

Configuring HDMI Output on a Zynq-7000 Board

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Introduction

In this document, I provide an overview of configuring HDMI output in PetaLinux 2024.2, using a custom Zynq-7000 board (see [Appendix D – My Zynq-7000 Board](#)). I developed this PCB based on reference designs from Digilent and Phil's Lab. The steps I have taken to configure HDMI output should be similar to steps required for Digilent Arty Z7 and Zybo Z7 boards.

In the future will post an accompanying video walking through some of this (see <https://www.youtube.com/@rehstd>). I also have related videos on the design and build of my Zynq-7000 board.

The information in this document is based on my personal experience and my limited knowledge of PetaLinux and Zynq-7000 systems. I am likely missing important details. Suggestions on how to improve this document can be emailed to me (Rich) at rehstd.info@gmail.com; I will do my best to update this document accordingly.

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Development Environment Overview

The following are details on the development environment I am using.

- Hardware: Intel Core i7-14700F, 32GB RAM, SD card reader
- Ubuntu Desktop 24.04.1 LTS (bare-metal, not virtualized)
 - Vivado 2024.2
 - PetaLinux 2024.2
- Digilent drivers
 - See [linux-digilent/drivers at digilent rebase v5.15 LTS 2022.1 · Digilent/linux-digilent · GitHub](#)
 - [clk-dgInt-dynclk.c](#)
 - [digilent_hdmi.c](#)

Ubuntu Operating System & Xilinx Tools Installation

I have taken the following steps to configure the development environment.

1. Install Ubuntu Desktop 24.04.1 LTS from bootable USB thumb drive to NVME storage.
 - a. Download at <https://ubuntu.com/download/desktop>.
2. Install Vivado Edition™ 2024.2.
 - a. Download at <https://www.xilinx.com/support/download.html>.
3. Install PetaLinux required packages.
 - a. Download and run plnx-env-setup.sh.
 - b. See https://adaptivesupport.amd.com/s/article/73296?language=en_US.
 - c. Carefully review output for errors and manually install any failed installations.
4. Install PetaLinux Tools 2024.2.
 - a. Download at <https://www.xilinx.com/support/download/index.html/content/xilinx/en/downloadNav/embedded-design-tools.html>.
5. Change the shell
 - a. `chsh -s /bin/bash`
 - b. See <https://www.baeldung.com/linux/change-default-shell>.
6. Modify the settings.sh file in the PetaLinux installation folder.
 - a. Added two lines:
 - i. `sudo sysctl -w kernel.apparmor_restrict_unprivileged_unconfined=0`
 - ii. `sudo sysctl -w kernel.apparmor_restrict_unprivileged_usersns=0`
 - b. See https://adaptivesupport.amd.com/s/question/0D54U00008PJPRhSAP/help-me-get-my-petalinux-working-ubuntu-2404-petalinuxv20232?language=en_US.

Development Workflow

1. Create the hardware design in Vivado. I originally started with the Arty Z7-20 HDMI Out Demo project (See <https://github.com/Digilent/Arty-Z7-20-hdmi-out>). I modified the project and have the following as my current, functional design.

- a. **Constraints File:** primary.xdc – **This is based on my specific hardware. You will want to update constraints (e.g., FPGA pin#'s) this to match your board (e.g., Digilent Arty Z7-20).**

##TDM5 Clock

```
set_property -dict {PACKAGE_PIN C18 IOSTANDARD TMDS_33} [get_ports TMDS_clk_n]
set_property -dict {PACKAGE_PIN C17 IOSTANDARD TMDS_33} [get_ports TMDS_clk_p]
```

#TDM5 Data (qty. 3)

```
set_property -dict {PACKAGE_PIN C19 IOSTANDARD TMDS_33} [get_ports {TMDS_data_n[0]}]
set_property -dict {PACKAGE_PIN D18 IOSTANDARD TMDS_33} [get_ports {TMDS_data_p[0]}]
set_property -dict {PACKAGE_PIN A19 IOSTANDARD TMDS_33} [get_ports {TMDS_data_n[1]}]
set_property -dict {PACKAGE_PIN A18 IOSTANDARD TMDS_33} [get_ports {TMDS_data_p[1]}]
set_property -dict {PACKAGE_PIN C20 IOSTANDARD TMDS_33} [get_ports {TMDS_data_n[2]}]
set_property -dict {PACKAGE_PIN D20 IOSTANDARD TMDS_33} [get_ports {TMDS_data_p[2]}]
```

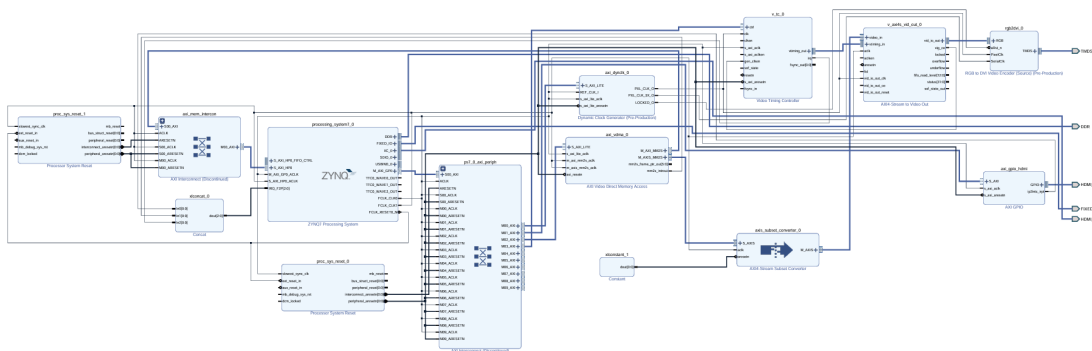
#HPD

```
set_property -dict {PACKAGE_PIN H15 IOSTANDARD LVCMOS33} [get_ports {HDMI_HPD_tri_i[0]}]
```

#I2C

```
set_property -dict {PACKAGE_PIN B16 IOSTANDARD LVCMOS33} [get_ports HDMI_DDC_scl_io]
set_property -dict {PACKAGE_PIN B17 IOSTANDARD LVCMOS33} [get_ports HDMI_DDC_sda_io]
```

- b. **Block Design** – See [Appendix A](#) for additional details.



- c. Generate Bitstream, Export Hardware (Include bitstream), and copy the exported .xsa file to the PetaLinux installation folder (e.g., I installed PetaLinux in /home/rich/petalinux20242/).
2. To start a PetaLinux development session, run the following from the PetaLinux installation folder (terminal): `source ./settings.sh`.

```
rich@i14700f-Ubuntu: ~/petalinux20242
rich@i14700f-Ubuntu:~/petalinux20242$ source ./settings.sh
*****
The PetaLinux source code and images provided/generated are for demonstration purposes only.
Please refer to https://xilinx-wiki.atlassian.net/wiki/spaces/A/pages/2741928025/Moving+from+PetaLinux+to+Production+Deployment
for more details
*****
PetaLinux environment set to '/home/rich/petalinux20242'
WARNING: /bin/sh is not bash!
bash is PetaLinux recommended shell. Please set your default shell to bash.
[WARNING] This is not a supported OS
[INFO] Checking free disk space
[INFO] Checking installed tools
[INFO] Checking installed development libraries
[INFO] Checking network and other services
[WARNING] No tftp server found - please refer to "UG1144 2024.2 PetaLinux Tools Documentation Reference Guide" for its impact and solution
rehsd additional processing...
update apparmor config
[sudo] password for rich:
kernel.apparmor_restrict_unprivileged_unconfined = 0
kernel.apparmor_restrict_unprivileged_userns = 0
complete
rich@i14700f-Ubuntu:~/petalinux20242$
```

