Building Linux usb device drivers with 2020.2

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The guide below shows you how to build USB drivers & boot the board and then run some example configurations (Host, Device, OTG mode of PS USB controller) on Versal platform.
The steps below use PetaLinux and assume you have some knowledge of using PetaLinux.

Table of Contents

Introduction

- The USB controller can be configured as host, device, or on-the-go (OTG).
- The core is compliant to USB 2.0 specification and supports high, full, and low-speed modes in all configurations.
- In host mode, the USB controller is compliant with the Intel XHCI specification. In device mode, it supports up to 12 end points.
- The universal low peripheral interface (ULPI) is used to connect the controller to an external PHY operating up to 480 Mb/s.
- Versal supports only USB 2.0 protocol.
- Provided below test cases are proven on vck190-es1 board with 2020.2 release.

ZynqMP Vs Versal USB controller support

Peripheral	Zynq UltraScale+ MPSoC	Versal Adapti
USB 3.0 (host, device, dual-role device)	2 controllers	N/A
Usb 2.0 (host, device, on-the-go)	2 controllers	1 controller

Hardware Setup

Boards: VCK190-ES1 Board

Host Machine: Linux Machine with USB ports (OR) Windows Machine

Software Setup

Linux Kernel image with xHCI Host enabled (static) and Mass Storage Gadget created as static or dynamic

- Boot image for initial FSBL sequence
- Device tree with DWC USB DWC3_DUAL mode enabled

PetaLinux build steps

```
source <PATH TO PETALINUX INSTALLATION>/petalinux-v2020.2-final/settings.sh
petalinux-create -t project -s <PATH to BSP>/xilinx-vck190-es1-v2020.2-final.bsp
petalinux-config
petalinux-build
petalinux-package --boot --plm --psmfw --u-boot --dtb
```

Host Mode

USB HOST mode Jumper settings

Note: Need to short the **J300** Jumper for Host Mode

Jumper 1-2 ---- **short** (The shield for the USB 2.0 type-A connector (J308) can be tied to GND by a jumper on header J300 pins 1-2 (default))

Kernel Configuration

By enabling the above we need to see the below mentioned Kconfig parameter enabled

```
CONFIG_USB_DWC3 = y
CONFIG_USB_DWC3=y
CONFIG_USB_DWC3_DUAL_ROLE=y
CONFIG_USB_DWC3_OF_SIMPLE=y
# USB HID support
CONFIG_USB_HID=y
# CONFIG_HID_PID is not set
# CONFIG_USB_HIDDEV is not set
CONFIG_USB_OHCI_LITTLE_ENDIAN=y
CONFIG_USB_SUPPORT=y
CONFIG_USB_COMMON=y
CONFIG_USB_ARCH_HAS_HCD=y
CONFIG_USB=y
CONFIG_USB_ANNOUNCE_NEW_DEVICES=y

# Miscellaneous USB options
CONFIG_USB_DEFAULT_PERSIST=y
CONFIG_USB_OTG=y
CONFIG_USB_OTG_FSM=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_XHCI_PLATFORM=y

CONFIG_USB_STORAGE=y

# USB Physical Layer drivers

CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2

CONFIG_USB_LIBCOMPOSITE=y
CONFIG_USB_U_ETHER=y
```

```
CONFIG_USB_F_RNDIS=y
CONFIG_USB_F_MASS_STORAGE=y
CONFIG_USB_F_FS=y
CONFIG_USB_F_UVC=y
CONFIG_USB_F_HID=y
CONFIG_USB_CONFIGFS=y
CONFIG_USB_CONFIGFS_RNDIS=y
CONFIG_USB_CONFIGFS_MASS_STORAGE=y
CONFIG_USB_CONFIGFS_F_FS=y
CONFIG_USB_CONFIGFS_F_HID=y
CONFIG_USB_CONFIGFS_F_UVC=y
```

Device Tree

Edit the following file and make the following changes.

"<path to petalinux project >/project-spec/meta-user/recipes-bsp/device-tree/files/system-user.dtsi"

After the build is finished, we should see below device tree changes in system.dts file once after converting system.dtb to sytem.dts using " **dtc -I dtb -O dts -o system.dts system.dtb**" command.

Note: dtc command by default not available on host side , please install using the "sudo apt-get install device-tree-compiler" command.

Test Procedure

Connect the USB 3.0/2.0 pendrive to USB 2.0 capable board and see it getting detected in /dev/sd<x>.

Logs

Once Linux boots the below highlighted prints should be visible when we connected the mass storage device

```
root@xilinx-vck190-es1-2020.2 :~#root@xilinx-vck190-es1-2020.2 :~#
[ 40.344230] usb 1-1: new high-speed USB device number 2 using xhci-hcd
[ 40.497113] usb 1-1: New USB device found, idVendor=8564, idProduct=1000, bcdDevic
[ 40.505293] usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 40.512428] usb 1-1: Product: Mass Storage Device
```

```
[ 40.517134] usb 1-1: Manufacturer: JetFlash
[ 40.521315] usb 1-1: SerialNumber: 152RHUF276CIFPSR
[ 40.526966] usb-storage 1-1:1.0: USB Mass Storage device detected
[ 40.533570] scsi host0: usb-storage 1-1:1.0
[ 41.949684] scsi 0:0:0:0: Direct-Access JetFlash Transcend 32GB 1100 PQ: 0 ANSI: 6
[ 41.960284] sd 0:0:0:0: [sda] 59725824 512-byte logical blocks: (30.6 GB/28.5 GiB)
[ 41.968608] sd 0:0:0:0: [sda] Write Protect is off
[ 41.973581] sd 0:0:0:0: [sda] Write cache: enabled, read cache: enabled, doesn't s
[ 41.984408] sda: sda1
[ 41.987825] sd 0:0:0:0: [sda] Attached SCSI removable disk
[ 42.146068] FAT-fs (sda1): Volume was not properly unmounted. Some data may be cor
```

Peripheral Mode

USB jumper settings for Peripheral mode

Note: Need to open the **J300** Jumper for device mode.

Jumper 1-2 –--- **Open** (The shield for the USB 2.0 type-A connector (J308) can be disconncted/floating from GND by removing the jumper on header J300 pins 1-2 (default))

Note: This same peripheral mode Jumpers can be used for all the Gadgets .

