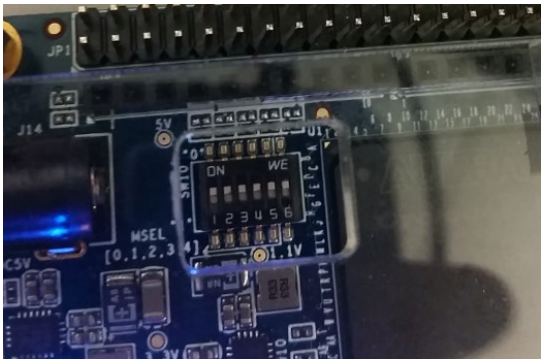
EELE 468
Lab 2 (part 1)
Due March 3, 2020

Audio Mini Passthrough Hardware Test

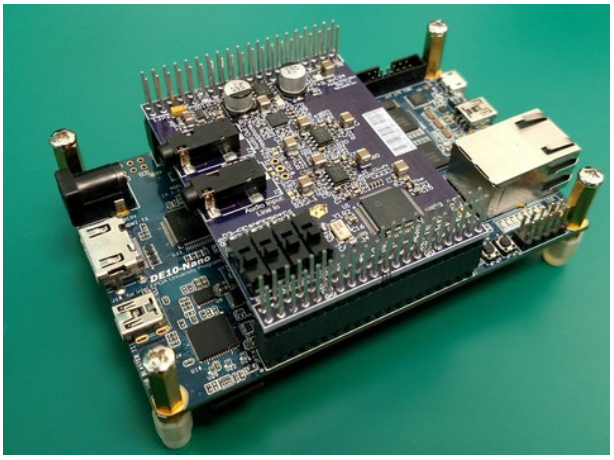
The goal of Lab 2 (part 1) is to make sure that your Audio Mini board works with the DE10-Nano board. Part 2 will be to do the same thing, but from the NFS boot setup.

Install the Audio Mini Board

1. Remove the clear acrylic (plastic) protective cover by unscrewing the four screws holding it in place. Remove the acrylic cover.
2. Make sure the MSEL switches are all placed into their ON (up) position as shown below. This tells the HPS how the .rbf file, which configures the FPGA fabric, should be interpreted and programmed by the bootloader.



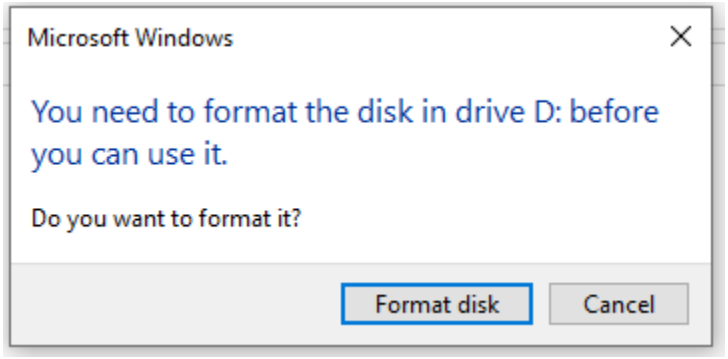
3. Orient the Audio Mini as shown below and plug it into the header posts on the DE10-Nano board.



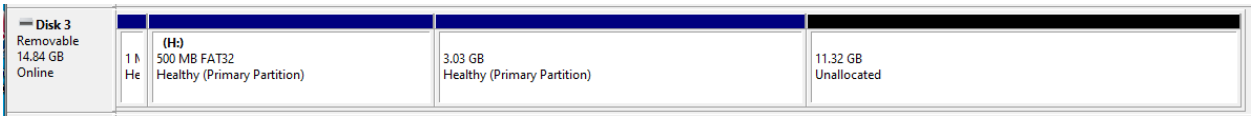
Reimage the microSD Card with the Passthrough image

Note: We are assuming that the microSD card you are going to image has a **16 GB** capacity.