3. Create a new PetaLinux project.
 - a. In the following command, replace “rehsdZynq” with your desired project name.
 - b. `petalinux-create project --template zynq --name rehsdZynq`
4. Create modules for Digilent DynClk and Digilent HDMI.
 - c. `petalinux-create -t modules --name clk-dglnt-dynclk --enable`
 - d. `petalinux-create -t modules --name diligent-hdmi --enable`
5. Within the project folder, copy the contents of `diligent_hdmi.c` and `clk-dglnt-dynclk.c` files (from Digilent’s GitHub) and replace the content of the auto-generated module `.c` files.
 - a. `project-spec/meta-user/recipes-modules/clk-dglnt-dynclk/files`
 - b. `project-spec/meta-user/recipes-modules/diligent-encoder/files`
 - i. Note that the file uses a dash (“-”) and not an underscore (“_”).
6. Import hardware
 - a. In the following command, replace “/home/rich/petalinux/” with the location of your PetaLinux installation.
 - b. `petalinux-config --get-hw-description=/home/rich/petalinux/`
 - c. For reference, my current settings are below.

```
#
# PetaLinux System Configuration
#
CONFIG_SUBSYSTEM_TYPE_LINUX=y
CONFIG_SYSTEM_ZYNQ=y
CONFIG_SUBSYSTEM_DISTRO_PETALINUX=y
CONFIG_SUBSYSTEM_ARCH_ARM=y
CONFIG_SUBSYSTEM_ENDIAN_LITTLE=y

#
# Linux Components Selection
#
CONFIG_SUBSYSTEM_COMPONENT_DEVICE__TREE_NAME_DEVICE__TREE_GENERATOR=y
CONFIG_SUBSYSTEM_COMPONENT_BOOTLOADER_AUTO_FSBL=y
CONFIG_SUBSYSTEM_COMPONENT_BOOTLOADER_NAME_ZYNQ_FSBL=y
CONFIG_SUBSYSTEM_COMPONENT_U__BOOT_NAME_U__BOOT__XLNX=y
CONFIG_SUBSYSTEM_COMPONENT_LINUX__KERNEL_NAME_LINUX__XLNX=y
```

```
#
# Auto Config Settings
#
CONFIG_SUBSYSTEM_AUTOCONFIG_DEVICE__TREE=y

#
# Subsystem Hardware Settings
#
CONFIG_SUBSYSTEM_PROCESSOR0_IP_NAME="ps7_cortexa9_0"
CONFIG_SUBSYSTEM_ENABLE_ARCHARM=y
CONFIG_SUBSYSTEM_PROCESSOR_ps7_cortexa9_0_SELECT=y

#
# Memory Settings
#
CONFIG_SUBSYSTEM_MEMORY_PS7_DDR_0_SELECT=y
CONFIG_SUBSYSTEM_MEMORY_PS7_DDR_0_BASEADDR=0x0
CONFIG_SUBSYSTEM_MEMORY_PS7_DDR_0_SIZE=0x40000000
CONFIG_SUBSYSTEM_MEMORY_PS7_DDR_0_U__BOOT_TEXTBASE_OFFSET=0x4000000
CONFIG_SUBSYSTEM_MEMORY_IP_NAME="ps7_ddr_0"

#
# Serial Settings
#
CONFIG_SUBSYSTEM_FSBL_SERIAL_PS7_UART_0_SELECT=y
CONFIG_SUBSYSTEM_SERIAL_PS7_UART_0_SELECT=y
CONFIG_SUBSYSTEM_SERIAL_PS7_UART_0_BAUDRATE_115200=y
CONFIG_SUBSYSTEM_SERIAL_FSBL_IP_NAME="ps7_uart_0"
CONFIG_SUBSYSTEM_SERIAL_IP_NAME="ps7_uart_0"

#
# Ethernet Settings
#
CONFIG_SUBSYSTEM_ETHERNET_PS7_ETHERNET_0_SELECT=y
CONFIG_SUBSYSTEM_ETHERNET_PS7_ETHERNET_0_MAC="00:0a:35:00:1e:53"
CONFIG_SUBSYSTEM_ETHERNET_PS7_ETHERNET_0_USE_DHCP=y

#
# Flash Settings
#
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_SELECT=y

#
# partition 0
#
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_PART0_NAME="qspi-boot"
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_PART0_SIZE=0x500000

#
# partition 1
#
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_PART1_NAME="qspi-kernel"
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_PART1_SIZE=0xA80000

#
# partition 2
#
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_PART2_NAME="qspi-bootenv"
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_PART2_SIZE=0x20000
```

```

#
# partition 3
#
CONFIG_SUBSYSTEM_FLASH_PS7_QSPI_0_PART3_NAME=""
CONFIG_SUBSYSTEM_FLASH_IP_NAME="ps7_qspi_0"

#
# SD/SDIO Settings
#
CONFIG_SUBSYSTEM_PRIMARY_SD_PS7_SD_0_SELECT=y
# CONFIG_SUBSYSTEM_PRIMARY_SD_MANUAL_SELECT is not set

#
# DTG Settings
#
CONFIG_SUBSYSTEM_MACHINE_NAME="template"
CONFIG_SUBSYSTEM_DT_XSCT_WORKSPACE="${PROOT}/components/plnx_workspace/device-tree"
CONFIG_SUBSYSTEM_DTB_PADDING_SIZE=0x1000
CONFIG_SUBSYSTEM_EXTRA_DT_FILES=""

#
# Kernel Bootargs
#
CONFIG_SUBSYSTEM_BOOTARGS_AUTO=y
CONFIG_SUBSYSTEM_BOOTARGS_EARLYPRINTK=y
CONFIG_SUBSYSTEM_EXTRA_BOOTARGS=""
CONFIG_SUBSYSTEM_DEVICETREE_COMPILER_FLAGS="-@"

#
# FSBL Configuration
#
CONFIG_SUBSYSTEM_FSBL_BSPCOMPILER_FLAGS=""
CONFIG_SUBSYSTEM_FSBL_COMPILER_EXTRA_FLAGS=""

#
# u-boot Configuration
#
CONFIG_SUBSYSTEM_UBOOT_CONFIG_TARGET="xilinx_zynq_virt_defconfig"

#
# u-boot script configuration
#
CONFIG_SUBSYSTEM_UBOOT_APPEND_BASEADDR=y
CONFIG_SUBSYSTEM_UBOOT_PRE_BOOTENV=""

#
# JTAG/DDR image offsets
#
CONFIG_SUBSYSTEM_UBOOT_DEVICETREE_OFFSET="0x100000"
CONFIG_SUBSYSTEM_UBOOT_KERNEL_OFFSET=0x200000
CONFIG_SUBSYSTEM_UBOOT_RAMDISK_IMAGE_OFFSET=0x4000000
CONFIG_SUBSYSTEM_UBOOT_FIT_IMAGE_OFFSET=0x10000000
CONFIG_SUBSYSTEM_UBOOT_BOOTSCR_OFFSET=0x3000000

#
# QSPI/OSPI image offsets
#
CONFIG_SUBSYSTEM_UBOOT_QSPI_KERNEL_OFFSET=0xA00000
CONFIG_SUBSYSTEM_UBOOT_QSPI_KERNEL_SIZE=0x600000
CONFIG_SUBSYSTEM_UBOOT_QSPI_RAMDISK_OFFSET=0x1000000

```

```

CONFIG_SUBSYSTEM_UBOOT_QSPI_RAMDISK_SIZE=0xF80000
CONFIG_SUBSYSTEM_UBOOT_QSPI_FIT_IMAGE_OFFSET=0xA80000
CONFIG_SUBSYSTEM_UBOOT_QSPI_FIT_IMAGE_SIZE=0x1500000
CONFIG_SUBSYSTEM_UBOOT_QSPI_BOOTSCR_OFFSET="AUTO"
CONFIG_SUBSYSTEM_UBOOT_QSPI_BOOTSCR_SIZE="AUTO"

#
# NAND image offsets
#
CONFIG_SUBSYSTEM_UBOOT_NAND_KERNEL_OFFSET=0x1000000
CONFIG_SUBSYSTEM_UBOOT_NAND_KERNEL_SIZE=0x3200000
CONFIG_SUBSYSTEM_UBOOT_NAND_RAMDISK_OFFSET=0x4600000
CONFIG_SUBSYSTEM_UBOOT_NAND_RAMDISK_SIZE=0x3200000
CONFIG_SUBSYSTEM_UBOOT_NAND_FIT_IMAGE_OFFSET=0x1080000
CONFIG_SUBSYSTEM_UBOOT_NAND_FIT_IMAGE_SIZE=0x6400000
CONFIG_SUBSYSTEM_UBOOT_KERNEL_IMAGE="ulImage"
CONFIG_SUBSYSTEM_UBOOT_FIT_IMAGE="image.ub"
# CONFIG_SUBSYSTEM_UBOOT_EXT_DTB is not set

#
# Linux Configuration
#
CONFIG_SUBSYSTEM_LINUX_CONFIG_TARGET=""

#
# Image Packaging Configuration
#
CONFIG_SUBSYSTEM_ROOTFS_INITRD=y
CONFIG_SUBSYSTEM_INITRD_RAMDISK_LOADADDR=0x0
CONFIG_SUBSYSTEM_INITRAMFS_IMAGE_NAME="petalinux-image-minimal"
CONFIG_SUBSYSTEM_UIIMAGE_NAME="image.ub"
CONFIG_SUBSYSTEM_RFS_FORMATS="cpio cpio.gz cpio.gz.u-boot ext4 tar.gz"

#
# Firmware Version Configuration
#
CONFIG_SUBSYSTEM_HOSTNAME="rehsdZynq"
CONFIG_SUBSYSTEM_PRODUCT="rehsdZynq"
CONFIG_SUBSYSTEM_FW_VERSION="1.00"
CONFIG_YOCTO_MACHINE_NAME="zynq-generic"
CONFIG_YOCTO_INCLUDE_MACHINE_NAME=""
CONFIG_YOCTO_ADD_OVERRIDES=""

#
# Yocto Settings
#

#
# TMPDIR Location
#
CONFIG_TMP_DIR_LOCATION="${PROOT}/build/tmp"

#
# Devtool Workspace Location
#
CONFIG_DEVTOOL_WORKSPACE_LOCATION="${PROOT}/components/yocto/workspace"
CONFIG_PLNX_IMAGES_LOCATION="${PROOT}/images/linux"

#
# Parallel thread execution

```

```
#
CONFIG_YOCTO_BB_NUMBER_THREADS=""
CONFIG_YOCTO_BB_NUMBER_PARSE_THREADS=""
CONFIG_YOCTO_PARALLEL_MAKE=""

#
# Add pre-mirror url
#
CONFIG_PRE_MIRROR_URL="https://petalinux.xilinx.com/sswreleases/rel-v${PETALINUX_VER}/downloads"

#
# Local sstate feeds settings
#
CONFIG_YOCTO_LOCAL_SSTATE_FEEDS_URL=""
CONFIG_YOCTO_NETWORK_SSTATE_FEEDS=y

#
# Network sstate feeds URL
#
CONFIG_YOCTO_NETWORK_SSTATE_FEEDS_URL="https://petalinux.xilinx.com/sswreleases/rel-v${PETALINUX_VER}/arm/sstate-cache"

#
# User Layers
#
CONFIG_USER_LAYER_0=""
CONFIG_SUBSYSTEM_BOOTARGS_GENERATED="console=ttyPS0,115200 earlycon root=/dev/ram0 rw"
```