Kernel configurations

This document only explains the USB 2.0 peripheral mode configurations for MASS STORAGE gadget

Device Drivers --->[*] USB support ---> <*> USB Gadget Support --->

By enabling the above we need to see the below mentioned Kconfig parameter enabled

```
CONFIG_USB_DWC3 = y
CONFIG_USB_DWC3=y
CONFIG_USB_DWC3_DUAL_ROLE=y
CONFIG_USB_DWC3_OF_SIMPLE=y

# USB HID support
```

```
CONFIG_USB_HID=y
# CONFIG_HID_PID is not set
# CONFIG_USB_HIDDEV is not set
CONFIG_USB_OHCI_LITTLE_ENDIAN=y
CONFIG_USB_SUPPORT=y
CONFIG_USB_COMMON=y
CONFIG_USB_ARCH_HAS_HCD=y
CONFIG_USB=y
CONFIG_USB_ANNOUNCE_NEW_DEVICES=y
# Miscellaneous USB options
CONFIG_USB_DEFAULT_PERSIST=y
CONFIG_USB_OTG=y
CONFIG_USB_OTG_FSM=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_XHCI_PLATFORM=y
CONFIG_USB_STORAGE=y
# USB Physical Layer drivers
CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2

CONFIG_USB_LIBCOMPOSITE=y
CONFIG_USB_U_ETHER=y
CONFIG_USB_F_RNDIS=y
CONFIG_USB_F_MASS_STORAGE=y
CONFIG_USB_F_FS=y
CONFIG_USB_F_UVC=y
CONFIG_USB_F_HID=y
CONFIG_USB_CONFIGFS=y
CONFIG_USB_CONFIGFS_RNDIS=y
CONFIG_USB_CONFIGFS_MASS_STORAGE=y
CONFIG_USB_CONFIGFS_F_FS=y
CONFIG_USB_CONFIGFS_F_HID=y
CONFIG_USB_CONFIGFS_F_UVC=y
```

Device Tree

Edit the following file and make the following changes.

"<path to petalinux project >/project-spec/meta-user/recipes-bsp/device-tree/files/system-user.dtsi"

Steps to test peripheral mode

Please use the below settings for configuring USB as MASS STORAGE profile in device mode:

```
dd if=/dev/zero of=/tmp/mydev count=500 bs=1M
mount -t configfs none /sys/kernel/config
cd /sys/kernel/config/usb_gadget
mkdir g1
cd g1
echo "64" > bMaxPacketSize0
echo "0x200" > bcdUSB
echo "0x100" > bcdDevice
echo "0x03FD" > idVendor
echo "0x0501" > idProduct
cat max_speed
echo "high-speed" > max_speed
mkdir functions/mass_storage.ms0
mkdir configs/c1.1
echo /tmp/mydev > functions/mass_storage.ms0/lun.0/file
echo 1 > functions/mass_storage.ms0/lun.0/removable
ln -s functions/mass_storage.ms0/ configs/c1.1/
echo "fe200000.dwc3" > UDC
```

Testing the mass storage functionality by connecting the board to windows host using the below steps:

1. Connect the cable from board to windows host machine
2. Format the mass storage device that got detected in windows
3. The windows screen shot when we the device gets detected should be as below

4. The board will be detected as mass storage drive with size 256 MB

5 .Copy some files into the mass storage drive , remove the cable and connect it again. We should be able to see the files that we copied into the drive.

Logs

```
root@xilinx-vck190-es1-2020_2:~#
root@xilinx-vck190-es1-2020_2:~# dd if=/dev/zero of=/tmp/mydev count=500 bs=1M
-t configfs none /sys/kernel/config
cd /sys/kernel/config/usb_gadget
mkdir g1
cd g1
echo "64" > bMaxPacketSize0
echo "0x200" > bcdUSB
echo "0x100" > bcdDevice
echo "0x03FD" > idVendor
echo "0x0501" > idProduct
cat max_speed
echo "high-speed" > max_speed
mkdir functions/mass_storage.ms0
mkdir configs/c1.1
echo /tmp/mydev > functions/mass_storage.ms0/lun.0/file
echo 1 > functions/mass_storage.ms0/lun.0/removable
ln -s functions/mass500+0 records in
500+0 records out
_storagroot@xilinx-vck190-es1-2020_2:~# mount -t configfs none /sys/kernel/config
fmount: mounting none on /sys/kernel/config failed: Device or resource busy
igs/c1.1/
root@xilinx-vck190-es1-2020_2:~# cd /sys/kernel/config/usb_gadget
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget# mkdir g1
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget# cd g1
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "64" > bMaxPac
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x200" > bcdU
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x100" > bcdD
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x03FD" > idV
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x0501" > idP
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# cat max_speed
super-speed
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "high-speed" >
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# mkdir functions/mas
[  108.770916] Mass Storage Function, version: 2009/09/11
[  108.776065] LUN: removable file: (no medium)
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# mkdir configs/c1.1
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo /tmp/mydev > f
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo 1 > functions/
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# ln -s functions/mas
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "fe200000.dwc3
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# [  109.920065] conf
```

```
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
```

If we connect the cable from board to Linux host machine then below are the logs:

Linux Host side logs

```
[ 8476.067699] usb 1-3.3: new high-speed USB device number 7 using xhci_hcd
[ 8476.084268] usb 1-3.3: New USB device found, idVendor=03fd, idProduct=0501
[ 8476.084277] usb 1-3.3: New USB device strings: Mfr=0, Product=0, SerialNumber=0
[ 8476.091222] usb-storage 1-3.3:1.0: USB Mass Storage device detected
[ 8476.091603] scsi3 : usb-storage 1-3.3:1.0
[ 8477.092408] scsi 3:0:0:0: Direct-Access     Linux    File-Stor Gadget 0504 PQ: 0
[ 8477.093651] sd 3:0:0:0: Attached scsi generic sg1 type 0
[ 8477.094246] sd 3:0:0:0: [sdb] 1024000 512-byte logical blocks: (524 MB/500 MiB)
[ 8477.094402] sd 3:0:0:0: [sdb] Write Protect is off
[ 8477.094409] sd 3:0:0:0: [sdb] Mode Sense: 0f 00 00 00
[ 8477.094627] sd 3:0:0:0: [sdb] Write cache: enabled, read cache: enabled, doesn't
[ 8477.097457]  sdb: unknown partition table
[ 8477.098887] sd 3:0:0:0: [sdb] Attached SCSI removable disk
```

OTG Mode

USB jumper settings for OTG mode

Kernel Configurations

By enabling the above we need to see the below mentioned Kconfig parameter enabled

```
CONFIG_USB_DWC3 = y
CONFIG_USB_DWC3=y
CONFIG_USB_DWC3_DUAL_ROLE=y
CONFIG_USB_DWC3_OF_SIMPLE=y

# USB HID support
```

```
CONFIG_USB_HID=y
# CONFIG_HID_PID is not set
# CONFIG_USB_HIDDEV is not set
CONFIG_USB_OHCI_LITTLE_ENDIAN=y
CONFIG_USB_SUPPORT=y
CONFIG_USB_COMMON=y
CONFIG_USB_ARCH_HAS_HCD=y
CONFIG_USB=y
CONFIG_USB_ANNOUNCE_NEW_DEVICES=y
# Miscellaneous USB options
CONFIG_USB_DEFAULT_PERSIST=y
CONFIG_USB_OTG=y
CONFIG_USB_OTG_FSM=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_XHCI_PLATFORM=y
CONFIG_USB_STORAGE=y
# USB Physical Layer drivers
CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2

CONFIG_USB_LIBCOMPOSITE=y
CONFIG_USB_U_ETHER=y
CONFIG_USB_F_RNDIS=y
CONFIG_USB_F_MASS_STORAGE=y
CONFIG_USB_F_FS=y
CONFIG_USB_F_UVC=y
CONFIG_USB_F_HID=y
CONFIG_USB_CONFIGFS=y
CONFIG_USB_CONFIGFS_RNDIS=y
CONFIG_USB_CONFIGFS_MASS_STORAGE=y
CONFIG_USB_CONFIGFS_F_FS=y
CONFIG_USB_CONFIGFS_F_HID=y
CONFIG_USB_CONFIGFS_F_UVC=y
```

Device Tree

Edit the following file and make the following changes.