1. **Before proceeding, make sure that your computer files are backed up!** If your computer hard drive (or SSD) got wiped or destroyed, could you restore the files you care about? If the answer is no, stop right now and back up the files you care about before proceeding.
2. If you don't already have **7-Zip**, download it from: https://www.7-zip.org/
3. Download the file **audiomini_master.img.xz** (233 MB), which is the new microSD card image from: https://www.dropbox.com/sh/jsr9qw5ecr3webo/AAAuiHvovjQSC5wr1897HN1Ea?dl=0
    a. Extract (7-Zip->Extract Here) audiomini_nfs.img.xz using 7-Zip (233 MB), which will extract and uncompress to audiomini_nfs.img (2.1 GB).
4. Plug the microSD card into the USB card reader and plug the card reader into your Windows machine. If Windows pops up a couple messages like the one below, this means the card has been previously used for the DE10-Nano and there two partitions (Partition 2 and 3) that Windows doesn't recognize (see figure above). Don't Format the disk, i.e. ignore the Windows pop-up messages (hit Cancel). If this is the case, proceed to step 5. If your card is new and windows recognizes it as a single FAT32 partition, then proceed to step 6.



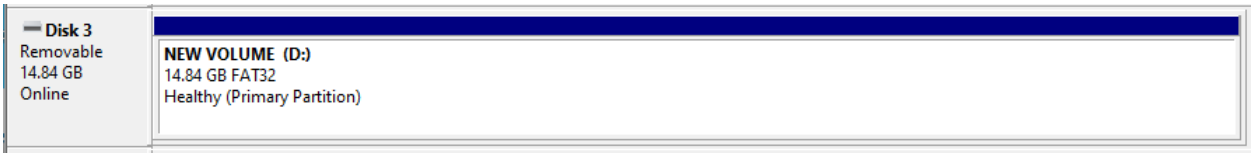
5. **Create a single partition on the microSD card.** In the Windows search bar, type "disk management" and Windows will suggest "Create and format hard disk partitions". Click on that suggestion. The Disk Management utility will pop up and there will be a disk listed (Disk 3 in this example) that is ~16 GB (14.84 GB in this example). Here's what the disk utility shows for Disk 3 that shows the three partitions.



    a. Verify that this is the 16 GB microSD card by unplugging from Windows. This Disk listing should disappear from the Disk Management utility and when you plug it back into Windows, it should reappear (after a bit).

b. *Danger Zone.* Make sure you are targeting the microSD card! **Triple check** that the disk is associated with the microSD card. For each partition listed for the microSD card disk, right click and select "Delete Volume". Windows will ask "Do you want to delete this partition?". Select Yes (after making sure this is the microSD card disk). It should now look like:

c. Right Click on the area that says 14.84 GB Unallocated and select "New Simple Volume" and create a volume that is the maximum disk space (15192 MB) with FAT32 (accept default settings).
d. Close the Disk Management utility and restart it (otherwise it may complain about some errors). It will say that the disk is a raw partition.
e. Right click on the partition and format with FAT32. The microSD card should now look like a new card with a single 14.84 GB FAT32 partition.



f. Proceed to step 6.

6. Run Win32DiskImager

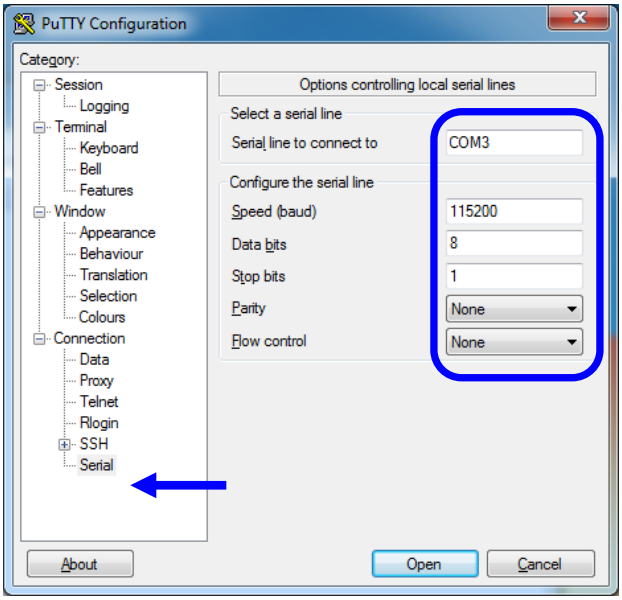
a. If you don't already have **Win32DiskImager**, download it from: https://sourceforge.net/projects/win32diskimager/
b. For the Image File, browse to where **audiomini_nfs.img** is located and select it.
c. The device should be the drive that contains the microSD card. **Double check that this is the microSD card (14.8 GB capacity)** since you will be overwriting this drive.
d. Click the **Write** button. Confirm again that you are targeting the drive with the microSD card. Don't worry about it complaining about extra space.
e. This will may take a few minutes to write, depending on your write speed (16 minutes @ 15 MB/s).
f. You are done when it says done in the lower left corner of the window.
g. Click Exit