7. Update the device tree.

- a. project-spec/meta-user/recipes-bsp/device-tree/files/ system-user.dtsi
- b. My file contents:

```
/include/ "system-conf.dtsi"
#include <dt-bindings/gpio/gpio.h>
/* #include </home/rich/petalinux20242/rehsdZynq/xilinx-vip.h> */ /*this doesn't work!*/

/{
    model = "rehsd Zynq-7000 Board";
    compatible = "rehsd,zynq-7000", "xlnx,zynq-7000";

    chosen {
        bootargs = "console=ttyPS0,115200 earlyprintk uio_pdrv_genirq.of_id=generic-uio";
    };

    usb_phy0: usb_phy@0 {
        compatible = "ulpi-phy";
        #phy-cells = <0>;
        reg = <0xe0002000 0x1000>;
        view-port = <0x0170>;
        reset-gpios = <&gpio0 46 1>;
        drv-vbus;
    };
};

&gem0 {
    phy-handle = <&ethernet_phy>;
    ethernet_phy: ethernet-phy@0 {
        device_type = "ethernet-phy";
        reg = <0>;
    };
};
```



```

/* dt-bindings/phy/realtek.h */
/* #define REALTEK_LED_LINK10      BIT(0)
#define REALTEK_LED_LINK100      BIT(1)
#define REALTEK_LED_LINK1000     BIT(3)
#define REALTEK_LED_ACT          BIT(4)
#define REALTEK_LED_DEFAULT      BIT(7)
*/
/* LED0=10+A, LED1=100+A, LED2=1000+A */
realtek,leds-config = <0x11 0x12 0x18>;
};

};
&usb0{
    status = "okay";
    dr_mode = "host";
    usb-phy = <&usb_phy0>;
};
&i2c0 {
    clock-frequency = <100000>;
    status = "okay";
};
&amba_pl {
    digilent_hdmi {
        compatible = "digilent,hdmi";

        clocks = <&axi_dynclk_0>;
        clock-names = "clk";

        digilent_edid_i2c = <&i2c0>;
        digilent_fmax = <150000>;

        port@0 {
            hdmi_ep: endpoint {
                remote-endpoint = <&pl_disp_ep>;
            };
        };

};

xlnx_pl_disp {
    compatible = "xlnx,pl-disp";

    dmas = <&axi_vdma_0 0>;
    dma-names = "dma0";

    /* xlnx,vtc = <&v_tc_0>; */
    /* dglnt,edid-i2c = <&i2c1>; */

    xlnx_vformat = "RG24";    /*XR24*/
    xlnx_bridge = <&v_tc_0>;
    port@0 {
        pl_disp_ep: endpoint {
            remote-endpoint = <&hdmi_ep>;
        };
    };
};

};
&axi_vdma_0 {
    dma-ranges = <0x00000000 0x00000000 0x40000000>;
};
&axi_dynclk_0 {
    compatible = "dglnt,axi-dynclk";

```

```

        #clock-cells = <0>;
        clocks = <&clkc 15>;
};
&v_tc_0{
    compatible = "xlnx,bridge-v-tc-6.1";
    xlnx,pixels-per-clock = <1>;

    /* clock-names = "s_axi_aclk", "clk"; */
    /* clocks = <&clkc 15>, <&axi_dynclk_0>; */
};

&axi_gpio_hdmi{
    compatible = "generic-uio";
};

```

8. Configure the kernel.

- a. petalinux-config -c kernel
- b. For reference, my current settings are below. For any of these that are not in the kernel config tool, I manually added them to project-spec/meta-user/recipes-kernel/linux/linux-xlnx/bsp.cfg.

```

CONFIG_I2C_XILINX=y
CONFIG_MEDIA_USB_SUPPORT=y
CONFIG_LOG_BUF_SHIFT=21
CONFIG_LOG_CPU_MAX_BUF_SHIFT=21
CONFIG_PRINTK_SAFE_LOG_BUF_SHIFT=21
CONFIG_COMMON_CLK_DGLNT_DYNCLK=y

#
# Digilent HDMI support
#
CONFIG_DRM_XLNX_BRIDGE=y
CONFIG_DRM_XLNX_PL_DISP=y
CONFIG_DRM_XLNX_BRIDGE_VTC=y
CONFIG_DRM_DIGILENT_HDMI=y
CONFIG_VT_HW_CONSOLE_BINDING=y
CONFIG_DRM_FBDEV_EMULATION=y
CONFIG_DRM_FBDEV_OVERALLOC=100
CONFIG_FB_NOTIFY=y
CONFIG_FB=y
CONFIG_FB_CFB_FILLRECT=y
CONFIG_FB_CFB_COPYAREA=y
CONFIG_FB_CFB_IMAGEBLIT=y
CONFIG_FB_SYS_FILLRECT=y
CONFIG_FB_SYS_COPYAREA=y
CONFIG_FB_SYS_IMAGEBLIT=y
CONFIG_FB_SYS_FOPS=y
CONFIG_FB_DEFERRED_IO=y

#
# Frame buffer hardware drivers
#
CONFIG_FRAMEBUFFER_CONSOLE=y
CONFIG_FRAMEBUFFER_CONSOLE_DETECT_PRIMARY=y
CONFIG_FONT_SUPPORT=y
CONFIG_FONT_8x8=y
CONFIG_FONT_8x16=y
CONFIG_DRM_DIGILENT_HDMI=y

```

```

CONFIG_USB_SISUSBVGA=y
CONFIG_DRM_XLNX_HDMITX=y
CONFIG_DRM_XLNX_HDCP=y
CONFIG_XILINX_HDCP_COMMON=y
CONFIG_CRYPT_SHA256=y
CONFIG_CRYPT_LIB_SHA256=y
CONFIG_FB_XILINX=y
CONFIG_FB_CFB_FILLRECT=y
CONFIG_FB_CFB_COPYAREA=y
CONFIG_FB_CFB_IMAGEBLIT=y
CONFIG_FB_IOMEM_HELPERS=y
CONFIG_XILINX_GMII2RGMII=y
CONFIG_VT_HW_CONSOLE_BINDING=y
CONFIG_APERTURE_HELPERS=y
CONFIG_AUXDISPLAY=y
CONFIG_CHARLCD_BL_FLASH=y
CONFIG_DRM_GEM_SHMEM_HELPER=y
CONFIG_DRM_SIMPLEDRM=y
CONFIG_DRM_XLNX_HDMITX=y
CONFIG_DRM_XLNX_PL_DISP=y
CONFIG_DRM_XLNX_HDCP=y
CONFIG_FB=y
CONFIG_FB_CORE=y
CONFIG_FB_NOTIFY=y
CONFIG_FIRMWARE_EDID=y
CONFIG_FB_DEVICE=y
CONFIG_FB_FOREIGN_ENDIAN=y
CONFIG_FB_BOTH_ENDIAN=y
CONFIG_FB_IOMEM_FOPS=y
CONFIG_FB_MODE_HELPERS=y
CONFIG_FB_TILEBLITTING=y
CONFIG_VIDEOMODE_HELPERS=y
CONFIG_FRAMEBUFFER_CONSOLE_LEGACY_ACCELERATION=y
CONFIG_LOGO=y
CONFIG_LOGO_LINUX_MONO=y
CONFIG_LOGO_LINUX_VGA16=y
CONFIG_LOGO_LINUX_CLUT224=y
CONFIG_USB_ANNOUNCE_NEW_DEVICES=y
CONFIG_USB_OTG=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_XHCI_PCI=y
CONFIG_USB_XHCI_PLATFORM=y
CONFIG_USB_EHCI_HCD_PLATFORM=y
CONFIG_USB_OHCI_HCD=y
CONFIG_USB_OHCI_HCD_PCI=y
CONFIG_USB_OHCI_HCD_PLATFORM=y
CONFIG_USB_SERIAL=y
CONFIG_USB_ONBOARD_DEV=y
CONFIG_TYPEC=y
CONFIG_XIL_AXIS_FIFO=y
CONFIG_XILINX_FCLK=y
CONFIG_XILINX_HDCP_COMMON=y
CONFIG_CRYPT_AES=y
CONFIG_CRYPT_LIB_AES=y

```

9. Configure u-boot

- a. petalinux-config -c u-boot
- b. For reference, my current settings are below.

CONFIG_SYS_CONFIG_NAME="platform-top"
CONFIG_BOOT_SCRIPT_OFFSET=0x9C0000
CONFIG_EXPO=y
CONFIG_QSPI_BOOT=y
CONFIG_SD_BOOT=y
CONFIG_SD_BOOT_QSPI=y
CONFIG_SPI_BOOT=y
CONFIG_SYS_STDIO_DEREGISTER=y
CONFIG_CMD_PINMUX=y
CONFIG_CMD_VIDCONSOLE=y
CONFIG_AXI=y
CONFIG_CLK_XLNX_CLKWZRD=y
CONFIG_DMA_LEGACY=y
CONFIG_SYS_I2C_XILINX_XIIC=y
CONFIG_I2C_ARB_GPIO_CHALLENGE=y
CONFIG_I2C_MUX_GPIO=y
CONFIG_DM_KEYBOARD=y
CONFIG_PHY_RESET_DELAY=10
CONFIG_MACB=y
CONFIG_RGMII=y
CONFIG_RMII=y
CONFIG_XILINX_AXIEMAC=y
CONFIG_PINCTRL=y
CONFIG_PINCTRL_FULL=y
CONFIG_PINCTRL_GENERIC=y
CONFIG_PINMUX=y
CONFIG_PINCONF=y
CONFIG_PINCONF_RECURSIVE=y
CONFIG_SPL_USB_HOST=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_EHCI_GENERIC=y
CONFIG_USB_OHCI_NEW=y
CONFIG_USB_OHCI_HCD=y
CONFIG_USB_OHCI_GENERIC=y
CONFIG_USB_MAX_CONTROLLER_COUNT=1
CONFIG_USB_KEYBOARD=y
CONFIG_USB_KEYBOARD_FN_KEYS=y
CONFIG_SYS_USB_EVENT_POLL=y
CONFIG_USB_GADGET_OS_DESCRIPTOR=y
CONFIG_VIDEO=y
CONFIG_VIDEO_FONT_4X6=y
CONFIG_VIDEO_FONT_8X16=y
CONFIG_VIDEO_FONT_SUN12X22=y
CONFIG_VIDEO_FONT_16X32=y
CONFIG_VIDEO_LOGO=y
CONFIG_BACKLIGHT=y
CONFIG_VIDEO_PCI_DEFAULT_FB_SIZE=0x0
CONFIG_VIDEO_BPP8=y
CONFIG_VIDEO_BPP16=y
CONFIG_VIDEO_BPP32=y
CONFIG_VIDEO_ANSI=y
CONFIG_VIDEO_MIPI_DSI=y
CONFIG_CONSOLE_NORMAL=y
CONFIG_PANEL=y
CONFIG_SIMPLE_PANEL=y
CONFIG_VIDEO_VESA=y
CONFIG_FRAMEBUFFER_SET_VESA_MODE=y
CONFIG_FRAMEBUFFER_VESA_MODE_118=y
CONFIG_FRAMEBUFFER_VESA_MODE=0x118
CONFIG_I2C_EDID=y

```
CONFIG_DISPLAY=y
CONFIG_CONSOLE_SCROLL_LINES=1
CONFIG_VIDEO_LOGO_MAX_SIZE=0x100000
CONFIG_VIDEO_BMP_RLE8=y
CONFIG_BMP_24BPP=y
```