"<path to petalinux project >/project-spec/meta-user/recipes-bsp/device-tree/files/system-user.dtsi"

Steps to test OTG

When the Linux kernel boots up, give the below commands:

```
dd if=/dev/zero of=/tmp/mydev count=500 bs=1M
mount -t configfs none /sys/kernel/config
cd /sys/kernel/config/usb_gadget
mkdir g1
cd g1
echo "64" > bMaxPacketSize0
echo "0x200" > bcdUSB
echo "0x100" > bcdDevice
echo "0x03FD" > idVendor
echo "0x0501" > idProduct
cat max_speed
echo "high-speed" > max_speed
mkdir functions/mass_storage.ms0
mkdir configs/c1.1
echo /tmp/mydev > functions/mass_storage.ms0/lun.0/file
echo 1 > functions/mass_storage.ms0/lun.0/removable
ln -s functions/mass_storage.ms0/ configs/c1.1/
echo "fe200000.dwc3" > UD
```

Peripheral Mode

- Connect board to any Host PC via USB Std-A-Male to Micro-B-Male cable.
- It should be detected as a Mass Storage Device
- Do some data transfers

Host Mode

- Connect any pen-drive with the board via USB Micro-A-Male to Std-A-Female type connector
- Check that the pen-drive is detected properly
- Do some data transfers.

Note : Both Host and Peripheral mode should work without resetting/rebooting the board.

Logs

```
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:~#
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:~# dd if=/dev/zero of=/tmp/
-t configfs none /sys/kernel/config
cd /sys/kernel/config/usb_gadget
mkdir g1
cd g1
echo "64" > bMaxPacketSize0
echo "0x200" > bcdUSB
echo "0x100" > bcdDevice
echo "0x03FD" > idVendor
echo "0x0501" > idProduct
cat max_speed
echo "high-speed" > max_speed
mkdir functions/mass_storage.ms0
mkdir configs/c1.1
echo /tmp/mydev > functions/mass_storage.ms0/lun.0/file
echo 1 > functions/mass_storage.ms0/lun.0/removable
ln -s functions/mass_storage.ms0/ configs/500+0 records in
500+0 records out
c1.1/
ecroot@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:~# mount -t configfs none
.mount: mounting none on /sys/kernel/config failed: Device or resource busy
dwc3" > UDCroot@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:~# cd /sys/kerne
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
super-speed
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
[  488.648805] Mass Storage Function, version: 2009/09/11
[  488.653966] LUN: removable file: (no medium)
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
```

```
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:/sys/kernel/config/usb_gadg
```

Remove the USB cable connected between host and target board & connect the USB flash storage drive(pendrive) & check is it properly detected or not.

```
root@xilinx-vc-p-a2197-00-reva-x-prc-04-reva-es1-2020_2:~#When the Linux kernel boo
usb 1-1: new high-speed USB device number 2 using xhci-hcd
usb 1-1: New USB device found, idVendor=8564, idProduct=1000, bcdDevice=11.00
usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
usb 1-1: Product: Mass Storage Device
usb 1-1: Manufacturer: JetFlash
usb 1-1: SerialNumber: 152RHUF276CIFPSR
usb-storage 1-1:1.0: USB Mass Storage device detected
scsi host0: usb-storage 1-1:1.0
scsi 0:0:0:0: Direct-Access JetFlash Transcend 32GB 1100 PQ: 0 ANSI: 6
sd 0:0:0:0: [sda] 59725824 512-byte logical blocks: (30.6 GB/28.5 GiB)
sd 0:0:0:0: [sda] Write Protect is off
sd 0:0:0:0: [sda] Write cache: enabled, read cache: enabled, doesn't support DPO or
sda: sda1
sd 0:0:0:0: [sda] Attached SCSI removable disk
```

Host machine side logs

```
[69588.590462] usb 1-1: new high-speed USB device number 6 using xhci_hcd
[69588.607166] usb 1-1: New USB device found, idVendor=03fd, idProduct=0501
[69588.607187] usb 1-1: New USB device strings: Mfr=0, Product=0, SerialNumber=0
[69588.614259] usb-storage 1-1:1.0: USB Mass Storage device detected
[69588.614940] scsi3 : usb-storage 1-1:1.0
[69589.615213] scsi 3:0:0:0: Direct-Access     Linux    File-Stor Gadget 0504 PQ: 0
[69589.616623] sd 3:0:0:0: Attached scsi generic sg1 type 0
[69589.619729] sd 3:0:0:0: [sdb] 1024000 512-byte logical blocks: (524 MB/500 MiB)
[69589.620070] sd 3:0:0:0: [sdb] Write Protect is off
[69589.620083] sd 3:0:0:0: [sdb] Mode Sense: 0f 00 00 00
[69589.620350] sd 3:0:0:0: [sdb] Write cache: enabled, read cache: enabled, doesn't
[69589.626470]  sdb: unknown partition table
[69589.627554] sd 3:0:0:0: [sdb] Attached SCSI removable disk
```

Ethernet Gadget

Kernel Configurations

Device Drivers --->[*] USB support ---> <*> USB Gadget Support --->

By enabling the above we need to see the below mentioned Kconfig parameter enabled

```
CONFIG_USB_DWC3 = y
CONFIG_USB_DWC3=y
CONFIG_USB_DWC3_DUAL_ROLE=y
CONFIG_USB_DWC3_OF_SIMPLE=y
# USB HID support
CONFIG_USB_HID=y
# CONFIG_HID_PID is not set
# CONFIG_USB_HIDDEV is not set
CONFIG_USB_OHCI_LITTLE_ENDIAN=y
CONFIG_USB_SUPPORT=y
CONFIG_USB_COMMON=y
CONFIG_USB_ARCH_HAS_HCD=y
CONFIG_USB=y
CONFIG_USB_ANNOUNCE_NEW_DEVICES=y
# Miscellaneous USB options
CONFIG_USB_DEFAULT_PERSIST=y
CONFIG_USB_OTG=y
CONFIG_USB_OTG_FSM=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_XHCI_PLATFORM=y
CONFIG_USB_STORAGE=y

# USB Physical Layer drivers
CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2

CONFIG_USB_LIBCOMPOSITE=y
CONFIG_USB_U_ETHER=y
CONFIG_USB_F_RNDIS=y
CONFIG_USB_F_MASS_STORAGE=y
```

```
CONFIG_USB_F_FS=y
CONFIG_USB_F_UVC=y
CONFIG_USB_F_HID=y
CONFIG_USB_CONFIGFS=y
CONFIG_USB_CONFIGFS_RNDIS=y
CONFIG_USB_CONFIGFS_MASS_STORAGE=y
CONFIG_USB_CONFIGFS_F_FS=y
CONFIG_USB_CONFIGFS_F_HID=y
CONFIG_USB_CONFIGFS_F_UVC=y
```

Device Tree

Edit the following file and make the following changes.