Booting from microSD Card

1. Insert the microSD card into the DE10-Nano board.
2. Connect the DE10-Nano board to PuTTY
    a. Connect a Mini-B USB cable to the UART-to-USB connector on the right side of the DE10-Nano board

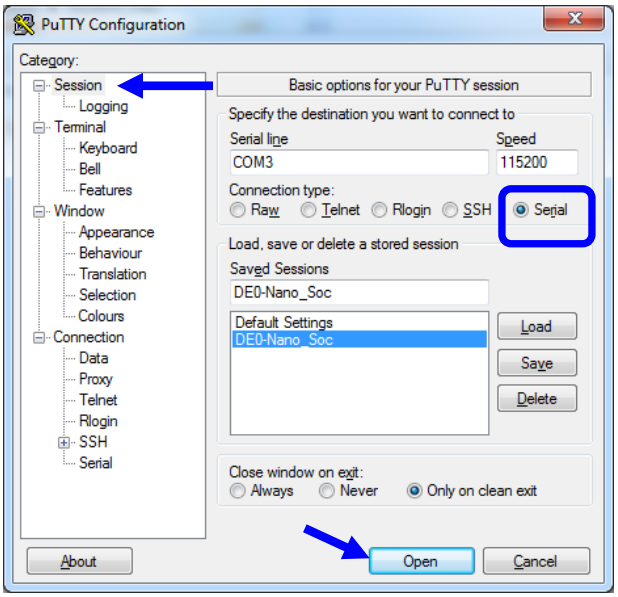
PuTTY

PuTTY is an open source terminal emulator that is used to communicate with Linux on the DE10 board. The serial settings to configure Putty are shown in the figure to the right where you need to select the following:



3. Determine your COM port number assigned to the USB serial port (This can be found on a Windows 7 machine at: Start -> Computer -> Systems Properties tab -> Device Manager -> Ports) Your COM port number might be different than what is shown.
4. Configure the Serial settings by selecting \Connection**Serial** in the ***Category*** panel (panel on left side).
    a. COM Port = Assigned by Windows.
    b. Speed (baud) = **115200**
    c. Data bits = **8**
    d. Stop bits = **1**
    e. Parity = **None**
    f. Flow control = **None**

5. Next, select **\Session** in the ***Category*** panel (left side).
    g. Make sure that the *Connection type* is **Serial**.



    h. Open the terminal window by clicking the Open button at the bottom. If PuTTY only beeps rather than opening a terminal window, you are probably trying to open the terminal window in the serial configuration setting window (\Connection\Serial) rather than being in the \Sessions window. Hit return if you don't see the Linux login prompt.

    i. Save the configuration settings in the Session window by clicking the Save button after entering an appropriate session name. See the figure below right that shows a saved session call DE0-Nano_Soc.

6. **U-boot Settings**
    a. Power cycle the DE10-Nano-SoC board with the USB cable connected to the UART port and you should now see the DE10 start booting in the terminal window.
    b. Immediately press a key to stop the U-boot process.
    a. Check what the U-boot environment variables are by typing:
        i. # `printenv`
    c. You should see a line that says:
        i. nfsboot=false
        ii. nfsboot=false means that Linux will boot from the microSD card rather than from a NFS server, which is what we want for this initial hardware test. If it said true, you would need to change it to false.
7. **Boot Linux**.
    a. Power cycle the DE10-Nano-SoC board with the USB cable connected to the UART port and you should see Linux boot in the terminal window.
    b. Type "root" for both the username and password in order to login into your FPGA!
        i. Username: root
        Password: root

c. The device drivers for the AD1939 audio codec and the TI headphone driver need to be loaded. If you type ls, you will see to .ko files, which are the loadable kernel modules.
d. Load the kernel modules by typing:
    i. `insmod FE_AD1939.ko`
    ii. `insmod FE_TPA613A2.ko`
e. Check that the kernel modules got loaded by typing:
    i. `Lsmod`
f. The audio mini board should now be functioning. Test the board by sending audio into the line-in port and listening to the line-out port.

Instructor Verification Sheet
Have this sheet signed off
and upload your VHDL and Matlab code to D2L
to get credit for the lab.

Lab 2

Audio Mini Passthrough Hardware Test

Due Date: 3/3/20

Name : _____

Demo: Show that the audio mini board works.

Verified: _____ Date:_____