10. Configure rootfs

- a. petalinux-config -c rootfs
- b. For reference, my current settings are below.

```
CONFIG_system-zynq=y
CONFIG_e2fsprogs-mke2fs=y
CONFIG_fpga-manager-script=y
CONFIG_mtd-utils=y
CONFIG_can-utils=y
CONFIG_nfs-utils=y
CONFIG_pciutils=y
CONFIG_run-postinsts=y
CONFIG_udev-extraconf=y
CONFIG_linux-xlnx-udev-rules=y
CONFIG_packagegroup-core-boot=y
CONFIG_tcf-agent=y
CONFIG_bridge-utils=y
CONFIG_dosfstools=y
CONFIG_u-boot-tools=y
CONFIG_libdrm=y
CONFIG_libdrm-drivers=y
CONFIG_libdrm-tests=y
CONFIG_imagefeature-ssh-server-openssh=y
CONFIG_imagefeature-hwcodecs=y
CONFIG_imagefeature-empty-root-password=y
CONFIG_imagefeature-serial-autologin-root=y
CONFIG_init-manager-sysvinit=y
CONFIG_clk-dgInt-dynclk=y
CONFIG_digilent-hdmi=y
CONFIG_ADD_EXTRA_USERS="root:root;petalinux::passwd-expire;"
CONFIG_CREATE_NEW_GROUPS="aie;"
CONFIG_ADD_USERS_TO_GROUPS="petalinux:audio,video,aie,input;"
CONFIG_ADD_USERS_TO_SUDOERS="petalinux"
```

11. Build

- a. petalinux-build

12. Package

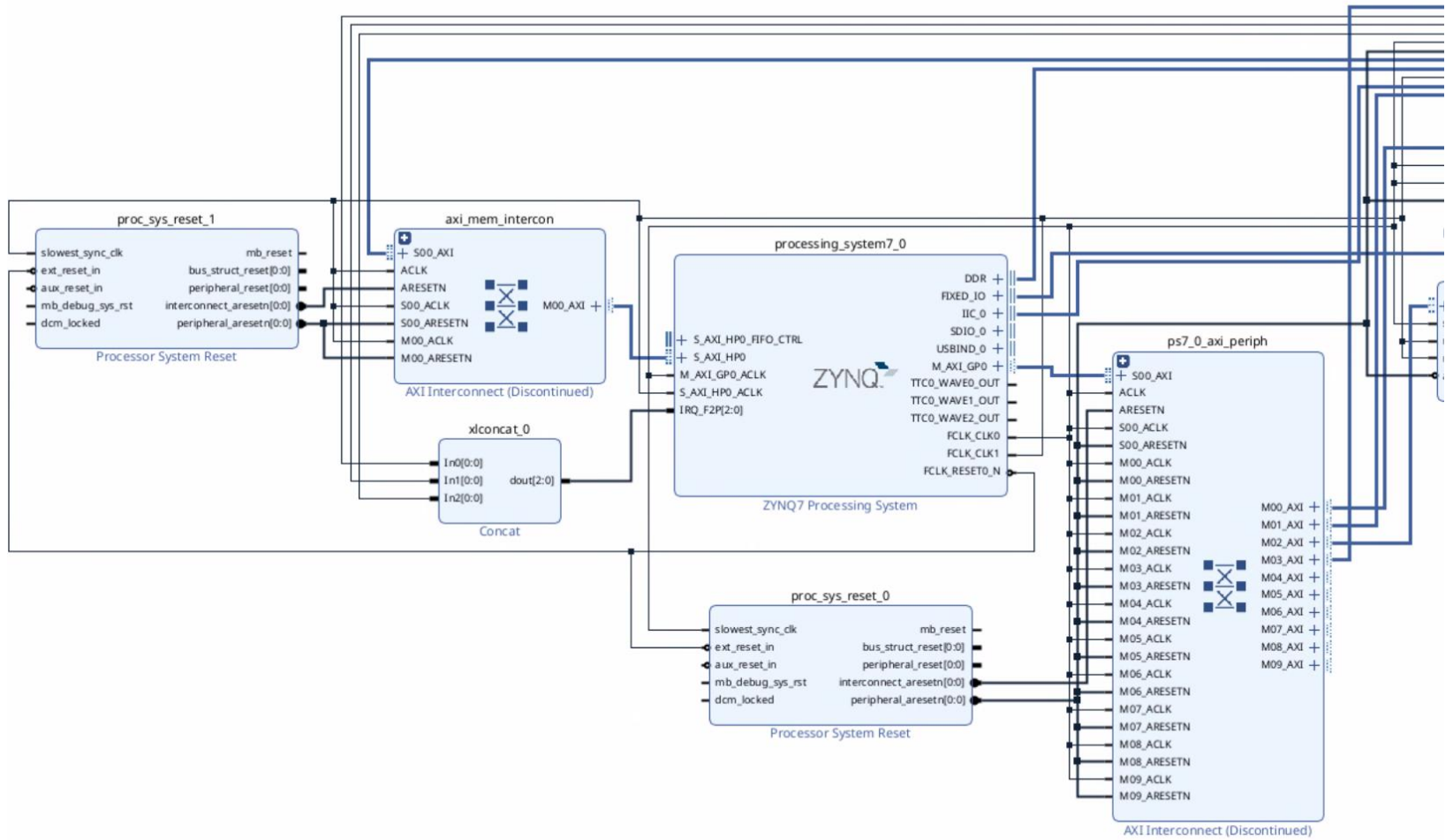
- a. From the images/linux/ folder:
- b. petalinux-package boot --format BIN --fsbl zynq_fsbl.elf --u-boot u-boot.elf --fpga system.bit --force