"<path to petalinux project >/project-spec/meta-user/recipes-bsp/device-tree/files/system-user.dtsi"

Steps to test Ethernet Gadget

Please use the below settings for configuring USB as ETHERNET gadget profile in device mode:

```
mount -t configfs none /sys/kernel/config

cd /sys/kernel/config/usb_gadget

mkdir g1

cd g1

echo "64" > bMaxPacketSize0

echo "0x200" > bcdUSB

echo "0x100" > bcdDevice

echo "0x03FD" > idVendor

echo "0x0502" > idProduct

mkdir configs/c1.1
```

```
mkdir functions/rndis.rn0

ln -s functions/rndis.rn0/ configs/c1.1/

echo "fe200000.dwc3" > UDC

ifconfig usb0 10.10.70.1

ifconfig usb0 up
```

Logs

```
root@xilinx-vck190-es1-2020_2:~# mount -t configfs none /sys/kernel/config
ymount: mounting none on /sys/kernel/config failed: Device or resource busy
s/kerneroot@xilinx-vck190-es1-2020_2:~#
root@xilinx-vck190-es1-2020_2:~# cd /sys/kernel/config/usb_gadget
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget# mkdir g1
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget# cd g1
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "64" > bMaxPac
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x200" > bcdU
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x100" > bcdD
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x03FD" > idV
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "0x0502" > idP
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# mkdir configs/c1.1
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# mkdir functions/rnd
[ 63.419085] using random self ethernet address
unc[ 63.423548] using random host ethernet address
tions/rnroot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# ln -s functions/rnd
"root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# echo "fe200000.dwc3
[ 63.534643] usb0: HOST MAC 42:e9:cb:bc:66:92
```

```
[ 63.538953] usb0: MAC f2:17:36:0e:f5:5d
fig usb0root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# ifconfig usb0 10.10
iroot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# ifconfig usb0 up[ 6
[ 63.879248] IPv6: ADDRCONF(NETDEV_CHANGE): usb0: link becomes ready
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1#
```

Note: After running the "ifconfig -a" , we should be able to see the usb0 interface with ipaddress 10.10.70.1

```
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# ifconfig -a
can0 Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
NOARP MTU:16 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:10
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
Interrupt:6

eth0 Link encap:Ethernet HWaddr 22:65:5D:75:A8:E9
inet addr:10.10.71.1 Bcast:10.10.71.255 Mask:255.255.255.0
inet6 addr: fe80::2065:5dff:fe75:a8e9/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:22 errors:0 dropped:0 overruns:0 frame:0
TX packets:28 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:3369 (3.2 KiB) TX bytes:4243 (4.1 KiB)
Interrupt:16

eth1 Link encap:Ethernet HWaddr 32:51:3E:27:EA:4E
BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
Interrupt:17

lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING MTU:65536 Metric:1
```

```
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

sit0 Link encap:IPv6-in-IPv4
NOARP MTU:1480 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

usb0 Link encap:Ethernet HWaddr F2:17:36:0E:F5:5D
inet addr:10.10.70.1 Bcast:10.255.255.255 Mask:255.0.0.0
inet6 addr: fe80::f017:36ff:fe0e:f55d/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

Ping to server(host ip)

root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g1# ping 10.10.x.x
PING 10.10.x.x (10.10.x.x): 56 data bytes
64 bytes from 10.10.x.x: seq=0 ttl=64 time=0.377 ms
64 bytes from 10.10.x.x: seq=1 ttl=64 time=0.384 ms
64 bytes from 10.10.x.x: seq=2 ttl=64 time=0.298 ms
64 bytes from 10.10.x.x: seq=3 ttl=64 time=0.258 ms
64 bytes from 10.10.x.x: seq=4 ttl=64 time=0.253 ms
64 bytes from 10.10.x.x: seq=5 ttl=64 time=0.337 ms
64 bytes from 10.10.x.x: seq=6 ttl=64 time=0.235 ms
64 bytes from 10.10.x.x: seq=7 ttl=64 time=0.299 ms
^C
--- 10.10.x.x ping statistics ---
8 packets transmitted, 8 packets received, 0% packet loss
round-trip min/avg/max = 0.235/0.305/0.384 ms
```

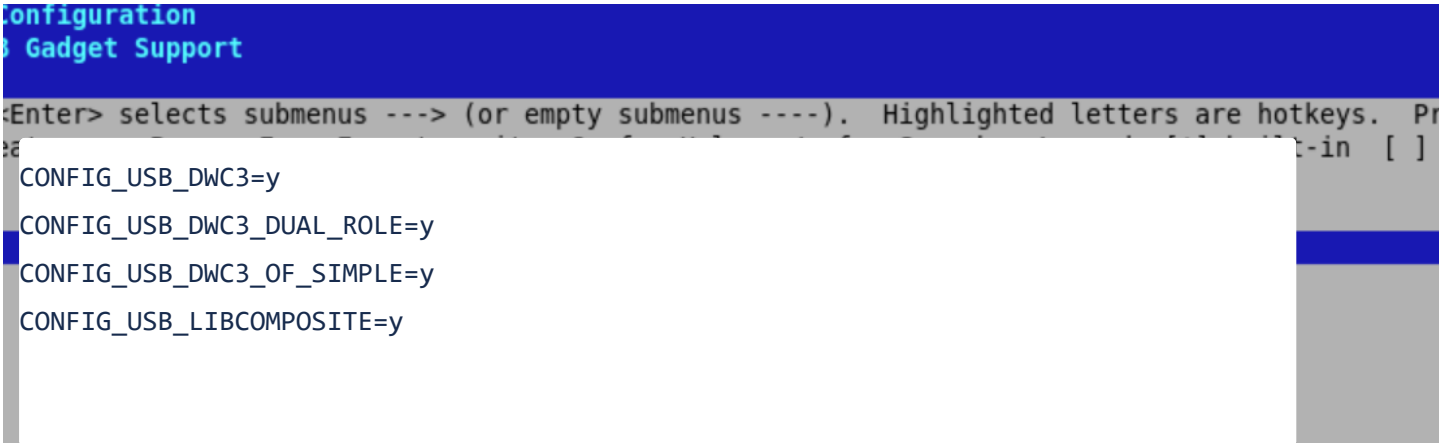
Host machine side logs

```
[24697.094113] usb 1-3.3: new high-speed USB device number 8 using xhci_hcd
[24697.110715] usb 1-3.3: New USB device found, idVendor=03fd, idProduct=0502
[24697.110765] usb 1-3.3: New USB device strings: Mfr=0, Product=0, SerialNumber=0
[24697.177798] cfg80211: Calling CRDA to update world regulatory domain
[24697.190642] usbcore: registered new interface driver cdc_ether
[24697.201236] rndis_host 1-3.3:1.0 usb0: register 'rndis_host' at usb-0000:00:14.0
[24697.201285] usbcore: registered new interface driver rndis_host
[24697.218561] usbcore: registered new interface driver rndis_wlan
[24697.225748] cfg80211: World regulatory domain updated:
[24697.225757] cfg80211: (start_freq - end_freq @ bandwidth), (max_antenna_gain, ma
[24697.225797] cfg80211: (2402000 KHz - 2472000 KHz @ 40000 KHz), (300 mBi, 2000 mB
[24697.225801] cfg80211: (2457000 KHz - 2482000 KHz @ 40000 KHz), (300 mBi, 2000 mB
[24697.225803] cfg80211: (2474000 KHz - 2494000 KHz @ 20000 KHz), (300 mBi, 2000 mB
[24697.225806] cfg80211: (5170000 KHz - 5250000 KHz @ 40000 KHz), (300 mBi, 2000 mB
[24697.225808] cfg80211: (5735000 KHz - 5835000 KHz @ 40000 KHz), (300 mBi, 2000 mB

ping 10.10.70.1
PING 10.10.70.1 (10.10.70.1) 56(84) bytes of data.
64 bytes from 10.10.70.1: icmp_seq=1 ttl=64 time=0.161 ms
64 bytes from 10.10.70.1: icmp_seq=2 ttl=64 time=0.159 ms
64 bytes from 10.10.70.1: icmp_seq=3 ttl=64 time=0.147 ms
64 bytes from 10.10.70.1: icmp_seq=4 ttl=64 time=0.117 ms
64 bytes from 10.10.70.1: icmp_seq=5 ttl=64 time=0.113 ms
64 bytes from 10.10.70.1: icmp_seq=6 ttl=64 time=0.145 ms
64 bytes from 10.10.70.1: icmp_seq=7 ttl=64 time=0.131 ms
^C
```

