

## LAB Assignment #1, for ECE 525

### Description: Create a Boot Disk on a MicroSD Card for your ZYBO/CORA board

A MicroSD card at least 8 GB is required. You will create two partitions on the card, one formatted as Fat-32 (1 GB) and one formatted as Linux ext4 (7 or more GB).

The most difficult part of this process is finding a computer that allows you to access and format the card. Linux is easy, Windows not so easy. The instructions below are for Linux. There are many variants to doing this in Windows, most times students are not successful. If you do not have access to a Linux OS (RedHat, Ubuntu, CentOS, POP), you can come to my office and I'll make the disk for you.

Under linux, all of the following need to be done as superuser.

- Insert your MicroSD card into a read/writer
- Type 'dmesg' to see what sdx is reported at the very bottom, e.g., 'sdd: sdd1' might show up. Make note of the 'x' in 'sdx'. Make sure you choose the correct device. The sdd, for example, refers to /dev/sdd, /dev/sdd1
- Run 'fdisk /dev/sdx'. Substitute your device letter here for 'x'. Always run fdisk on the base device, the entry withOUT the number.
- If successful, you get a prompt 'Command (m for help)'. Type 'm'. The command you will use are 'p' (print the partition table), 'd' (delete a partition), 'n' (create a new partition), 'a' (make a partition a boot partition), 't' (change a partition format type). Use the following sequence of commands to create the two partitions.
- Delete all existing partitions. Just type 'd' and the partition number
- 'p' to list the partitions, should be none
- 'n', 'p', '1', <enter>, '+1G' (create a 1 GB FAT32 filesystem) (<enter> means use the default)
- 't', 'b' (change 1G partition to be W95 FAT32)
- 'a', '1' (make the FAT partition bootable)
- 'n', 'p', '2', <enter>, <enter> (use the rest of the card for the second partition) Note that it is by default formatted as ext3 or ext4 so no need to change the type.
- 'p' (verify the partitions) Should say 'W95 FAT-2' and 'Linux'
- 'w' (write out the partition table)
- Once the partition table is written, you need to format the partitions. Type the following:
- 'mkfs.vfat -F 32 -n boot /dev/sdx1' Substitute your device letter here for 'x'.
- 'mount /dev/sdd1 /mnt' Mount the FAT32 on the directory /mnt. Substitute /mnt for whatever you like but it must exist (use 'mkdir' if needed) and it must be empty (not files).
- 'cp <path>/BOOT.BIN /mnt'
- 'cp <path>/image.ub /mnt' Copy the BOOT and image files for your board, assuming you have downloaded them in the directory <path>. Be sure to use to correct ones. ZYBO will not work for a CORA and vise versa.
- 'umount /mnt'
- 'dd if=<path>/rootfs.ext4 of=/dev/sdx2' (Copy the linux root filesystem to the second partition). Substitute your device letter here for 'x'.
- 'mount /dev/sdd2 /mnt'

- `'vi /mnt/etc/network/interfaces'` (Set the IP for you local area network, e.g., change `'192.168.0.10'` to `'192.168.1.10'` to use subset '1' instead of '0'. Or leave it as is. Just make note of it for the network configuration task.
- `'umount /mnt'` (Unmount the linux partition, which writes any changes to the card).
- Remove the SD card and insert it into your CORA or ZYBO board. Plug in the micro USB and power up your board.
- If the system boots, you will see two files created, `'/dev/ttyUSB0'` and `'/dev/ttyUSB1'`. The '0' and '1' may be '1' and '2', or other values. Check by doing a long list on `/dev`, e.g., type `'ls -ltra /dev'`. The `ttyUSBx` files will be listed at the very bottom.
- Still as superuser, you can give user permission to access these files using minicom by typing `'chmod a+rwX /dev/ttyUSB*'`.
- For CORA (ZYBO does not support programming from Vivado yet), you may also want to change permission of the jtag port. Type `'lsusb'` and look for 'Future Device Technologies'. The 'Bus xxx Device yyy' values identify your jtag device. Type `'chmod a+rwX /dev/bus/usb/xxx'` and then `'chmod a+rwX /dev/bus/usb/xxx/yyy'`.
- NOTE: You need to run these 'chmod' commands every time you power cycle your board.
- You may now exit superuser mode.
- Run `'minicom'` to access your board using a serial connection. Press `'<Ctrl>-A'` and then `'<Shift>-Z'` to bring up the configuration menu. Type `'o'` to configure minicom. Mouse down to 'Serial Port Setup', `<Enter>`. Type `'a'` to change the serial port. It usually needs to be `'/dev/ttyUSB1'` but see above for other possibilities. Use the higher numbered port of the two that are listed. The other one is the JTAG port and will appear dead.
- BEFORE EXITING minicom configuration, make sure 'Hardware Flow Control' is 'no'. Type `'F'` if needed to disable it.
- Press `<Enter>` to exit configuration. You return to the main menu. Select 'Save setup as default' so you do not need to do this every time. If you are superuser, this will succeed in writing a configuration file in `/etc`.
- Select 'Exit', which returns you to the serial term window. Press `<Enter>`. You should see `'xc7z010: login'` (on ZYBO, something similar on CORA).
- Type `'root'`, and the `'root'`. You are not logged into the ZYBO/CORA board. Do not confuse this with you desktop.
- Plug in the twisted pair between your laptop and the board. Type `'ifconfig'`. This will list the `eth0` configuration information. You should see `'inet addr:192.168.1.10'` or whatever you changed it to above. If you need to set it for this session to something else, type `'ifconfig eth0 192.168.x.xx'`.
- You can then try to ssh to the board through the twisted pair connection. Type `'ifconfig'` on your laptop (as superuser). You may need to set up the interface. Type `'ifconfig xxxx 192.168.1.20'`. `<xxxx>` is the ethernet device. Type `'ifconfig'` to see what devices exist and use the wired interface that is listed. ALWAYS BE SURE THAT BOTH THE FPGA AND YOUR LAPTOP are on the same subnet, e.g., 192.168.y.x (same 'y'), AND MAKE SURE THEY HAVE DIFFERENT IPs, different 'x' values.
- Type `'ping 192.168.1.10'` from your laptop to see it can see you ZYBO board with the IP configured to be, e.g. 192.168.1.10 on the ZYBO board.
- If successful, you can then ssh and scp files to and from your laptop and board, e.g., `'ssh root@192.168.1.10'`.