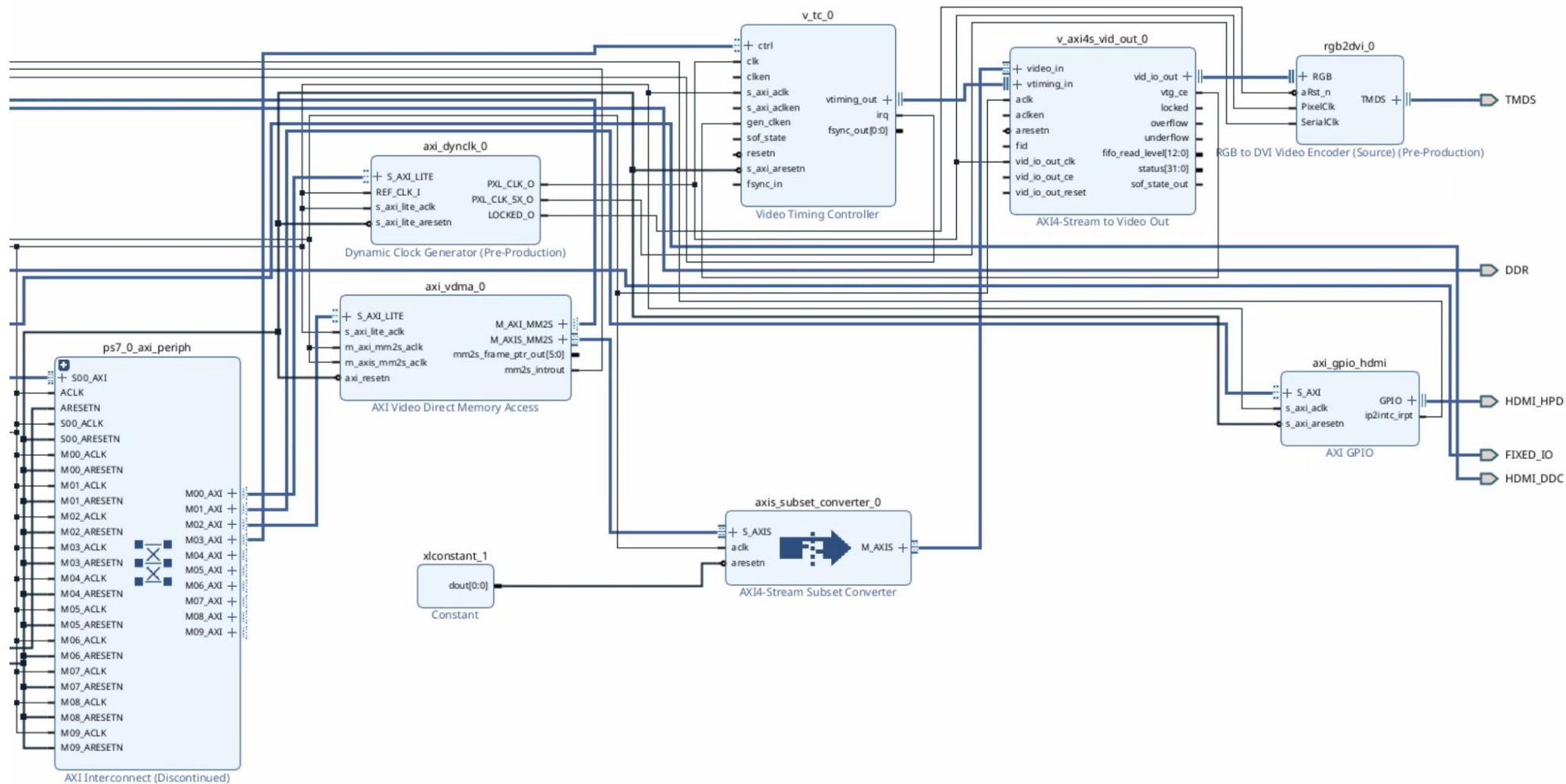
13. Copy files to SD card

- a. In the following command, replace “/dev/sdc2” with the appropriate device for your SD card second partition (ext4).
- b. `sudo dd if=rootfs.ext4 of=/dev/sdb2`
- c. Also, copy boot.scr, BOOT.BIN, image.ub from {project folder}/images/linux to the first partition (FAT/FAT32) on your SD card

14. Make sure your board is set to boot to SD Card. Power on and boot.

[illegible]







Page Navigator

[Zynq Block Design](#)[PS-PL Configuration](#)[Peripheral I/O Pins](#)[MIO Configuration](#)[Clock Configuration](#)[DDR Configuration](#)[SMC Timing Calculation](#)[Interrupts](#)

Peripheral I/O Pins

[Summary Report](#)Search:

Peripherals

☒ USB 0☐ USB 1> ☒ SD 0> ☐ SD 1> ☐ SPI 0> ☐ SPI 1> ☒ UART 0> ☐ UART 1> ☒ I2C 0☐ I2C 1> ☐ CAN 0> ☐ CAN 1☒ TTC0☐ TTC1☐ SWDT☐ PJTAG> ☐ TPIU> ☒ GPIO MIO☐ GPIO EMIO

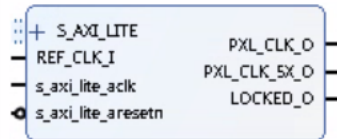
Bank 1 HSTL 1.8V



OK

Cancel

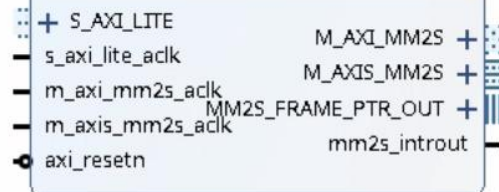
Dynamic Clock Generator (1.2)

[Documentation](#) [IP Location](#)☐ Show disabled portsComponent Name ☐ Add BUFMR on MMCM outputREF_CLK_I Frequency in Hz (Auto) 

OK

Cancel

AXI Video Direct Memory Access (6.3)

[Documentation](#) [IP Location](#)☐ Show disabled ports

Component Name axi_vdma_0

Basic **Advanced**Address Width (32-64) bitsFrame Buffers ☐ Enable Write Channel

Memory Map Data Width

Write Burst Size

Stream Data Width (Auto)

Line Buffer Depth

☒ Enable Read Channel

Memory Map Data Width

Read Burst Size

Stream Data Width

Line Buffer Depth

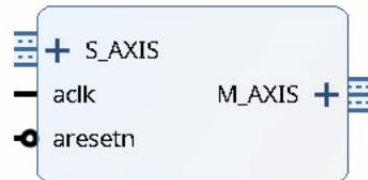
Note:

Configuring the IP with streaming width which is not a power of 2 results in significant increase in resources

OK

Cancel

AXI4-Stream Subset Converter (1.1)

[Documentation](#) [IP Location](#)☐ Show disabled portsComponent Name

Slave Interface Signal Properties

<input type="checkbox"/> MANUAL	Enable TREADY	Yes	▼
<input type="checkbox"/> MANUAL	TDATA Width (bytes)	3	⊗ [0 - 512]
<input type="checkbox"/> MANUAL	Enable TSTRB	No	▼
<input type="checkbox"/> MANUAL	Enable TKEEP	Yes	▼
<input type="checkbox"/> MANUAL	Enable TLAST	Yes	▼
<input type="checkbox"/> MANUAL	TID Width (bits)	0	⊗ [0 - 32]
<input type="checkbox"/> MANUAL	DEST Width (bits)	0	⊗ [0 - 32]
<input type="checkbox"/> MANUAL	USER Width (bits)	1	⊗ [0 - 4096]

Master Interface Signal Properties

<input type="checkbox"/> MANUAL	Enable TREADY	Yes	▼
<input type="checkbox"/> MANUAL	TDATA Width (bytes)	3	⊗ [0 - 512]
<input type="checkbox"/> MANUAL	Enable TSTRB	No	▼
<input type="checkbox"/> MANUAL	Enable TKEEP	Yes	▼
<input type="checkbox"/> MANUAL	Enable TLAST	Yes	▼
<input type="checkbox"/> MANUAL	TID Width (bits)	0	⊗ [0 - 32]
<input type="checkbox"/> MANUAL	DEST Width (bits)	0	⊗ [0 - 32]
<input type="checkbox"/> MANUAL	USER Width (bits)	1	⊗ [0 - 4096]

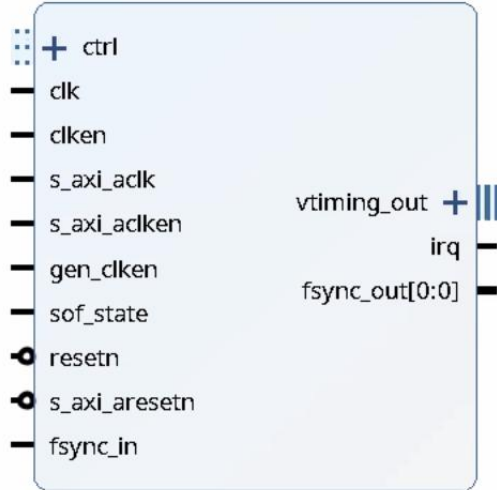
Extra Settings

TDATA Remap String	<input type="text" value="tdata[7:0],tdata[23:16],tdata[15:8]"/>	⊗
TUSER Remap String	<input type="text" value="tuser[0:0]"/>	⊗
TID Remap String	<input type="text" value="1'b0"/>	⊗
TDEST Remap String	<input type="text" value="1'b0"/>	⊗
TKEEP Remap String	<input type="text" value="tkeep[2:0]"/>	⊗
TSTRB Remap String	<input type="text" value="1'b0"/>	⊗
TLAST Remap String	<input type="text" value="tlast[0]"/>	⊗
Generate TLAST	<input type="text" value="0"/> [0 - 256]	
Enable ACLKEN	No	▼

OK

Cancel

Video Timing Controller (6.2)

[Documentation](#) [IP Location](#)☐ Show disabled portsComponent Name **Detection/Generation** **Default/Constant** **Frame Sync Position****Optional Features**

- ☒ Include AXI4-Lite Interface
- ☐ Include INTC Interface
- ☐ Interlaced Video Support
- ☐ Synchronize Generator to Detector or to fsync_in

Max Clocks Per Line Max Lines Per Frame Frame Syncs ☒ Enable Generation☐ Enable Detection**Generation Options**

- ☐ Field ID Generation
- ☒ Vertical Blank Generation
- ☒ Horizontal Blank Generation
- ☒ Vertical Sync Generation
- ☒ Horizontal Sync Generation
- ☒ Active Video Generation
- ☐ Active Chroma Generation
- ☐ Auto Generation Mode

Detection Options

- ☐ Field ID Detection
- ☒ Vertical Blank Detection
- ☒ Horizontal Blank Detection
- ☒ Vertical Sync Detection
- ☒ Horizontal Sync Detection
- ☒ Active Video Detection
- ☐ Active Chroma Detection

OK

Cancel

Component Name v_tc_0

Detection/Generation

Default/Constant

Frame Sync Position

Video Format

Video Mode 720p ▾

Horizontal Settings

Active Size 1280 [0 - 8191]

Frame Size 1650 [0 - 8191]

Sync Start 1390 [0 - 8191]

Sync End 1430 [0 - 8191]

Frame/Field 0 Vertical Settings

Active Size 720 [0 - 8191]

Frame Size 750 [0 - 8191]

Sync Start 724 [0 - 8191]

Sync End 729 [0 - 8191]

Field 1 Vertical Settings

☐ Interlaced

Frame Size 750 [0 - 8191]

Sync Start 724 [0 - 8191]

Sync End 729 [0 - 8191]

Active Polarity

Field ID High ▾

Vblank High ▾

Hblank High ▾

Vsync High ▾

Hsync High ▾

Active Video High ▾

Active Chroma High ▾

Frame/Field 0 Horizontal Fine Adjustment

Vblank Start 640 [0 - 8191]

Vblank End 640 [0 - 8191]

VSyn Start 640 [0 - 8191]

VSyn End 695 [0 - 8191]

Field 1 Horizontal Fine Adjustment

Vblank Start 640 [0 - 8191]

Vblank End 640 [0 - 8191]

VSyn Start 695 [0 - 8191]

VSyn End 695 [0 - 8191]

AXI4-Stream Subset Converter (1.1)