Composite gadget

Kernel configurations



```
CONFIG_USB_F_ACM=y
CONFIG_USB_F_SS_LB=y
CONFIG_USB_U_SERIAL=y
CONFIG_USB_U_ETHER=y
CONFIG_USB_F_ECM=y
CONFIG_USB_F_RNDIS=y
CONFIG_USB_F_MASS_STORAGE=y
CONFIG_USB_F_FS=y
CONFIG_USB_F_UVC=y
CONFIG_USB_F_HID=y
CONFIG_USB_CONFIGFS=y
CONFIG_USB_CONFIGFS_ACM=y
CONFIG_USB_CONFIGFS_ECM=y
CONFIG_USB_CONFIGFS_RNDIS=y
CONFIG_USB_CONFIGFS_MASS_STORAGE=y
CONFIG_USB_CONFIGFS_F_LB_SS=y
CONFIG_USB_CONFIGFS_F_FS=y
CONFIG_USB_CONFIGFS_F_HID=y
CONFIG_USB_CONFIGFS_F_UVC=y

CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2
CONFIG_U_SERIAL_CONSOLE=y
```

Device Tree

Edit the following file and make the following changes.

<path to petalinux project >/project-spec/meta-user/recipe-bsp/device-tree/system-user.dtsi

Steps to test Composite Gadget

When the Linux kernel boots up, give the below commands:

```
insmod udc-xilinx.ko

mount -t configfs none /sys/kernel/config
```

```
cd /sys/kernel/config/usb_gadget/

mkdir g && cd g

echo 0x1d6b > idVendor  # Linux Foundation

echo 0x0104 > idProduct # Multifunction Composite Gadget

echo 0x0100 > bcdDevice # v1.0.0

echo 0x0200 > bcdUSB    # USB 2.0

mkdir -p strings/0x409

echo "xxxxxxxxxxxx" > strings/0x409/serialnumber

echo "xilinx"        > strings/0x409/manufacturer

echo "versal"   > strings/0x409/product

mkdir -p functions/acm.usb0    # serial

mkdir -p functions/ecm.usb0  # network

mkdir -p functions/rndis.usb0  # network

mkdir -p functions/mass_storage.ms0 # mass storage

dd if=/dev/zero of=/tmp/mydev count=256 bs=1M

echo /tmp/mydev > functions/mass_storage.ms0/lun.0/file

echo 1 > functions/mass_storage.ms0/lun.0/removable

mkdir -p configs/c.1

echo 250 > configs/c.1/MaxPower

echo 0xE0 > configs/c.1/bmAttributes

ln -s functions/rndis.usb0 configs/c.1/

ln -s functions/mass_storage.ms0/ configs/c.1/
```

```
#ln -s functions/ecm.usb0 configs/c.1/

ln -s functions/acm.usb0   configs/c.1/

ls /sys/class/udc/ > UDC
```

Logs

```
root@xilinx-vck190-es1-2020_2:~# mount -t configfs none /sys/kernel/config
/mount: mounting none on /sys/kernel/config failed: Device or resource busy
kernel/croot@xilinx-vck190-es1-2020_2:~#
root@xilinx-vck190-es1-2020_2:~# cd /sys/kernel/config/usb_gadget/
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget# mkdir g && cd g
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo 0x1d6b > idVend
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo 0x0104 > idProd
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo 0x0100 > bcdDev
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo 0x0200 > bcdUSB
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# mkdir -p strings/0x4
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo "xxxxxxxxxxx"
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo "xilinx" > stri
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo "versal" > stri
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# mkdir -p functions/a
-proot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# mkdir -p functions/e
p mkdir: can't create directory 'functions/ecm.usb0': No such file or directory
functionsroot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# mkdir -p functions/r
[ 103.054675] using random self ethernet address
[ 103.059147] using random host ethernet address
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# mkdir -p functions/m
d[ 141.238768] Mass Storage Function, version: 2009/09/11
[ 141.243939] LUN: removable file: (no medium)
ev/zero of=/root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# dd if=/dev/zero of=/
```

```
tmp/mydev > functions/mass_storage.ms0/lun.0/file

echo 1 > functions/mass_storage.ms0/lun.0/removable

mkdir -p configs/c.1

echo 250 > configs/c.1/MaxPower

echo 0xE0 > configs/c.1/bmAttributes

ln -s functions/rndis.256+0 records in
256+0 records out
usb0 coroot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo /tmp/mydev > fu
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo 1 > functions/m
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# mkdir -p configs/c.1
figs/c.root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo 250 > configs/c
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# echo 0xE0 > configs/
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# ln -s functions/rndi
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# ln -s functions/mass
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# ln -s functions/acm.
s/class/root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# ls /sys/class/udc/ >
[ 155.915282] usb0: HOST MAC 76:5d:c3:e3:7a:e1
[ 155.919616] usb0: MAC f2:26:48:7a:ab:ed
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# [ 156.331433] config

root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# ifconfig -a
can0 Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
NOARP MTU:16 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:10
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
Interrupt:6
```

```
eth0 Link encap:Ethernet HWaddr CE:49:EC:C8:49:B3
inet addr:10.10.71.2 Bcast:10.10.71.255 Mask:255.255.255.0
inet6 addr: fe80::cc49:ecff:fec8:49b3/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:49 errors:0 dropped:0 overruns:0 frame:0
TX packets:57 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:6105 (5.9 KiB) TX bytes:9135 (8.9 KiB)
Interrupt:16

eth1 Link encap:Ethernet HWaddr C6:86:53:97:D6:F2
BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
Interrupt:17

lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

sit0 Link encap:IPv6-in-IPv4
NOARP MTU:1480 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

usb0 Link encap:Ethernet HWaddr F2:26:48:7A:AB:ED
BROADCAST MULTICAST MTU:1500 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```

