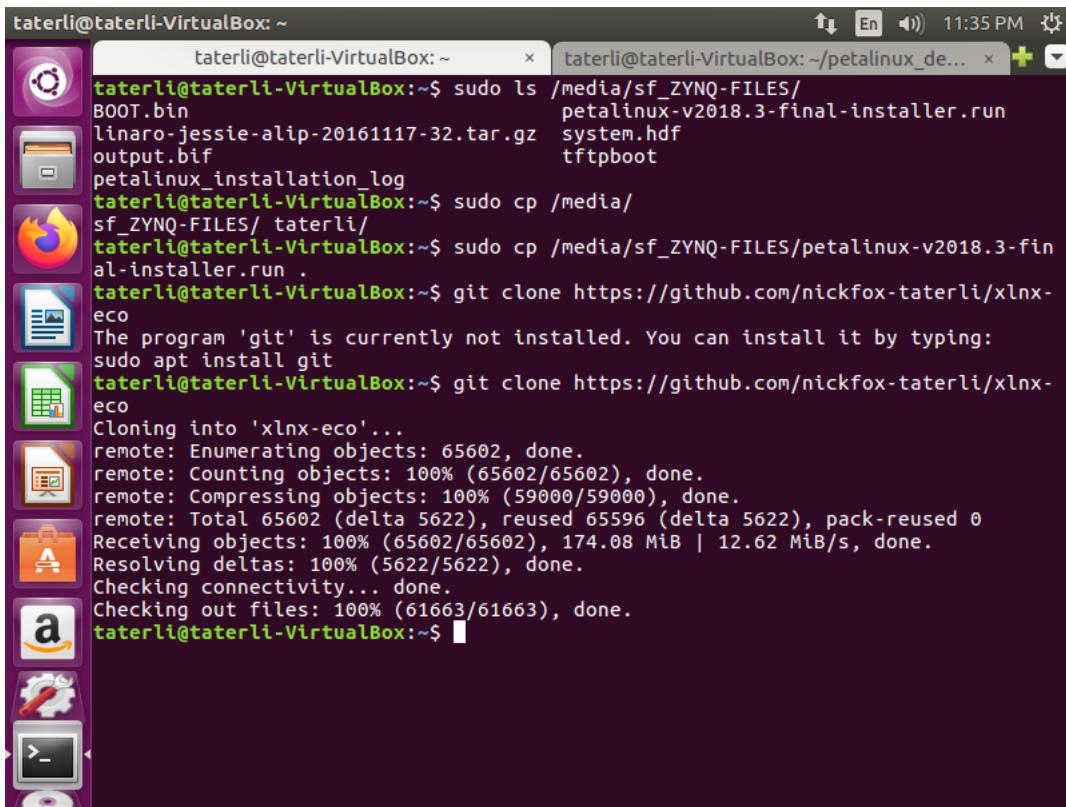
加料Repo:<https://github.com/nickfox-taterli/xlnx-eco>

Screenshot of the GitHub repository page for Xilinx/linux-xlnx. The repository is public and has 229 watchers, 1.3k forks, and 942 stars. It contains 29 branches and 163 tags. The code tab is selected, showing a list of commits from the eeab73d120 branch. The commits are as follows:

Author	Commit Message	Date
vishals-xlnx and michalsimek-xilinx	misc: xilinx-sdfec: Driver document improvements	3 years ago
LICENSES/preferred	LICENSES: Add the GPL 2.0 license	4 years ago
arch	arm64: zynqmp: Change the spi-rx-bus-width prop...	3 years ago
block	License cleanup: add SPDX GPL-2.0 license identifie...	4 years ago
certs	License cleanup: add SPDX GPL-2.0 license identifie...	4 years ago
crypto	crypto: Adds user space interface for ALG_SET_KEY_...	3 years ago
drivers	drm: xlnx: crt: Fix max width and height overflow	3 years ago
firmware	License cleanup: add SPDX GPL-2.0 license identifie...	4 years ago
fs	fs/hugetlbfs/inode.c: fix hwpoison reserve accounting	4 years ago
include	misc: xilinx-sdfec: Driver kernel-doc improvements	3 years ago
init	Merge tag 'spdx_identifiers-4.14-rc8' of git://git.ker...	4 years ago
ipc	License cleanup: add SPDX GPL-2.0 license identifie...	4 years ago
kernel	Merge tag 'pm-final-4.14' of git://git.kernel.org/pu...	4 years ago
lib	KEYS: fix NULL pointer dereference during ASN.1 p...	4 years ago
mm	mm: page_alloc: Demote the PFNs busy message to...	4 years ago
net	vlan: fix a use-after-free in vlan_device_event()	4 years ago
samples	samples: xilinx_apm: Add sample application for xili...	4 years ago

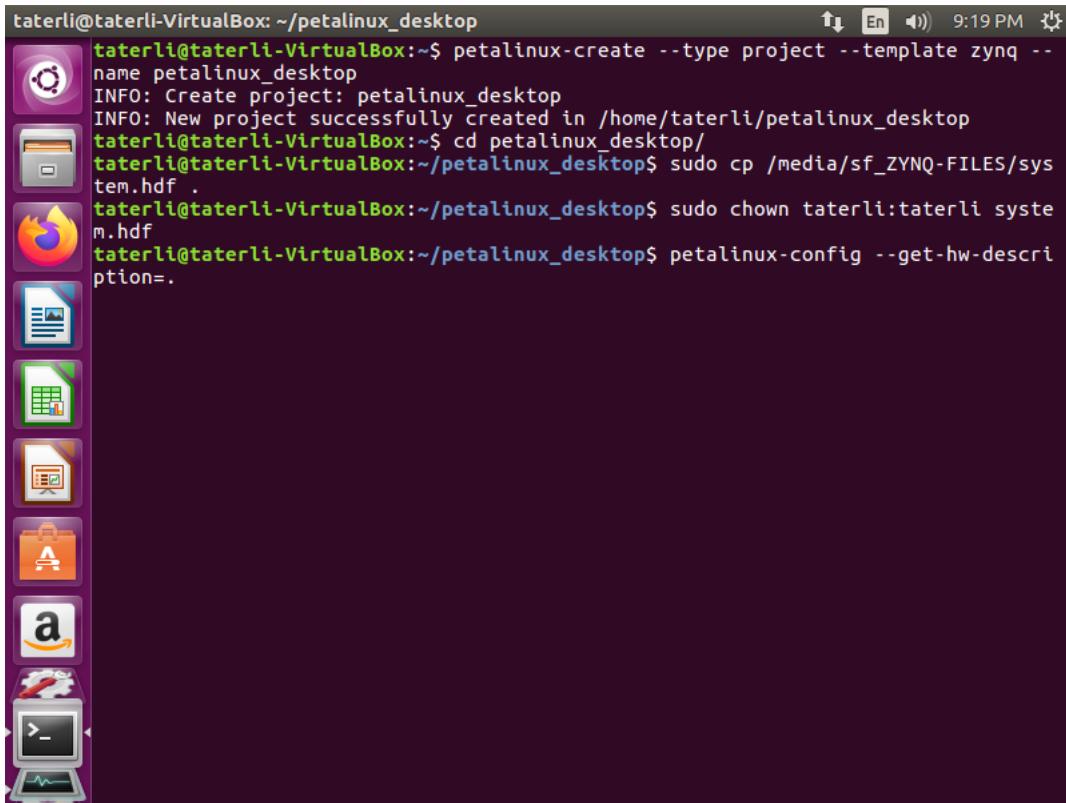
The repository has an About section describing it as "The official Linux kernel from Xilinx". It also includes sections for Releases (163 tags), Packages (No packages published), Contributors (3,424 contributors, including 3,413 GitHub users), and Environments (1 environment, github-pages, Active).

不过由于缺少一些自定义代码,建议从我的Git仓库下载.

A screenshot of an Ubuntu desktop environment. On the left is a vertical dock with icons for Dash, Home, Applications, and a terminal. Two terminal windows are open at the top. The left window shows the command `sudo ls /media/sf_ZYNQ-FILES/` followed by a list of files: BOOT.bin, linaro-jessie-alip-20161117-32.tar.gz, output.bif, petalinux_installation_log, and tftpboot. The right window shows the command `sudo cp /media/sf_ZYNQ-FILES/ taterli/` followed by `taterli@taterli-VirtualBox:~\$ sudo cp /media/sf_ZYNQ-FILES/petalinux-v2018.3-final-installer.run .` and `taterli@taterli-VirtualBox:~\$ git clone https://github.com/nickfox-taterli/xlnx-eco`. The terminal then outputs the process of cloning the repository, including object enumeration, counting, compressing, receiving objects, and checking out files.

```
taterli@taterli-VirtualBox:~$ sudo ls /media/sf_ZYNQ-FILES/  
BOOT.bin  
linaro-jessie-alip-20161117-32.tar.gz  
output.bif  
petalinux_installation_log  
taterli@taterli-VirtualBox:~$ sudo cp /media/  
sf_ZYNQ-FILES/ taterli/  
taterli@taterli-VirtualBox:~$ sudo cp /media/sf_ZYNQ-FILES/petalinux-v2018.3-fin  
al-installer.run .  
taterli@taterli-VirtualBox:~$ git clone https://github.com/nickfox-taterli/xlnx-  
eco  
The program 'git' is currently not installed. You can install it by typing:  
sudo apt install git  
taterli@taterli-VirtualBox:~$ git clone https://github.com/nickfox-taterli/xlnx-  
eco  
Cloning into 'xlnx-eco'...  
remote: Enumerating objects: 65602, done.  
remote: Counting objects: 100% (65602/65602), done.  
remote: Compressing objects: 100% (59000/59000), done.  
remote: Total 65602 (delta 5622), reused 65596 (delta 5622), pack-reused 0  
Receiving objects: 100% (65602/65602), 174.08 MiB | 12.62 MiB/s, done.  
Resolving deltas: 100% (5622/5622), done.  
Checking connectivity... done.  
Checking out files: 100% (61663/61663), done.  
taterli@taterli-VirtualBox:~$
```

创建新的工程并复制HDF文件.

A screenshot of an Ubuntu desktop environment. On the left is a vertical dock with icons for Dash, Home, Applications, and a terminal. A single terminal window is open at the top. The command `petalinux-create --type project --template zynq --name petalinux_desktop` is run, creating a new project named `petalinux_desktop` in the current directory. Then, `cd petalinux_desktop/` is run to change the directory. Finally, `sudo cp /media/sf_ZYNQ-FILES/system.hdf .` is run to copy the `system.hdf` file from the mounted ZYNQ-FILES directory into the project directory. The terminal then runs `sudo chown taterli:taterli system.hdf` to change ownership of the copied file.

```
taterli@taterli-VirtualBox:~/petalinux_desktop$ petalinux-create --type project --template zynq --  
name petalinux_desktop  
INFO: Create project: petalinux_desktop  
INFO: New project successfully created in /home/taterli/petalinux_desktop  
taterli@taterli-VirtualBox:~/petalinux_desktop$ cd petalinux_desktop/  
taterli@taterli-VirtualBox:~/petalinux_desktop$ sudo cp /media/sf_ZYNQ-FILES/sys  
tem.hdf .  
taterli@taterli-VirtualBox:~/petalinux_desktop$ sudo chown taterli:taterli syste  
m.hdf  
taterli@taterli-VirtualBox:~/petalinux_desktop$ petalinux-config --get-hw-descri  
ption=.
```

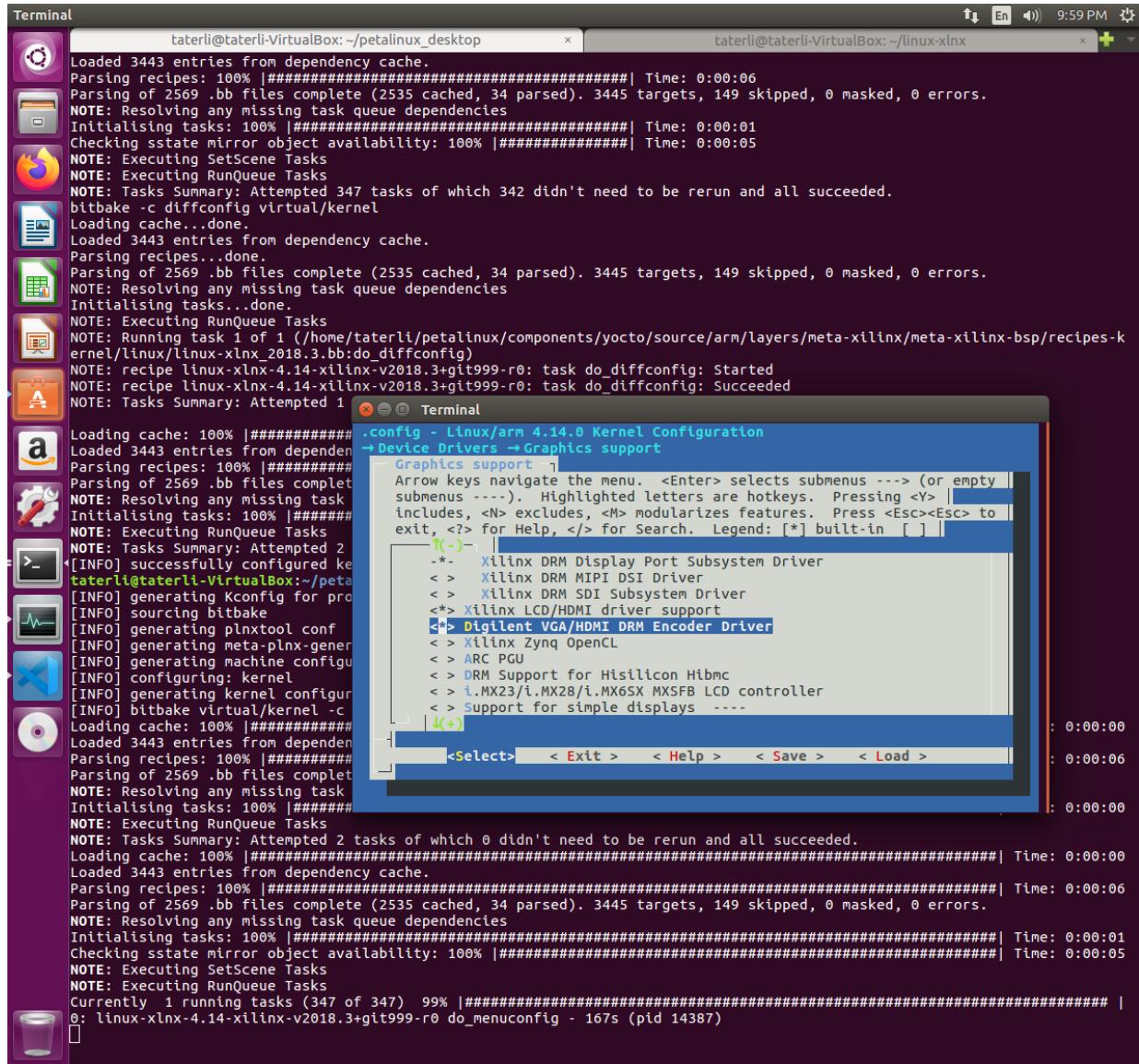
配置:

1. Image Packing Configuration → Root filesystem type → SD Card
2. Linux Components Selection → linux-kernel → ext-local-src
3. Linux Components Selection → External linux-kernel local source settings → [/home/taterli/xlnx-eco (填写实际路径)]

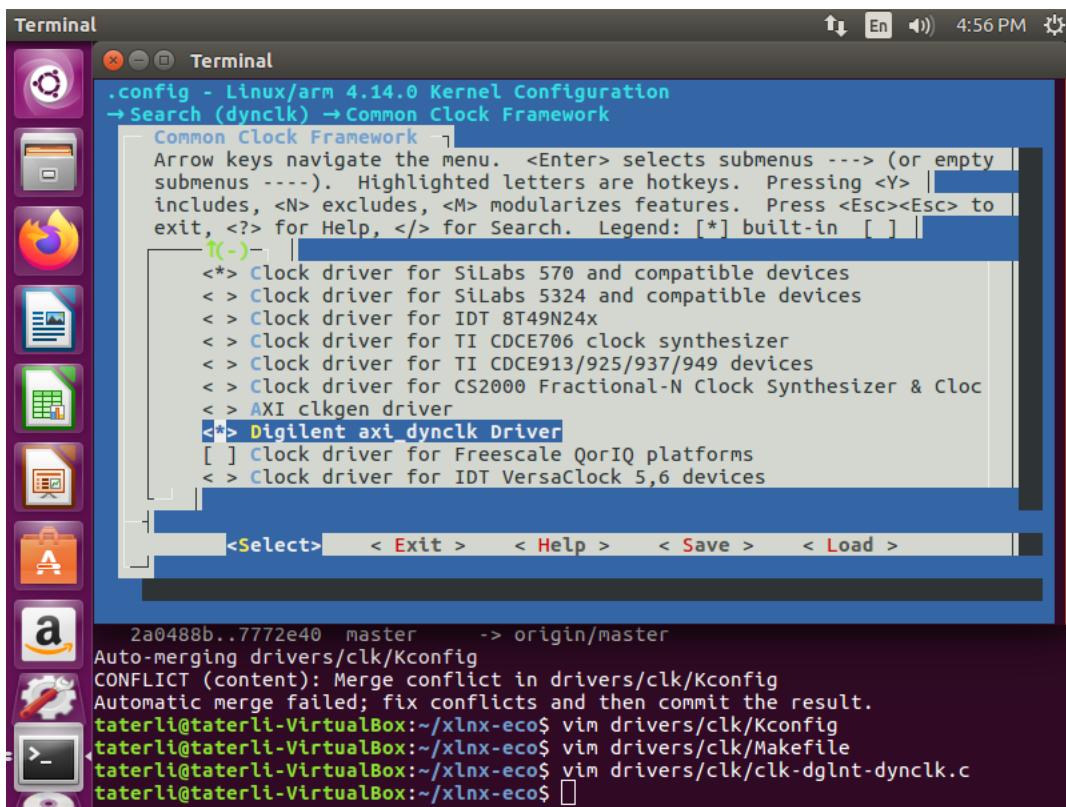
退出并保存,然后进行内核配置.

```
petalinux-config -c kernel
```

使能Digilent VGA/HDMI驱动,使能LCD/HDMI转换驱动,这个官方内核没有,是我补上的.



使能时钟生成CLK_DGLNT_DYNCLK.



但是只有驱动还不行,还要补上dts配置才可以,由于是针对工程的单独设置,所以文件位于以下路径.

```
project-spec/meta-user/recipes-bsp/device-tree/files/system-user.dtsi
```

填入这些内容,具体什么意思就单独学习下Linux来认识.

```
/include/ "system-conf.dtsi"

#define GPIO_ACTIVE_HIGH 0
#define GPIO_ACTIVE_LOW 1

/ {
    model = "Navigator Development Board";
    compatible = "zynq7010,zynq-7020","xlnx,zynq-7000";

    usb_phy0: phy0 {
        compatible = "ulpi-phy";
        #phy-cells = <0>;
        reg = <0xe0002000 0x1000>;
        view-port = <0x170>;
        drv-vbus;
    };

    video_timings {
        timing_4x3_480x272: timing0 {
            clock-frequency = <90000000>;
            hactive = <480>;
            vactive = <272>;

            hback-porch = <40>;
            hsync-len = <20>;
            hfront-porch = <5>;
            vback-porch = <8>;
            vsync-len = <3>;
            vfront-porch = <8>;
        };
    };
}
```

```

        hsync-active = <0>;
        vsync-active = <0>;
        de-active = <1>;
        pixelclk-active = <0>;
    };

    timing_1920x1080: timing1 {
        clock-frequency = <148500000>;
        hactive = <1920>;
        vactive = <1080>;

        hback-porch = <148>;
        hsync-len = <44>;
        hfront-porch = <88>;
        vback-porch = <36>;
        vsync-len = <5>;
        vfront-porch = <4>;

        hsync-active = <0>;
        vsync-active = <0>;
        de-active = <1>;
        pixelclk-active = <1>;
    };
};

&usb0{
    dr_mode = "host";
    usb-phy = <&usb_phy0>;
};

&axi_dynclk_0 {
    compatible = "digilent,axi-dynclk";
    clocks = <&clkc 15>;
    #clock-cells = <0>;
};

&v_tc_0 {
    compatible = "xlnx,v-tc-5.01.a";
};

&amba_pl {
    xlnx_vdma_hdmi {
        compatible = "xilinx,vdmafb";
        status = "okay";

        xlnx,vtc = <&v_tc_0>;
        clocks = <&axi_dynclk_0>;
        clock-names = "hdmi_pclk";
        dmas = <&axi_vdma_0 0>;
        dma-names = "hdmi_vdma";

        is-hdmi = <0x1>;

        display-timings = <&timing_1920x1080>;
        xlnx,pixel-format = "bgr888";
    };
};

```

然后执行petalinux-build进行构建,除了SDK打包,我么也可以在Linux打包,注意路径.

```

taterli@taterli-VirtualBox:~/petalinux_desktop/images/linux$ petalinux-package --boot --fsbl /tftpboot/zynq_fsbl.elf --fpga --u-boot --force
INFO: File in BOOT BIN: "/tftpboot/zynq_fsbl.elf"
INFO: File in BOOT BIN: "/home/taterli/petalinux_desktop/project-spec/hw-description/design_1_wrapper.bit"
INFO: File in BOOT BIN: "/home/taterli/petalinux_desktop/images/linux/u-boot.elf"
INFO: Generating Zynq binary package BOOT.BIN...

***** Xilinx Bootgen v2018.3
**** Build date : Nov 15 2018-19:22:29
** Copyright 1986-2018 Xilinx, Inc. All Rights Reserved.

INFO: Binary is ready.
taterli@taterli-VirtualBox:~/petalinux_desktop/images/linux$ ls
BOOT.BIN          rootfs.ext3      rootfs.tar.bz2      u-boot.bin
image.ub          rootfs.ext3.bz2   rootfs.tar.gz     u-boot.elf
rootfs.cpio       rootfs.ext4      rootfs.testdata.json vmlinuz
rootfs.cpio.bz2   rootfs.ext4.gz   system.bit       zImage

```

```
rootfs.cpio.gz      rootfs.jffs2    system.dtb        zynq_fsbl.elf  
rootfs.cpio.gz.u-boot  rootfs.manifest  System.map.linux  
taterli@taterli-VirtualBox:~/petalinux_desktop/images/linux$
```

写入SD卡.

```
taterli@taterli-VirtualBox:~/petalinux_desktop$ sudo fdisk /dev/sdb

Welcome to fdisk (util-linux 2.27.1).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Command (m for help): d
Partition number (1,2,4, default 4): 1

Partition 1 has been deleted.

Command (m for help): d
Partition number (2,4, default 4): 2

Partition 2 has been deleted.

Command (m for help): d
Selected partition 4
Partition 4 has been deleted.

Command (m for help): n
Partition type
  p  primary (0 primary, 0 extended, 4 free)
  e  extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-31457279, default 2048):
Last sector, +sectors or +size{K,M,G,T,P} (2048-31457279, default 31457279): +500M

Created a new partition 1 of type 'Linux' and of size 500 MiB.

Command (m for help): t
Selected partition 1
Partition type (type L to list all types): 1
Changed type of partition 'Linux' to 'FAT12'.

Command (m for help): a
Selected partition 1
The bootable flag on partition 1 is enabled now.

Command (m for help): n
Partition type
  p  primary (1 primary, 0 extended, 3 free)
  e  extended (container for logical partitions)
Select (default p):

Using default response p.
Partition number (2-4, default 2):
First sector (1026048-31457279, default 1026048):
Last sector, +sectors or +size{K,M,G,T,P} (1026048-31457279, default 31457279):

Created a new partition 2 of type 'Linux' and of size 14.5 GiB.

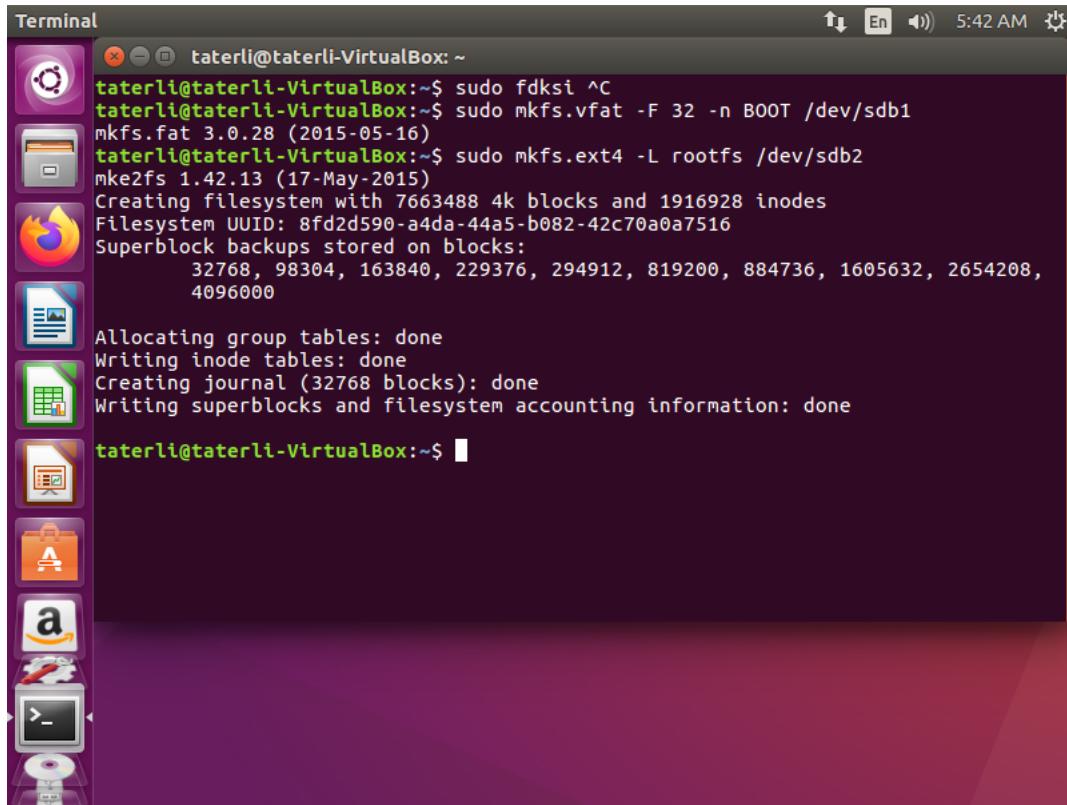
Command (m for help): p
Disk /dev/sdb: 15 GiB, 16106127360 bytes, 31457280 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x500a0dff

Device     Boot   Start     End Sectors Size Id Type
/dev/sdb1  *       2048 1026047 1024000 500M  1 FAT12
/dev/sdb2        1026048 31457279 30431232 14.5G 83 Linux

Command (m for help):w
```

格式化:

```
sudo mkfs.vfat -F 32 -n BOOT /dev/sdb1  
sudo mkfs.ext4 -L rootfs /dev/sdb2 # 如果时间太长可以考虑换个卡.
```



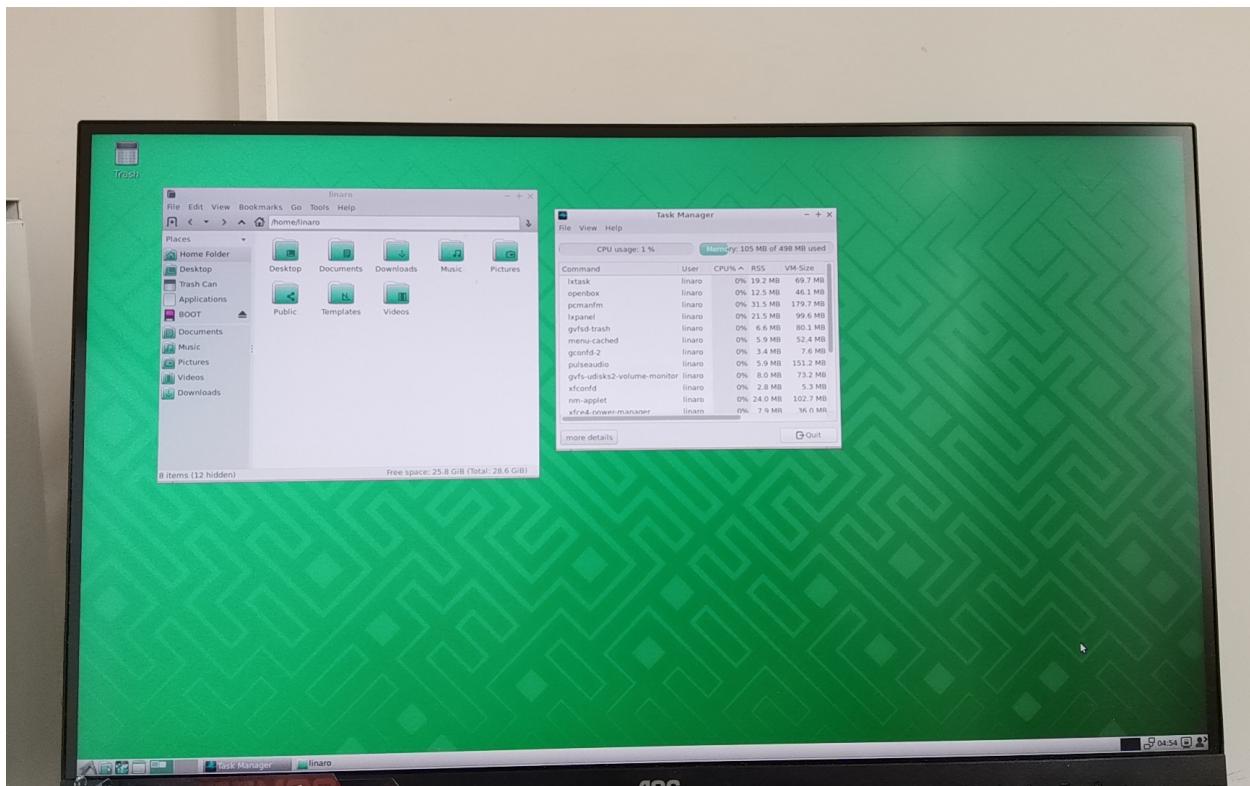
把BOOT.bin和image.ub复制到BOOT,rootfs就解压照样复制,这个应该没难度,不展开解释了,记得umount,不然可能会有写入缓存丢失.

```

taterli@taterli-VirtualBox: ~/rootfs-binary
taterli@taterli-VirtualBox:~$ cd /media/taterli/BOOT/
taterli@taterli-VirtualBox:/media/taterli/BOOT$ cp /tftpboot/image.ub .
taterli@taterli-VirtualBox:/media/taterli/BOOT$ cp ~/petalinux_desktop/images/linux/BOOT.BIN .
taterli@taterli-VirtualBox:/media/taterli/BOOT$ cd ~/rootfs-binary/
taterli@taterli-VirtualBox:~/rootfs-binary$ sudo cp -a ./* /media/taterli/rootfs/
taterli@taterli-VirtualBox:~/rootfs-binary$ sudo sync
taterli@taterli-VirtualBox:~/rootfs-binary$ sudo umount /media/taterli/BOOT
taterli@taterli-VirtualBox:~/rootfs-binary$ sudo umount /media/taterli/rootfs
taterli@taterli-VirtualBox:~/rootfs-binary$

```

启动顺利.



另外此工程涉及东西很多,因此更多细节需要自己慢慢探讨,以及非常细心地去做实验,由于工程比较复杂,所以bd文件就附在这里以备有任何问题好对照.

https://s3-us-west-2.amazonaws.com/secure.notion-static.com/eb978816-e1ee-4930-a6ba-4f64a5f494ef/design_1.bd