[Documentation](#) [IP Location](#)☐ Show disabled portsComponent Name

Slave Interface Signal Properties

<input type="checkbox"/> MANUAL	Enable TREADY	Yes	▼
<input type="checkbox"/> MANUAL	TDATA Width (bytes)	3	[0 - 512]
<input type="checkbox"/> MANUAL	Enable TSTRB	No	▼
<input type="checkbox"/> MANUAL	Enable TKEEP	Yes	▼
<input type="checkbox"/> MANUAL	Enable TLAST	Yes	▼
<input type="checkbox"/> MANUAL	TID Width (bits)	0	[0 - 32]
<input type="checkbox"/> MANUAL	DEST Width (bits)	0	[0 - 32]
<input type="checkbox"/> MANUAL	USER Width (bits)	1	[0 - 4096]

Master Interface Signal Properties

<input type="checkbox"/> MANUAL	Enable TREADY	Yes	▼
<input type="checkbox"/> MANUAL	TDATA Width (bytes)	3	[0 - 512]
<input type="checkbox"/> MANUAL	Enable TSTRB	No	▼
<input type="checkbox"/> MANUAL	Enable TKEEP	Yes	▼
<input type="checkbox"/> MANUAL	Enable TLAST	Yes	▼
<input type="checkbox"/> MANUAL	TID Width (bits)	0	[0 - 32]
<input type="checkbox"/> MANUAL	DEST Width (bits)	0	[0 - 32]
<input type="checkbox"/> MANUAL	USER Width (bits)	1	[0 - 4096]

Extra Settings

TDATA Remap String	<input type="text" value="tdata[7:0],tdata[23:16],tdata[15:8]"/>
TUSER Remap String	<input type="text" value="tuser[0:0]"/>
TID Remap String	<input type="text" value="1'b0"/>
TDEST Remap String	<input type="text" value="1'b0"/>
TKEEP Remap String	<input type="text" value="tkeep[2:0]"/>
TSTRB Remap String	<input type="text" value="1'b0"/>
TLAST Remap String	<input type="text" value="tlast[0]"/>
Generate TLAST	<input type="text" value="0"/> [0 - 256]
Enable ACLKEN	No ▼

OK

Cancel

AXI4-Stream to Video Out (4.0)

[Documentation](#) [IP Location](#)☐ Show disabled portsComponent Name

Pixels Per Clock

Video Format

AXI4S Video Input Component Width

Native Video Output Component Width

FIFO Depth

Clock Mode☐ Common ☒ Independent**Timing Mode**☐ Slave ☒ Master

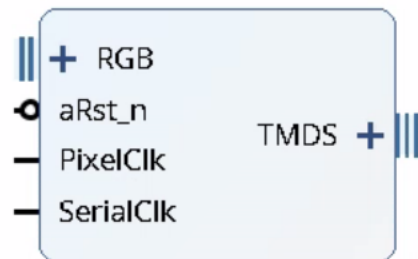
Hysteresis Level

 [0 - 4095]

OK

Cancel

RGB to DVI Video Encoder (Source) (1.4)

[Documentation](#) [IP Location](#)☐ Show disabled portsComponent Name

- ☐ Reset active high
- ☐ Generate SerialClk internally from pixel clock.

MMCM/PLL

☐ MMCM ☒ PLL

TMDS clock range

- ☒ ≥ 120 MHz (1080p)
- ☐ < 120 MHz
- ☐ < 80 MHz (720p)

Invert TMDS lanes

- ☐ Data0 ☐ Data1 ☐ Data2 ☐ Clock

OK

Cancel

AXI GPIO (2.0)

[Documentation](#) [IP Location](#)☐ Show disabled portsComponent Name

GPIO

☒ All Inputs☐ All OutputsGPIO Width [1 - 32]Default Output Value [0x00000000,0xFFFFFFFF]Default Tri State Value [0x00000000,0xFFFFFFFF]☐ Enable Dual Channel

GPIO 2

☐ All Inputs☐ All OutputsGPIO Width [1 - 32]Default Output Value [0x00000000,0xFFFFFFFF]Default Tri State Value [0x00000000,0xFFFFFFFF]☒ Enable Interrupt

OK

Cancel

Appendix B – project-spec/configs/plnx_syshw_data

```
device_id: 7z020
hw_design_name: SixteenBit_Processor_BD_wrapper
processor:
  ps7_cortexa9_0:
    arch: arm
    ip_name: ps7_cortexa9
    slaves_strings: axi_dyncclk_0 axi_gpio_hdmi axi_vdma_0 ps7_afi_0 ps7_afi_1 ps7_afi_2 ps7_afi_3
ps7_coresight_comp_0 ps7_ddr_0 ps7_ddrc_0 ps7_dev_cfg_0 ps7_dma_ns ps7_dma_s ps7_ethernet_0 ps7_globaltimer_0
ps7_gpio_0 ps7_gpv_0 ps7_i2c_0 ps7_intc_dist_0 ps7_iop_bus_config_0 ps7_l2cachec_0 ps7_ocmc_0 ps7_pl310_0
ps7_pmu_0 ps7_qspi_0 ps7_qspi_linear_0 ps7_ram_0 ps7_ram_1 ps7_scuc_0 ps7_scugic_0 ps7_scutimer_0 ps7_scuwdt_0
ps7_sd_0 ps7_slcr_0 ps7_ttc_0 ps7_uart_0 ps7_usb_0 ps7_xadc_0 v_tc_0
  slaves:
    ps7_ddr_0:
      device_type: memory
      ip_name: ps7_ddr
      baseaddr: 0x0
      highaddr: 0x3FFFFFFF
    ps7_uart_0:
      device_type: serial
      ip_name: ps7_uart
      is_pl: 0
    ps7_ethernet_0:
      device_type: ethernet
      ip_name: ps7_ethernet
    ps7_qspi_0:
      device_type: flash
      ip_name: ps7_qspi
    ps7_sd_0:
      device_type: sd
      ip_name: ps7_sdio
    ps7_usb_0:
      device_type: usb
      ip_name: ps7_usb
    axi_dyncclk_0:
      ip_name: axi_dyncclk
    axi_gpio_hdmi:
      ip_name: axi_gpio
    axi_vdma_0:
      ip_name: axi_vdma
    ps7_afi_0:
      ip_name: ps7_afi
    ps7_afi_1:
      ip_name: ps7_afi
    ps7_afi_2:
      ip_name: ps7_afi
    ps7_afi_3:
      ip_name: ps7_afi
    ps7_coresight_comp_0:
      ip_name: ps7_coresight_comp
    ps7_ddrc_0:
      ip_name: ps7_ddrc
    ps7_dev_cfg_0:
      ip_name: ps7_dev_cfg
    ps7_dma_ns:
      ip_name: ps7_dma
    ps7_dma_s:
      ip_name: ps7_dma
    ps7_globaltimer_0:
      ip_name: ps7_globaltimer
    ps7_gpio_0:
      ip_name: ps7_gpio
    ps7_gpv_0:
      ip_name: ps7_gpv
    ps7_i2c_0:
      ip_name: ps7_i2c
    ps7_intc_dist_0:
      ip_name: ps7_intc_dist
    ps7_iop_bus_config_0:
      ip_name: ps7_iop_bus_config
    ps7_l2cachec_0:
      ip_name: ps7_l2cachec
    ps7_ocmc_0:
      ip_name: ps7_ocmc
    ps7_pl310_0:
```

```
        ip_name: ps7_pl310
ps7_pmu_0:
    ip_name: ps7_pmu
ps7_qspi_linear_0:
    ip_name: ps7_qspi_linear
ps7_ram_0:
    ip_name: ps7_ram
ps7_ram_1:
    ip_name: ps7_ram
ps7_scuc_0:
    ip_name: ps7_scuc
ps7_scugic_0:
    ip_name: ps7_scugic
ps7_scutimer_0:
    ip_name: ps7_scutimer
ps7_scuwdt_0:
    ip_name: ps7_scuwdt
ps7_slcr_0:
    ip_name: ps7_slcr
ps7_ttc_0:
    ip_name: ps7_ttc
ps7_xadc_0:
    ip_name: ps7_xadc
v_tc_0:
    ip_name: v_tc
```

Appendix C – PetaLinux Boot (UART output)