```
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# ifconfig usb0 10.10.
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g# ping 10.10.71.101
PING 10.10.71.101 (10.10.71.101): 56 data bytes
64 bytes from 10.10.71.101: seq=0 ttl=64 time=0.389 ms
64 bytes from 10.10.71.101: seq=1 ttl=64 time=0.305 ms
64 bytes from 10.10.71.101: seq=2 ttl=64 time=0.343 ms
64 bytes from 10.10.71.101: seq=3 ttl=64 time=0.290 ms
64 bytes from 10.10.71.101: seq=4 ttl=64 time=0.351 ms
^C
--- 10.10.71.101 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 0.290/0.335/0.389 ms
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/g#
```

Host machine side logs

```
[ 1755.910088] usb 1-3.3: new high-speed USB device number 9 using xhci_hcd
[ 1755.927165] usb 1-3.3: New USB device found, idVendor=1d6b, idProduct=0104
[ 1755.927186] usb 1-3.3: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 1755.927201] usb 1-3.3: Product: versal
[ 1755.927214] usb 1-3.3: Manufacturer: xilinx
[ 1755.927279] usb 1-3.3: SerialNumber: xxxxxxxxxxxx
[ 1755.936451] rndis_host 1-3.3:1.0 usb0: register 'rndis_host' at usb-0000:00:14.0
[ 1755.937461] usb-storage 1-3.3:1.2: USB Mass Storage device detected
[ 1755.937882] scsi4 : usb-storage 1-3.3:1.2
[ 1755.972414] cdc_acm 1-3.3:1.3: This device cannot do calls on its own. It is not
[ 1755.972553] cdc_acm 1-3.3:1.3: ttyACM0: USB ACM device
[ 1755.972852] usbcore: registered new interface driver cdc_acm
[ 1755.972856] cdc_acm: USB Abstract Control Model driver for USB modems and ISDN a
[ 1756.938574] scsi 4:0:0:0: Direct-Access Linux File-Stor Gadget 0504 PQ: 0 ANSI:
[ 1756.940140] sd 4:0:0:0: Attached scsi generic sg1 type 0
[ 1756.941633] sd 4:0:0:0: [sdb] 524288 512-byte logical blocks: (268 MB/256 MiB)
[ 1756.942523] sd 4:0:0:0: [sdb] Write Protect is off
[ 1756.942546] sd 4:0:0:0: [sdb] Mode Sense: 0f 00 00 00
[ 1756.942851] sd 4:0:0:0: [sdb] Write cache: enabled, read cache: enabled, doesn't
[ 1756.948682] sdb: unknown partition table
[ 1756.949962] sd 4:0:0:0: [sdb] Attached SCSI removable disk
```

HID Gadget

Kernel configurations

Device Drivers --->[*] USB support ---> <*> USB Gadget Support --->

By enabling the above we need to see the below mentioned Kconfig parameter enabled

```
CONFIG_USB_DWC3 = y
CONFIG_USB_DWC3=y
CONFIG_USB_DWC3_DUAL_ROLE=y
CONFIG_USB_DWC3_OF_SIMPLE=y
# USB HID support
CONFIG_USB_HID=y
# CONFIG_HID_PID is not set
# CONFIG_USB_HIDDEV is not set
CONFIG_USB_OHCI_LITTLE_ENDIAN=y
CONFIG_USB_SUPPORT=y
CONFIG_USB_COMMON=y
CONFIG_USB_ARCH_HAS_HCD=y
CONFIG_USB=y
CONFIG_USB_ANNOUNCE_NEW_DEVICES=y

# Miscellaneous USB options
CONFIG_USB_DEFAULT_PERSIST=y
CONFIG_USB_OTG=y
CONFIG_USB_OTG_FSM=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_XHCI_PLATFORM=y
CONFIG_USB_STORAGE=y
# USB Physical Layer drivers

CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2
CONFIG_USB_LIBCOMPOSITE=y
CONFIG_USB_U_ETHER=y
CONFIG_USB_F_RNDIS=y
CONFIG_USB_F_MASS_STORAGE=y
```

```
CONFIG_USB_F_FS=y
CONFIG_USB_F_UVC=y
CONFIG_USB_F_HID=y
CONFIG_USB_CONFIGFS=y
CONFIG_USB_CONFIGFS_RNDIS=y
CONFIG_USB_CONFIGFS_MASS_STORAGE=y
CONFIG_USB_CONFIGFS_F_FS=y
CONFIG_USB_CONFIGFS_F_HID=y
CONFIG_USB_CONFIGFS_F_UVC=y
```

Device Tree

Edit the following file and make the following changes.

"<path to petalinux project >/project-spec/meta-user/recipes-bsp/device-tree/files/system-user.dtsi"

Steps to test HID Gadget

```
mount -t configfs none /sys/kernel/config/
echo ""Creating HID...""
cd /sys/kernel/config/usb_gadget/
mkdir -p gadget
cd gadget
echo 0x0525 > idVendor
echo 0xa4ac > idProduct
echo 0x00 > bDeviceClass
echo 0x00 > bDeviceSubClass
echo 0x00 > bDeviceProtocol
bmAttributes
mkdir -p strings/0x409
echo ""0000000001"" > strings/0x409/serialnumber
echo ""manufacturer"" > strings/0x409/manufacturer
echo ""HID Gadget"" > strings/0x409/product
mkdir -p functions/hid.usb0
echo 1 > functions/hid.usb0/protocol
echo 1 > functions/hid.usb0/subclass
echo 8 > functions/hid.usb0/report_length
echo -ne \\x05\\x01\\x09\\x06\\xa1\\x01\\x05\\x07\\x19\\xe0\\x29\\xe7\\x15\\x00\\x2
mkdir -p configs/c.1/strings/0x409
echo ""Conf 1"" > configs/c.1/strings/0x409/configuration
```

```
echo 0x00 > configs/c.1/MaxPower
echo 0xC0 > configs/c.1/bmAttributes
ln -s functions/hid.usb0 configs/c.1/
ls /sys/class/udc > UDC
//Key Press
echo -ne ""\0\0\0\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\x06\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\0\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\x07\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\0\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\x08\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\0\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\x04\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\0\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\x00\0\x05\0\0\0\0\0"" > /dev/hidg0
echo -ne ""\0\0\0\0\0\0\0\0"" > /dev/hidg0
```

Logs