As I was trying to get this to work, I was not sure what to be looking for in the boot process. For reference, this is what my current boot looks like (serial console output).

```
U-Boot 2024.01 (Oct 24 2024 - 10:42:51 +0000)

CPU:      Zynq 7z020
Silicon:  v3.1
Model:    rehsd Zynq-7000 Board
DRAM:     ECC disabled 1 GiB
Core:     22 devices, 15 uclasses, devicetree: board
Flash:    0 Bytes
NAND:     0 MiB
MMC:      mmc@e0100000: 0
Loading Environment from FAT... *** Error - No Valid Environment Area found
*** Warning - bad env area, using default environment

In:       serial@e0000000
Out:      serial@e0000000
Err:      serial@e0000000
Net:

ZYNQ GEM: e000b000, mdio bus e000b000, phyaddr 0, interface rgmii-id
eth0: ethernet@e000b000
Hit any key to stop autoboot:  0
switch to partitions #0, OK
mmc0 is current device
Scanning mmc 0:1...
Found U-Boot script /boot.scr
3830 bytes read in 14 ms (266.6 KiB/s)
## Executing script at 03000000
Trying to load boot images from mmc0
31805599 bytes read in 1721 ms (17.6 MiB/s)
## Loading kernel from FIT Image at 10000000 ...
   Using 'conf-system-top.dtb' configuration
   Verifying Hash Integrity ... OK
   Trying 'kernel-1' kernel subimage
     Description:  Linux kernel
     Type:         Kernel Image
     Compression:  uncompressed
     Data Start:   0x100000ec
     Data Size:    5053720 Bytes = 4.8 MiB
     Architecture: ARM
     OS:           Linux
     Load Address: 0x00200000
     Entry Point:  0x00200000
     Hash algo:    sha256
     Hash value:   cc78af5676b26e25e0b72bdefee6afd60d56ad2e52cfea0d430c15bb6ca14dd0
   Verifying Hash Integrity ... sha256+ OK
## Loading ramdisk from FIT Image at 10000000 ...
   Using 'conf-system-top.dtb' configuration
   Verifying Hash Integrity ... OK
   Trying 'ramdisk-1' ramdisk subimage
     Description:  petalinux-image-minimal
     Type:         RAMDisk Image
     Compression:  uncompressed
     Data Start:   0x104d761c
     Data Size:    26727640 Bytes = 25.5 MiB
     Architecture: ARM
     OS:           Linux
     Load Address: unavailable
     Entry Point:  unavailable
     Hash algo:    sha256
     Hash value:   9924987a685d9e507b86a465ad70238aa849892c2e13374f0b5a557790a4856f
   Verifying Hash Integrity ... sha256+ OK
## Loading fdt from FIT Image at 10000000 ...
   Using 'conf-system-top.dtb' configuration
   Verifying Hash Integrity ... OK
   Trying 'fdt-system-top.dtb' fdt subimage
     Description:  Flattened Device Tree blob
     Type:         Flat Device Tree
     Compression:  uncompressed
     Data Start:   0x104d1f10
     Data Size:    22078 Bytes = 21.6 KiB
     Architecture: ARM
```

```

Hash algo:      sha256
Hash value:     c74672b1cbcf28c00499c24f6557ab9d0ba6711650561da8b2e7d4618
Verifying Hash Integrity ... sha256+ OK
Bootimg using the fdt blob at 0x104d1f10
Working FDT set to 104d1f10
Loading Kernel Image
Loading Ramdisk to 2e682000, end 2ffff4d8 ... OK
Loading Device Tree to 2e679000, end 2e68163d ... OK
Working FDT set to 2e679000

Starting kernel ...

Booting Linux on physical CPU 0x0
Linux version 6.6.40-xilinx-g2b7f6f70a62a (oe-user@oe-host) (arm-xilinx-linux-gnueabi-gcc (GCC) 13.3.0, GNU ld
(GNU Binutils) 2.42.0.20240716) #1 SMP PREEMPT Tue Oct 29 11:52:30 UTC 2024
CPU: ARMv7 Processor [413fc090] revision 0 (ARMv7), cr=18c5387d
CPU: PIPT / VIPT nonaliasing data cache, VIPT aliasing instruction cache
OF: fdt: Machine model: rehds Zynq-7000 Board
Memory policy: Data cache writealloc
cma: Reserved 128 MiB at 0x38000000 on node -1
Zone ranges:
  Normal [mem 0x0000000000000000-0x000000002ffffff]
  HighMem [mem 0x0000000030000000-0x000000003ffffff]
Movable zone start for each node
Early memory node ranges
  node 0: [mem 0x0000000000000000-0x000000003ffffff]
Initmem setup node 0 [mem 0x0000000000000000-0x000000003ffffff]
percpu: Embedded 12 pages/cpu s17940 r8192 d23020 u49152
Kernel command line: console=ttypS0,115200 earlyprintk uio_pdrv_genirq.of_id=generic-uio
Unknown kernel command line parameters "earlyprintk", will be passed to user space.
printk: log_buf_len individual max cpu contribution: 2097152 bytes
printk: log_buf_len total cpu_extra contributions: 2097152 bytes
printk: log_buf_len min size: 2097152 bytes
printk: log_buf_len: 4194304 bytes
printk: early log buf free: 2095792 (99%)
Dentry cache hash table entries: 131072 (order: 7, 524288 bytes, linear)
Inode-cache hash table entries: 65536 (order: 6, 262144 bytes, linear)
Built 1 zonelists, mobility grouping on. Total pages: 260608
mem auto-init: stack:all(zero), heap alloc:off, heap free:off
Memory: 844776K/1048576K available (7168K kernel code, 6605K rwddata, 2236K rodata, 1024K init, 2188K bss, 72728K
reserved, 131072K cma-reserved, 131072K highmem)
SLUB: HWalign=64, Order=0-3, MinObjects=0, CPUs=2, Nodes=1
rcu: Preemptible hierarchical RCU implementation.
rcu: RCU event tracing is enabled.
rcu: RCU restricting CPUs from NR_CPUS=4 to nr_cpu_ids=2.
rcu: RCU calculated value of scheduler-enlistment delay is 10 jiffies.
rcu: Adjusting geometry for rcu_fanout_leaf=16, nr_cpu_ids=2
NR_IRQS: 16, nr_irqs: 16, preallocated irq: 16
efuse mapped to (ptrval)
slcr mapped to (ptrval)
GIC physical location is 0xf8f01000
L2C: platform modifies aux control register: 0x72360000 -> 0x72760000
L2C: DT/platform modifies aux control register: 0x72360000 -> 0x72760000
L2C-310 erratum 769419 enabled
L2C-310 enabling early BRESP for Cortex-A9
L2C-310 full line of zeros enabled for Cortex-A9
L2C-310 ID prefetch enabled, offset 1 lines
L2C-310 dynamic clock gating enabled, standby mode enabled
L2C-310 cache controller enabled, 8 ways, 512 kB
L2C-310: CACHE_ID 0x410000c8, AUX_CTRL 0x76760001
rcu: srcu init: Setting srcu_struct sizes based on contention.
zynq_clock_init: clkc starts at (ptrval)
Zynq clock init
sched_clock: 64 bits at 167MHz, resolution 6ns, wraps every 4398046511103ns
clocksource: arm_global_timer: mask: 0xffffffffffffffff max_cycles: 0x26703d7dd8, max_idle_ns: 440795208065 ns
Switching to timer-based delay loop, resolution 6ns
Console: colour dummy device 80x30
Calibrating delay loop (skipped), value calculated using timer frequency.. 333.33 BogoMIPS (lpj=1666666)
CPU: Testing write buffer coherency: ok
CPU0: Spectre v2: using BPIALL workaround
pid_max: default: 32768 minimum: 301
Mount-cache hash table entries: 2048 (order: 1, 8192 bytes, linear)
Mountpoint-cache hash table entries: 2048 (order: 1, 8192 bytes, linear)
CPU0: thread -1, cpu 0, socket 0, mpidr 80000000
Setting up static identity map for 0x100000 - 0x100060
rcu: Hierarchical SRCU implementation.
rcu: Max phase no-delay instances is 1000.
smp: Bringing up secondary CPUs ...
CPU1: thread -1, cpu 1, socket 0, mpidr 80000001