```
root@xilinx-vck190-es1-2020_2:~# mount -t configfs none /sys/kernel/config/
"mount: mounting none on /sys/kernel/config/ failed: Device or resource busy
"Crearoot@xilinx-vck190-es1-2020_2:~# echo ""Creating HID...""
Creating HID...
kernel/croot@xilinx-vck190-es1-2020_2:~# cd /sys/kernel/config/usb_gadget/
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget# mkdir -p gadget
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget# cd gadget
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 0x0525 > i
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 0xa4ac > i
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 0x00 > bDe
x00 > bDeroot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 0
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 0x00 > bDe
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# bmAttributes
-sh: bmAttributes: command not found
p stringsroot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# mkdir
"root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo ""0000000
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo ""manufact
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo ""HID Gadg
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# mkdir -p functi
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 1 > functi
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 1 > functi
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 8 > functi
```

```
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne \\x05\
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# mkdir -p config
oroot@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo ""Conf 1"
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 0x00 > con
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo 0xC0 > con
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# ln -s functions
/root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# ls /sys/class/
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# [ 92.584761] co

root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\0\0
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\0\0
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\0\0
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\0\0
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\0\0
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\0\0
ne ""\0\0root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -
e ""\0\0root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -n
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\0\0
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\x00
ne root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# echo -ne ""\
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget#
root@xilinx-vck190-es1-2020_2:/sys/kernel/config/usb_gadget/gadget# cat /dev/hidg0

root@xilinx-vck190-es1-2020_2:~# ./hid_gadget_test /dev/hidg0 keyboard
keyboard options:
--hold
--left-ctrl
--right-ctrl
--left-shift
--right-shift
--left-alt
--right-alt
--left-meta
--right-meta

keyboard values:
[a-z] or
--return --esc
--bckspc --tab
--spacebar --caps-lock
```

```
--f1 --f2
--f3 --f4
--f5 --f6
--f7 --f8
--f9 --f10
--f11 --f12
--insert --home
--pageup --del
--end --pagedown
--right --left
--down --kp-enter
--up --num-lock
```

Host machine side logs

```
[ 4121.608405] usb 1-3.3: new high-speed USB device number 10 using xhci_hcd
[ 4121.625395] usb 1-3.3: New USB device found, idVendor=0525, idProduct=a4ac
[ 4121.625419] usb 1-3.3: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[ 4121.625435] usb 1-3.3: Product: HID Gadget
[ 4121.625448] usb 1-3.3: Manufacturer: manufacturer
[ 4121.625461] usb 1-3.3: SerialNumber: 0000000001
[ 4121.634479] input: manufacturer HID Gadget as /devices/pci0000:00/0000:00:14.0/u
[ 4121.635191] hid-generic 0003:0525:A4AC.0002: input,hidraw0: USB HID v1.01 Keyboa
```

Audio Gadget

Kernel configurations

```
CONFIG_USB_DWC3 = y
CONFIG_USB_DWC3=y
CONFIG_USB_DWC3_DUAL_ROLE=y
CONFIG_USB_DWC3_OF_SIMPLE=y
# USB HID support
CONFIG_USB_HID=y
# CONFIG_HID_PID is not set
# CONFIG_USB_HIDDEV is not set
CONFIG_USB_OHCI_LITTLE_ENDIAN=y
CONFIG_USB_SUPPORT=y
```

```
CONFIG_USB_COMMON=y
CONFIG_USB_ARCH_HAS_HCD=y
CONFIG_USB=y
CONFIG_USB_ANNOUNCE_NEW_DEVICES=y

# Miscellaneous USB options
CONFIG_USB_DEFAULT_PERSIST=y
CONFIG_USB_OTG=y
CONFIG_USB_OTG_FSM=y
CONFIG_USB_XHCI_HCD=y
CONFIG_USB_XHCI_PLATFORM=y
CONFIG_USB_STORAGE=y

# USB Physical Layer drivers

CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2

CONFIG_USB_LIBCOMPOSITE=y
CONFIG_USB_U_ETHER=y
CONFIG_USB_F_RNDIS=y
CONFIG_USB_F_MASS_STORAGE=y
CONFIG_USB_F_FS=y
CONFIG_USB_F_UVC=y
CONFIG_USB_F_HID=y
CONFIG_USB_CONFIGFS=y
CONFIG_USB_CONFIGFS_RNDIS=y
CONFIG_USB_CONFIGFS_MASS_STORAGE=y
CONFIG_USB_CONFIGFS_F_FS=y
CONFIG_USB_CONFIGFS_F_HID=y
CONFIG_USB_CONFIGFS_F_UVC=y
CONFIG_USB_CONFIGFS_F_UAC1=y
CONFIG_USB_PHY=y
CONFIG_USB_GADGET=y
CONFIG_USB_GADGET_DEBUG_FS=y
CONFIG_USB_GADGET_VBUS_DRAW=2
CONFIG_USB_GADGET_STORAGE_NUM_BUFFERS=2
CONFIG_U_SERIAL_CONSOLE=y
```

For reference Attaching complete kernel config file: kernel_config.txt

Device Tree

Edit the following file and make the following changes.

<path to petalinux project >/project-spec/meta-user/recipe-bsp/device-tree/system-user.dtsi

Steps to test Audio Gadget

When the Linux kernel boots up, give the below commands:

```
CONFIGFS_BASE_PATH="/sys/kernel/config"

CONFIGFS_GADGET_PATH=${CONFIGFS_BASE_PATH}"/usb_gadget/g1"

GADGET_SERIAL_NUMBER="Xilinx_1234567890"

GADGET_MANUFACTURER="Xilinx"

GADGET_PRODUCT="Xilinx - HID Audio"

GADGET_IDVENDOR=0x0101

GADGET_IDPRODUCT=0x1d6b

GADGET_CONFIG_DESCRIPTION="Config 1: BB HID Keyboard"

mount none ${CONFIGFS_BASE_PATH} -t configfs

mkdir -p ${CONFIGFS_GADGET_PATH}

echo ${GADGET_IDVENDOR} > ${CONFIGFS_GADGET_PATH}/idVendor

echo ${GADGET_IDPRODUCT} > ${CONFIGFS_GADGET_PATH}/idProduct

echo 0xef  > ${CONFIGFS_GADGET_PATH}/bDeviceClass

echo 0x02  > ${CONFIGFS_GADGET_PATH}/bDeviceSubClass

echo 0x01  > ${CONFIGFS_GADGET_PATH}/bDeviceProtocol
```

```
mkdir -p ${CONFIGFS_GADGET_PATH}/configs/c.1/

mkdir -p ${CONFIGFS_GADGET_PATH}/functions/uac1.0/

mkdir -p ${CONFIGFS_GADGET_PATH}/strings/0x409

mkdir -p ${CONFIGFS_GADGET_PATH}/configs/c.1/strings/0x409

echo ${GADGET_CONFIG_DESCRIPTION} > ${CONFIGFS_GADGET_PATH}/configs/c.1/strings/0x4

echo 250 > ${CONFIGFS_GADGET_PATH}/configs/c.1/MaxPower

echo 0xA0 > ${CONFIGFS_GADGET_PATH}/configs/c.1/MaxPower

echo ${GADGET_SERIAL_NUMBER} > ${CONFIGFS_GADGET_PATH}/strings/0x409/serialnumber

echo ${GADGET_MANUFACTURER} > ${CONFIGFS_GADGET_PATH}/strings/0x409/manufacturer

echo ${GADGET_PRODUCT} > ${CONFIGFS_GADGET_PATH}/strings/0x409/product

#ln -s ${CONFIGFS_GADGET_PATH}/functions/mass_storage.ms0/ ${CONFIGFS_GADGET_PATH}/

ln -s ${CONFIGFS_GADGET_PATH}/functions/uac1.0 ${CONFIGFS_GADGET_PATH}/configs/c.1/

ls /sys/class/udc > ${CONFIGFS_GADGET_PATH}/UDC

aplay -v -D hw:0,0 -f S16_LE -r 48000 -c 2 <path to audio file>/audio.wav

or

Open VLC player & play the audio by changing its interface audio device.
```

Logs

```
root@xilinx-vck190-es1-2020_2:~# CONFIGFS_BASE_PATH="/sys/kernel/config"
root@xilinx-vck190-es1-2020_2:~#
root@xilinx-vck190-es1-2020_2:~# CONFIGFS_GADGET_PATH=${CONFIGFS_BASE_PATH}"/usb_ga
root@xilinx-vck190-es1-2020_2:~# GADGET_SERIAL_NUMBER="Xilinx_1234567890"
root@xilinx-vck190-es1-2020_2:~# GADGET_MANUFACTURER="Xilinx"
root@xilinx-vck190-es1-2020_2:~# GADGET_PRODUCT="Xilinx - HID Audio"
```

```
root@xilinx-vck190-es1-2020_2:~# GADGET_IDVENDOR=0x0101
root@xilinx-vck190-es1-2020_2:~# GADGET_IDPRODUCT=0x1d6b
root@xilinx-vck190-es1-2020_2:~# GADGET_CONFIG_DESCRIPTION="Config 1: BB HID Keyboa
root@xilinx-vck190-es1-2020_2:~# mount none ${CONFIGFS_BASE_PATH} -t configfs
pmount: mounting none on /sys/kernel/config failed: Device or resource busy
${CONFIGFroot@xilinx-vck190-es1-2020_2:~#
root@xilinx-vck190-es1-2020_2:~# mkdir -p ${CONFIGFS_GADGET_PATH}
root@xilinx-vck190-es1-2020_2:~# echo ${GADGET_IDVENDOR} > ${CONFIGFS_GADGET_PATH}/
root@xilinx-vck190-es1-2020_2:~# echo ${GADGET_IDPRODUCT} > ${CONFIGFS_GADGET_PATH}
root@xilinx-vck190-es1-2020_2:~# echo 0xef > ${CONFIGFS_GADGET_PATH}/bDeviceClass
root@xilinx-vck190-es1-2020_2:~# echo 0x02 > ${CONFIGFS_GADGET_PATH}/bDeviceSubClas
root@xilinx-vck190-es1-2020_2:~# echo 0x01 > ${CONFIGFS_GADGET_PATH}/bDeviceProtoco
root@xilinx-vck190-es1-2020_2:~# mkdir -p ${CONFIGFS_GADGET_PATH}/configs/c.1/
root@xilinx-vck190-es1-2020_2:~# mkdir -p ${CONFIGFS_GADGET_PATH}/functions/uac1.0/
root@xilinx-vck190-es1-2020_2:~# mkdir -p ${CONFIGFS_GADGET_PATH}/strings/0x409
root@xilinx-vck190-es1-2020_2:~# mkdir -p ${CONFIGFS_GADGET_PATH}/configs/c.1/strin
root@xilinx-vck190-es1-2020_2:~# echo ${GADGET_CONFIG_DESCRIPTION} > ${CONFIGFS_GAD
root@xilinx-vck190-es1-2020_2:~# echo 250 > ${CONFIGFS_GADGET_PATH}/configs/c.1/Max
root@xilinx-vck190-es1-2020_2:~# echo 0xA0 > ${CONFIGFS_GADGET_PATH}/configs/c.1/Ma
root@xilinx-vck190-es1-2020_2:~# echo ${GADGET_SERIAL_NUMBER} > ${CONFIGFS_GADGET_P
root@xilinx-vck190-es1-2020_2:~# echo ${GADGET_MANUFACTURER} > ${CONFIGFS_GADGET_PA
root@xilinx-vck190-es1-2020_2:~# echo ${GADGET_PRODUCT} > ${CONFIGFS_GADGET_PATH}/s
root@xilinx-vck190-es1-2020_2:~# #ln -s ${CONFIGFS_GADGET_PATH}/functions/mass_stor
root@xilinx-vck190-es1-2020_2:~# ln -s ${CONFIGFS_GADGET_PATH}/functions/uac1.0 ${C
root@xilinx-vck190-es1-2020_2:~# ls /sys/class/udc > ${CONFIGFS_GADGET_PATH}/UDC
root@xilinx-vck190-es1-2020_2:~# [ 55.981478] configfs-gadget gadget: high-speed co
root@xilinx-vck190-es1-2020_2:~# aplay -v -D hw:0,0 -f S16_LE -r 48000 -c 2 audio_t
Playing WAVE 'audio_test.wav' : Signed 16 bit Little Endian, Rate 64000 Hz, Stereo
Warning: rate is not accurate (requested = 64000Hz, got = 48000Hz)
please, try the plug plugin
Hardware PCM card 0 'UAC1_Gadget' device 0 subdevice 0
Its setup is:
stream : PLAYBACK
access : RW_INTERLEAVED
format : S16_LE
subformat : STD
channels : 2
rate : 48000
exact rate : 48000 (48000/1)
msbits : 16
buffer_size : 16384
period_size : 1024
```

```
period_time : 21333
tstamp_mode : NONE
tstamp_type : MONOTONIC
period_step : 1
avail_min : 1024
period_event : 0
start_threshold : 16384
stop_threshold : 16384
silence_threshold: 0
silence_size : 0
boundary : 4611686018427387904
appl_ptr : 0
hw_ptr : 0
```

Host side machine logs

```
[28962.568558] usb 1-3.3: new high-speed USB device number 27 using xhci_hcd
[28962.585670] usb 1-3.3: New USB device found, idVendor=0101, idProduct=1d6b
[28962.585691] usb 1-3.3: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[28962.585706] usb 1-3.3: Product: XilinxTest - HID Audio
[28962.585720] usb 1-3.3: Manufacturer: Xilinx
[28962.585734] usb 1-3.3: SerialNumber: Xilinx_1234567890
[28962.653843] usbcore: registered new interface driver snd-usb-audio
```

References

Zynq Ultrascale MPSOC Linux USB device driver