```

CPU1: Spectre v2: using BPIALL workaround
smp: Brought up 1 node, 2 CPUs
SMP: Total of 2 processors activated (666.66 BogoMIPS).
CPU: All CPU(s) started in SVC mode.
devtmpfs: initialized
VFP support v0.3: implementor 41 architecture 3 part 30 variant 9 rev 4
clocksource: jiffies: mask: 0xffffffff max_cycles: 0xffffffff, max_idle_ns: 19112604462750000 ns
futex hash table entries: 512 (order: 3, 32768 bytes, linear)
pinctrl core: initialized pinctrl subsystem
NET: Registered PF NETLINK/PF_ROUTE protocol family
DMA: preallocated 256 KiB pool for atomic coherent allocations
thermal_sys: Registered thermal governor 'step_wise'
cpuidle: using governor menu
platform axi: Fixed dependency cycle(s) with /axi/interrupt-controller@f8f01000
platform replicator: Fixed dependency cycle(s) with /axi/etb@f8801000
amba f8801000.etb: Fixed dependency cycle(s) with /replicator
platform replicator: Fixed dependency cycle(s) with /axi/tpiu@f8803000
amba f8803000.tpiu: Fixed dependency cycle(s) with /replicator
platform replicator: Fixed dependency cycle(s) with /axi/funnel@f8804000
amba f8804000.funnel: Fixed dependency cycle(s) with /axi/ptm@f889d000
amba f8804000.funnel: Fixed dependency cycle(s) with /axi/ptm@f889c000
amba f8804000.funnel: Fixed dependency cycle(s) with /replicator
amba f8804000.funnel: Fixed dependency cycle(s) with /axi/ptm@f889c000
amba f889c000.ptm: Fixed dependency cycle(s) with /axi/funnel@f8804000
amba f8804000.funnel: Fixed dependency cycle(s) with /axi/ptm@f889d000
amba f889d000.ptm: Fixed dependency cycle(s) with /axi/funnel@f8804000
platform pl-bus:digilent_hdmi: Fixed dependency cycle(s) with /pl-bus/xlnx_pl_disp
platform pl-bus:digilent_hdmi: Fixed dependency cycle(s) with /pl-bus/xlnx_pl_disp
platform pl-bus:xlnx_pl_disp: Fixed dependency cycle(s) with /pl-bus/digilent_hdmi
hw-breakpoint: found 5 (+1 reserved) breakpoint and 1 watchpoint registers.
hw-breakpoint: maximum watchpoint size is 4 bytes.
e0000000.serial: ttyPS0 at MMIO 0xe0000000 (irq = 26, base_baud = 6249999) is a xuartps
printk: console [ttyPS0] enabled
SCSI subsystem initialized
usbcore: registered new interface driver usbfs
usbcore: registered new interface driver hub
usbcore: registered new device driver usb
mc: Linux media interface: v0.10
videodev: Linux video capture interface: v2.00
pps_core: LinuxPPS API ver. 1 registered
pps_core: Software ver. 5.3.6 - Copyright 2005-2007 Rodolfo Giometti <giometti@linux.it>
PTP clock support registered
EDAC MC: Ver: 3.0.0
FPGA manager framework
Advanced Linux Sound Architecture Driver Initialized.
vgaarb: loaded
clocksource: Switched to clocksource arm_global_timer
NET: Registered PF_INET protocol family
IP idents hash table entries: 16384 (order: 5, 131072 bytes, linear)
tcp_listen_portaddr_hash hash table entries: 512 (order: 0, 4096 bytes, linear)
Table-perturb hash table entries: 65536 (order: 6, 262144 bytes, linear)
TCP established hash table entries: 8192 (order: 3, 32768 bytes, linear)
TCP bind hash table entries: 8192 (order: 5, 131072 bytes, linear)
TCP: Hash tables configured (established 8192 bind 8192)
UDP hash table entries: 512 (order: 2, 16384 bytes, linear)
UDP-Lite hash table entries: 512 (order: 2, 16384 bytes, linear)
NET: Registered PF_UNIX/PF_LOCAL protocol family
RPC: Registered named UNIX socket transport module.
RPC: Registered udp transport module.
RPC: Registered tcp transport module.
RPC: Registered tcp-with-tls transport module.
RPC: Registered tcp NFSv4.1 backchannel transport module.
PCI: CLS 0 bytes, default 64
Trying to unpack rootfs image as initramfs...
armv7-pmu f8891000.pmu: hw perfevents: no interrupt-affinity property, guessing.
hw perfevents: enabled with armv7_cortex_a9 PMU driver, 7 counters available
workingset: timestamp_bits=30 max_order=18 bucket_order=0
jffs2: version 2.2. (NAND) (SUMMARY) © 2001-2006 Red Hat, Inc.
bounce: pool size: 64 pages
io scheduler mq-deadline registered
io scheduler kyber registered
io scheduler bfq registered
zynq-pinctrl 700.pinctrl: zynq pinctrl initialized
dma-pl330 f8003000.dma-controller: Loaded driver for PL330 DMAC-241330
dma-pl330 f8003000.dma-controller: DBUFF-128x8bytes Num_Chans-8 Num_Peri-4 Num_Events-16
xilinx-vdma 43000000.dma: Xilinx AXI VDMA Engine Driver Probed!!
xlnx,bridge-vtc 43c10000.v_tc: vtc ppc = 1
xlnx,bridge-vtc 43c10000.v_tc: Xilinx VTC IP version : 0x0602000c
xlnx,bridge-vtc 43c10000.v_tc: Xilinx VTC DRM Bridge driver probed

```
xlnx-pl-disp pl-bus:xlnx_pl_disp: Xlnx PL display driver probed
brd: module loaded
loop: module loaded
spi_master spi0: cannot find modalias for /axi/spi@e000d000/flash@0
spi_master spi0: Failed to create SPI device for /axi/spi@e000d000/flash@0
Freeing initrd memory: 26104K
macb e000b000.ethernet eth0: Cadence GEM rev 0x00020118 at 0xe000b000 irq 41 (00:0a:35:00:1e:53)
usbcore: registered new interface driver usb-storage
usbcore: registered new interface driver sisusb
usbcore: registered new device driver onboard-usb-dev
ULPI transceiver vendor/product ID 0x0424/0x0007
Found SMSC USB3320 ULPI transceiver.
ULPI integrity check: passed.
ci_hdrc ci_hdrc.0: EHCI Host Controller
ci_hdrc ci_hdrc.0: new USB bus registered, assigned bus number 1
ci_hdrc ci_hdrc.0: USB 2.0 started, EHCI 1.00
usb usb1: New USB device found, idVendor=1d6b, idProduct=0002, bcdDevice= 6.06
usb usb1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
usb usb1: Product: EHCI Host Controller
usb usb1: Manufacturer: Linux 6.6.40-xilinx-g2b7f6f70a62a ehci_hcd
usb usb1: SerialNumber: ci_hdrc.0
hub 1-0:1.0: USB hub found
hub 1-0:1.0: 1 port detected
i2c dev: i2c /dev entries driver
cdns-i2c e0004000.i2c: can't get pinctrl, bus recovery not supported
cdns-i2c e0004000.i2c: 100 kHz mmio e0004000 irq 44
usbcore: registered new interface driver uvcvideo
cdns-wdt f8005000.watchdog: Xilinx Watchdog Timer with timeout 10s
EDAC MC: ECC not enabled
Xilinx Zynq CpuIdle Driver started
sdhci: Secure Digital Host Controller Interface driver
sdhci: Copyright(c) Pierre Ossman
sdhci-pltfm: SDHCI platform and OF driver helper
ledtrig-cpu: registered to indicate activity on CPUs
clocksource: ttc_clocksource: mask: 0xffff max_cycles: 0xffff, max_idle_ns: 537538477 ns
timer #0 at (ptrval), irq=47
usbcore: registered new interface driver usbhid
usbhid: USB HID core driver
fpga_manager fpga0: Xilinx Zynq FPGA Manager registered
mmc0: SDHCI controller on e0100000.mmc [e0100000.mmc] using ADMA
NET: Registered PF_INET6 protocol family
Segment Routing with IPv6
In-situ OAM (IOAM) with IPv6
sit: IPv6, IPv4 and MPLS over IPv4 tunneling driver
NET: Registered PF_PACKET protocol family
can: controller area network core
NET: Registered PF_CAN protocol family
can: raw protocol
can: broadcast manager protocol
can: netlink gateway - max_hops=1
Registering SWP/SWPB emulation handler
mmc0: new high speed SDXC card at address aaaa
mmcblk0: mmc0:aaaa SN256 238 GiB
  mmcblk0: p1 p2
of-fpga-region fpga-region: FPGA Region probed
of_cfs_init
of_cfs_init: OK
clk: Disabling unused clocks
ALSA device list:
  No soundcards found.
Freeing unused kernel image (initmem) memory: 1024K
Run /init as init process
INIT: version 3.04 booting
usb 1-1: new low-speed USB device number 2 using ci_hdrc
Starting udev
udev[80]: starting version 3.2.14
usb 1-1: New USB device found, idVendor=413c, idProduct=2003, bcdDevice= 3.01
usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=0
usb 1-1: Product: Dell USB Keyboard
usb 1-1: Manufacturer: Dell
input: Dell Dell USB Keyboard as /devices/soc0/axi/e0002000.usb/ci_hdrc.0/usb1/1-1/1-1.0/0003:413C:2003.0001/input/input0
hid-generic 0003:413C:2003.0001: input: USB HID v1.10 Keyboard [Dell Dell USB Keyboard] on usb-ci_hdrc.0-1/input0
random: crng init done
udev[81]: starting eudev-3.2.14
macb e000b000.ethernet enx000a35001e53: renamed from eth0
digilent_hdmi: loading out-of-tree module taints kernel.
clk_dgln_t_dynclk: loading out-of-tree module taints kernel.
```



```
xlnx-drm xlnx-drm.0: bound pl-bus:xlnx_pl_disp (ops 0xc083f684)
xlnx-drm xlnx-drm.0: bound pl-bus:digilent_hdmi (ops hdmi_driver_exit [digilent_hdmi])
Console: switching to colour frame buffer device 240x67
xlnx-pl-disp pl-bus:xlnx_pl_disp: [drm] fb0: xlnxdrmfb frame buffer device
[drm] Initialized xlnx 1.0.0 20130509 for pl-bus:xlnx_pl_disp on minor 0
ext3: Unknown parameter 'umask'
ext2: Unknown parameter 'umask'
ext4: Unknown parameter 'umask'
FAT-fs (mmcblk0p1): Volume was not properly unmounted. Some data may be corrupt. Please run fsck.
EXT4-fs (mmcblk0p2): recovery complete
EXT4-fs (mmcblk0p2): mounted filesystem e9674b5e-1520-4a6d-8c35-f1404be72284 r/w with ordered data mode. Quota
mode: disabled.
hwclock: can't open '/dev/misc/rtc': No such file or directory
Fri Mar  9 12:34:56 UTC 2018
hwclock: can't open '/dev/misc/rtc': No such file or directory
hwclock: can't open '/dev/misc/rtc': No such file or directory
INIT: Entering runlevel: 5
Configuring network interfaces... udhcpc: SIOCGIFINDEX: No such device
ifup: failed to bring up eth0
udhcpc: started, v1.36.1
macb e000b000.ethernet enx000a35001e53: PHY [e000b000.ethernet-ffffffff:00] driver [RTL8211F Gigabit Ethernet]
(irq=POLL)
macb e000b000.ethernet enx000a35001e53: configuring for phy/rgmii-id link mode
udhcpc: broadcasting discover
udhcpc: broadcasting discover
macb e000b000.ethernet enx000a35001e53: Link is Up - 1Gbps/Full - flow control off
udhcpc: broadcasting discover
udhcpc: broadcasting select for 192.168.55.150, server 192.168.55.1
udhcpc: lease of 192.168.55.150 obtained from 192.168.55.1, lease time 7200
/etc/udhcpc.d/50default: Adding DNS 208.67.222.222
/etc/udhcpc.d/50default: Adding DNS 208.67.220.220
Starting OpenBSD Secure Shell server: sshd
    generating ssh RSA host key...
    generating ssh ECDSA host key...
    generating ssh ED25519 host key...
done.
Starting rpcbind daemon...done.
starting statd: done
Starting internet superserver: inetd.
NFS daemon support not enabled in kernel
Starting syslogd/klogd: done
Starting tcf-agent: OK

*****
The PetaLinux source code and images provided/generated are for demonstration purposes only.
Please refer to https://xilinx-wiki.atlassian.net/wiki/spaces/A/pages/2741928025/Moving+from+PetaLinux+to+Production+Deployment
for more details.
*****
PetaLinux 2024.2+release-S11061705 rehdsZynq ttyPS0

rehdsZynq login: root (automatic login)

root@rehdsZynq:~#
```

Appendix D – My Zynq-7000 Board

I am using a custom PCB that I designed and assembled. Relevant portions of the schematic:

