Deephi DNNDK Tutorial for Ultra96

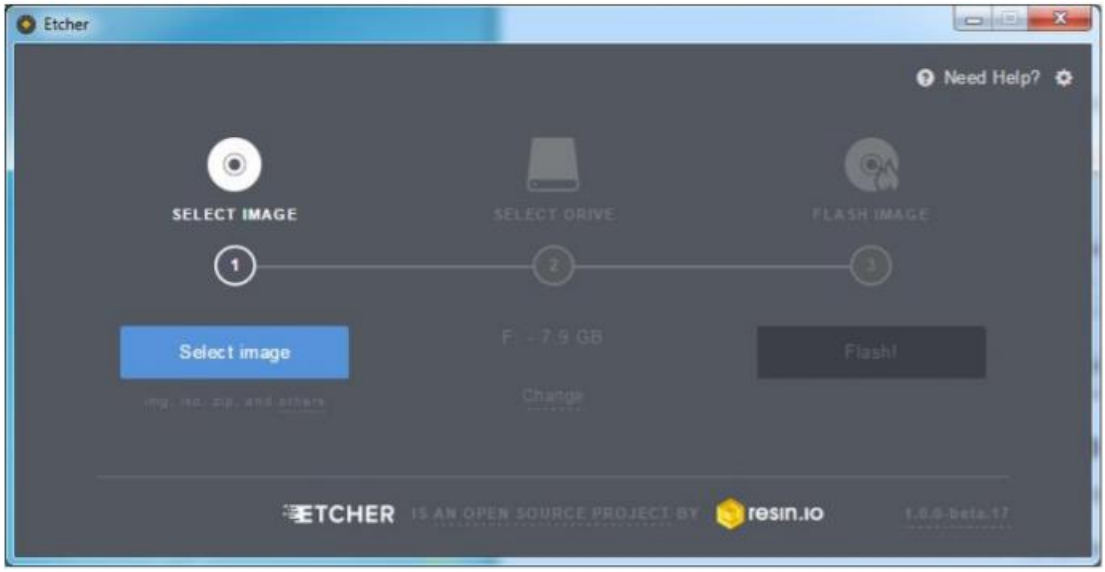
Version 1.0 [June 25, 2019]

In this tutorial we are going to run DNNDK SDK tools and sample applications on Ultra96 board.

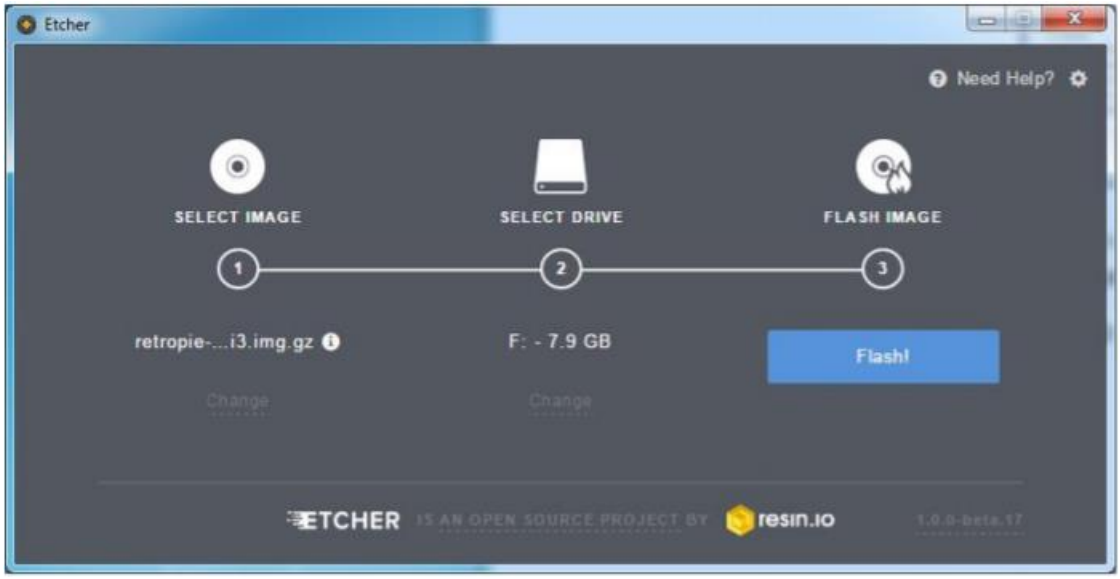
1. First download DDNK SDK and board Image for Ultra96.
2. When goto the link download 'xilinx-ultra96-desktop-stretch-2018-12-10.img.zip' which supports DNNDK version 2.08: **xilinx_dnndk_v2.08** *[if you don't get the DNNDK v2.08 then let us know at info@logictronix.com, we can provide you].*

Product	Documentation	Image Download	DNNDK Version	File Size	MD5 Checksum
ZCU102 Kit	ZCU102 User Guide (UG1182)	xilinx-zcu102-prod-dpu1.4-2018.3-desktop-buster-2019-04-24.img.zip	v3.0	657 MB	d49eab4d293d8d1af40fcc369e1c4f53
		2018-12-04-zcu102-desktop-stretch.img.zip	v2.08	571 MB	d0d5faf8ece80b96f5591d09756d5a5d
ZCU104 Kit	ZCU104 User Guide (UG1267)	xilinx-zcu104-prod-dpu1.4-desktop-buster-2019-04-23.img.zip	v3.0	655 MB	503661dd1ee4549a562775034b95d0c8
		2018-12-04-zcu104-desktop-stretch.img.zip	v2.08	571 MB	ada2420c4afbd89efdeea741e0917e26
Avnet Ultra 96	Ultra 96 User Guide	xilinx-ultra96-prod-dpu1.4-desktop-buster-2019-05-31.img.zip	v3.0	576 MB	c9c6a5f5a772077abc8fffde6ea8f3db
		xilinx-ultra96-desktop-stretch-2018-12-10.img.zip	v2.08	566 MB	c5d2422063213b4bc4c18a3223c6adc8

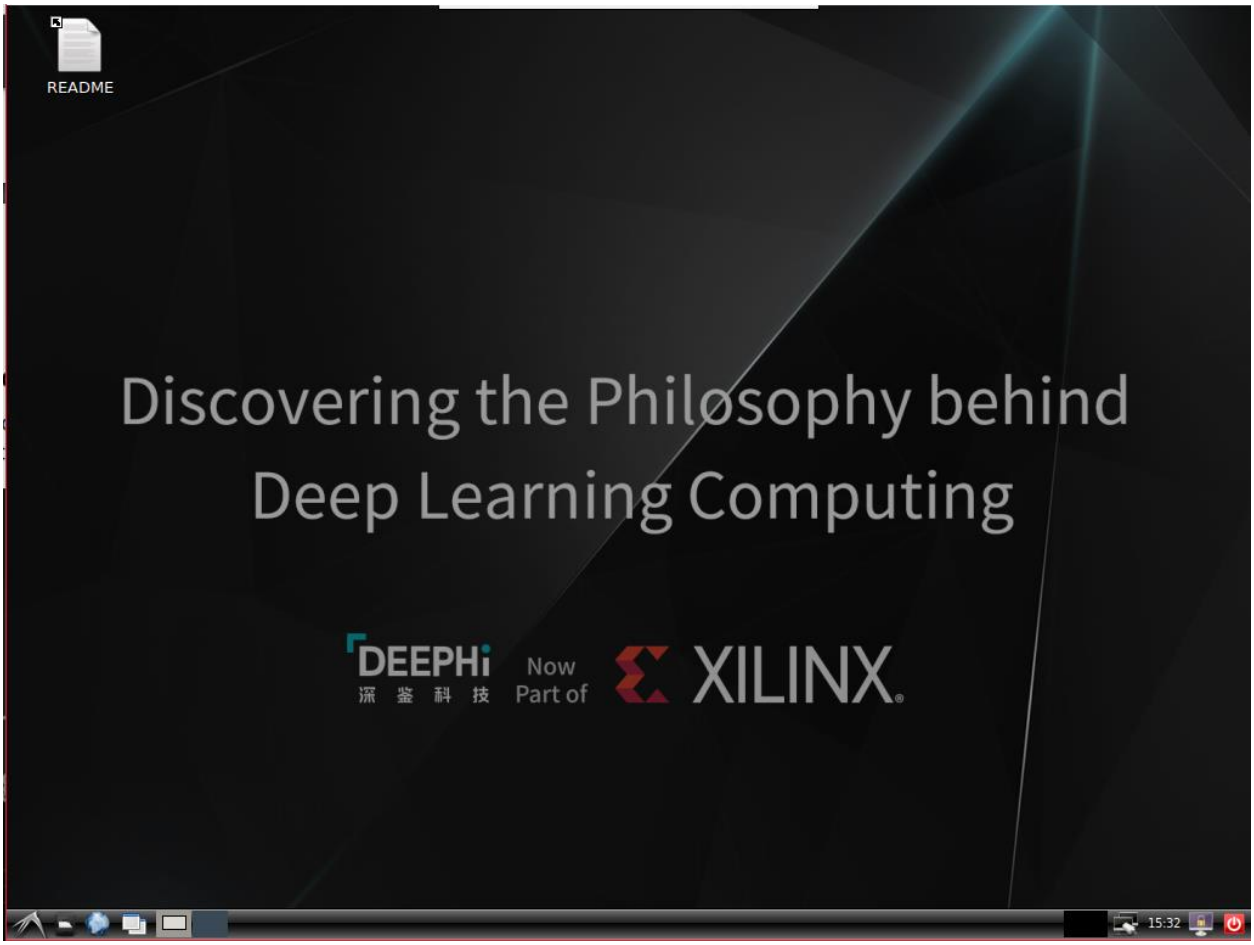
3. Then flash the downloaded OS image to the SDCard.
4. To flash the OS we use a software called Etcher. You can download it from https://etcher.io/
5. Install the Etcher. Eject any external storage devices such as USB flash drives and backup hard disks before flashing. This makes it easier to identify the SD card. Then, insert the SD card into the slot on your computer, or into the reader.
6. Launch the Etcher application, will you see screen as shown below.



7. Select the image file by clicking Select Image. You can select a .zip or .gz compressed file.
8. Etcher tries to detect the SD card. Verify the drive designation and check the image size to make sure that it is correct. And Click Flash.

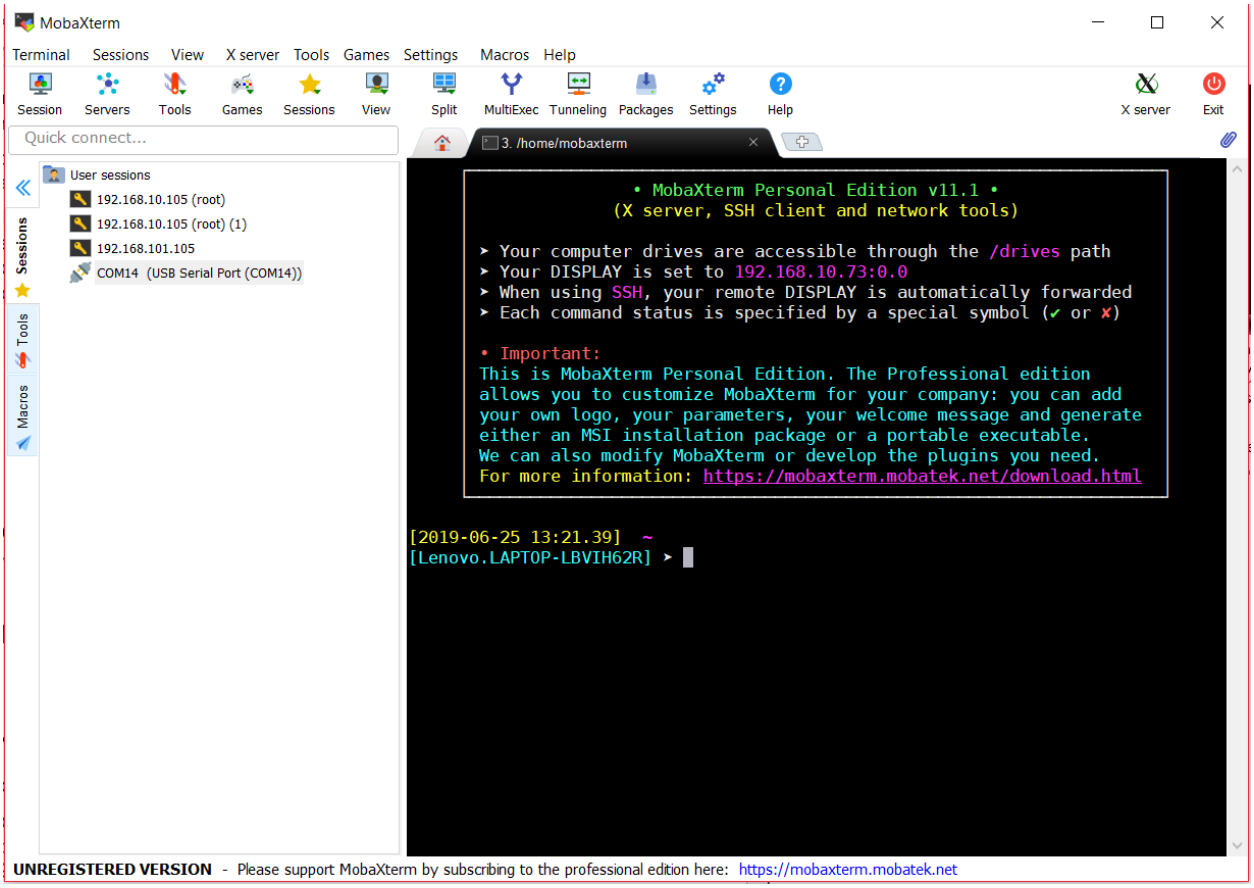


9. Now we are going to boot the Ultra96 board with this SDCard.
10. Insert the SDCard into board and connect the UART interface to the host PC and other peripherals as required.
11. Turn on the power, and wait for the system to boot.
12. Configure the UART with following settings:
    - baud rate: 115200 bps
    - data bit: 8
    - stop bit:1
    - no parity
13. Wait for the system to boot. You will see the system booting in the UART terminal. For UART connection we are using MobaXterm software.
14. The login credentials are
    - username: root
    - password: root
15. You can also access the board as Standalone by connecting keyboard, mouse and monitor. After booting, a Linux GUI desktop is displayed.

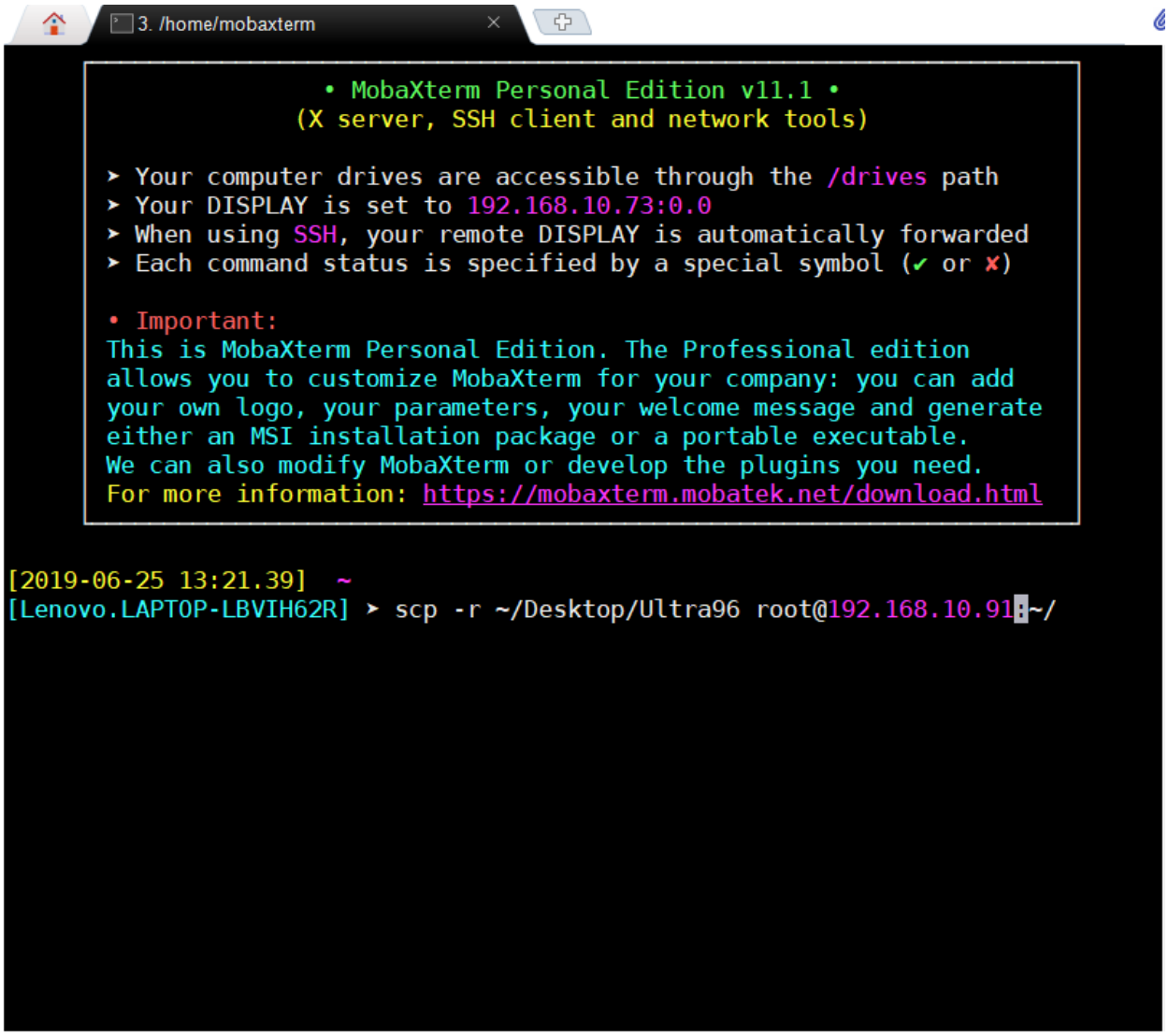


Now you have to copy the DNNDK package [Copy Ultra96 folder from **xilinx_dnndk_v2.08** or **xlnx_dnndk_v3.0_190531.tar.gz**] from the host machine to the evaluation board. You can do this through Ethernet connection or Wifi and using MobaXterm for transfer.

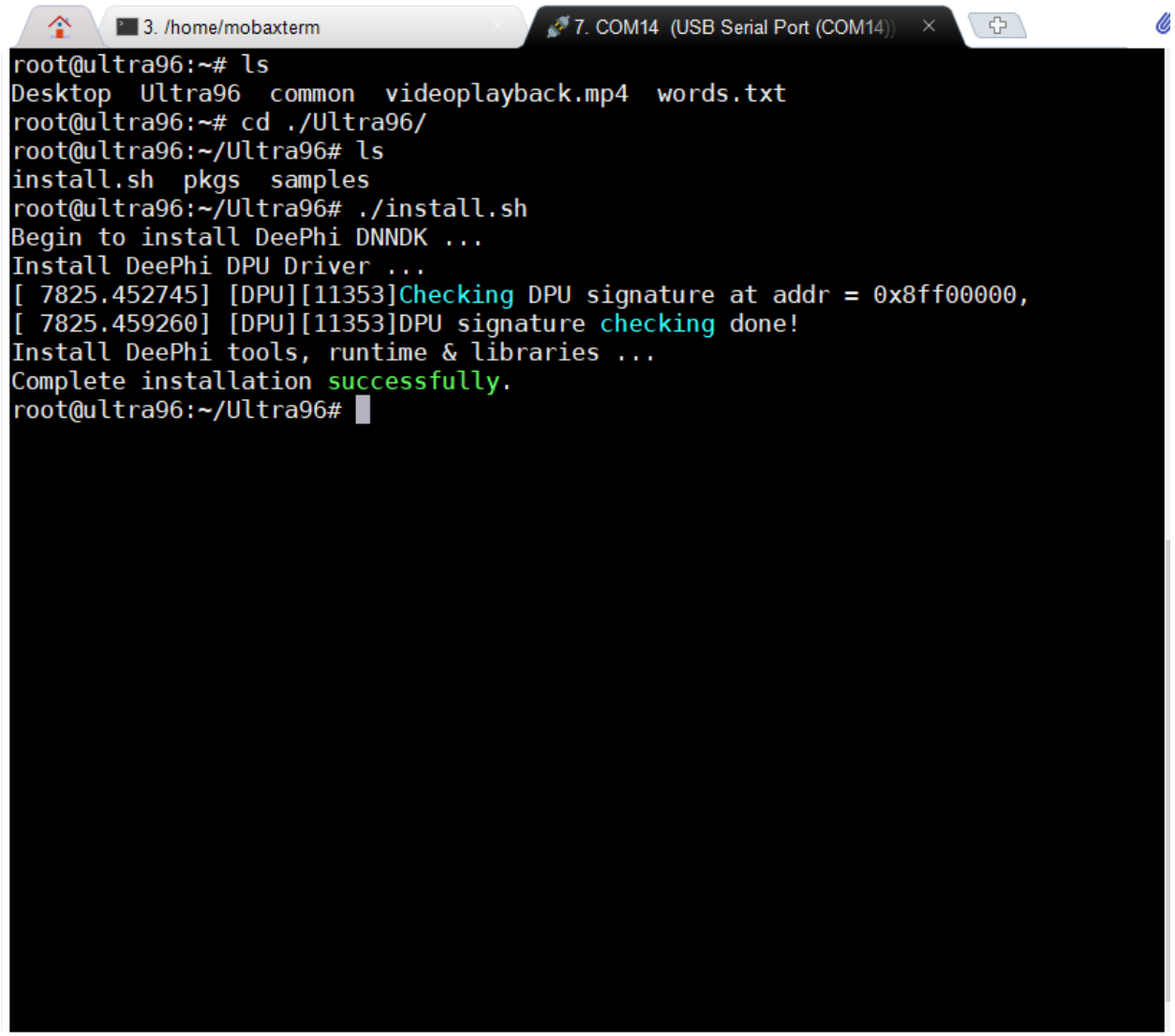
16. In our case we used Wifi connection where out host PC was also connected. (How to connect Wifi is shown at the end)
17. After the board has been connected to the same network, open MobaXterm and Click Start local terminal to open a terminal where the filesystem of Windows can be accessed.



18. Extract the DNNDK v2.08 package on the host PC. To transfer you use the following method: For example, suppose that the DNNDK package is located under the root directory of disk D. In this case, use the following commands to extract and copy the package for the Ultra96 board with IP address 192.168.10.91



19. On the Ultra96 board, change to the ~/Ultra96/ directory and run install.sh



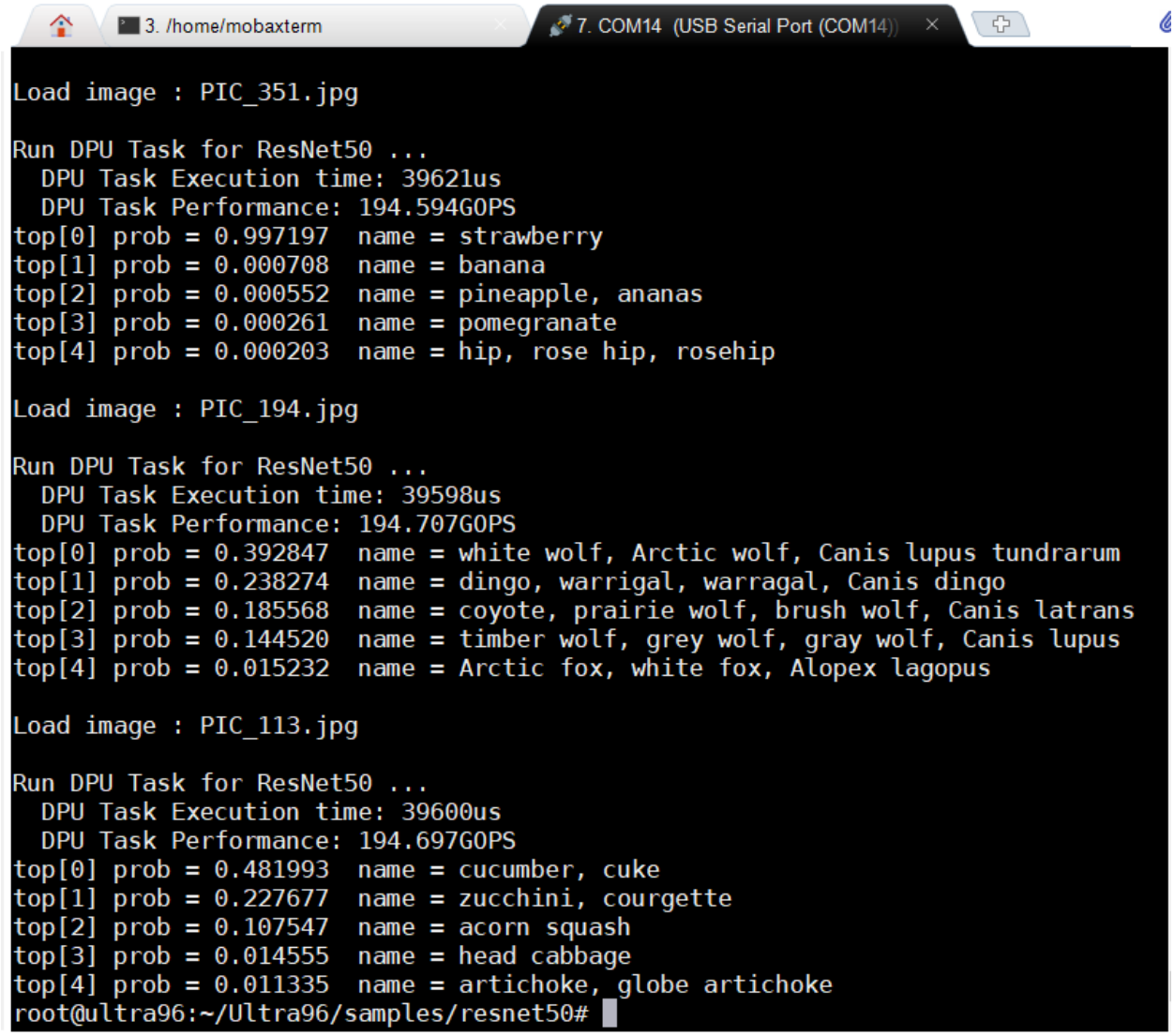
20. Also transfer the common folder inside the DNNDK zip to the board in the same way. Then copy the common folder inside the ~/Ultra96/samples folder. This common folder contains sample images.
21. We can now test the example applications inside the Ultra96 folder. Following example applications are present:
    - adas_detection
    - inception_v1
    - mobilenet_mt
    - resnet50_mt
    - inception_v1_mt
    - pose_detection
    - segmentation
    - face_detection
    - mobilenet
    - resnet50

- video_analysis

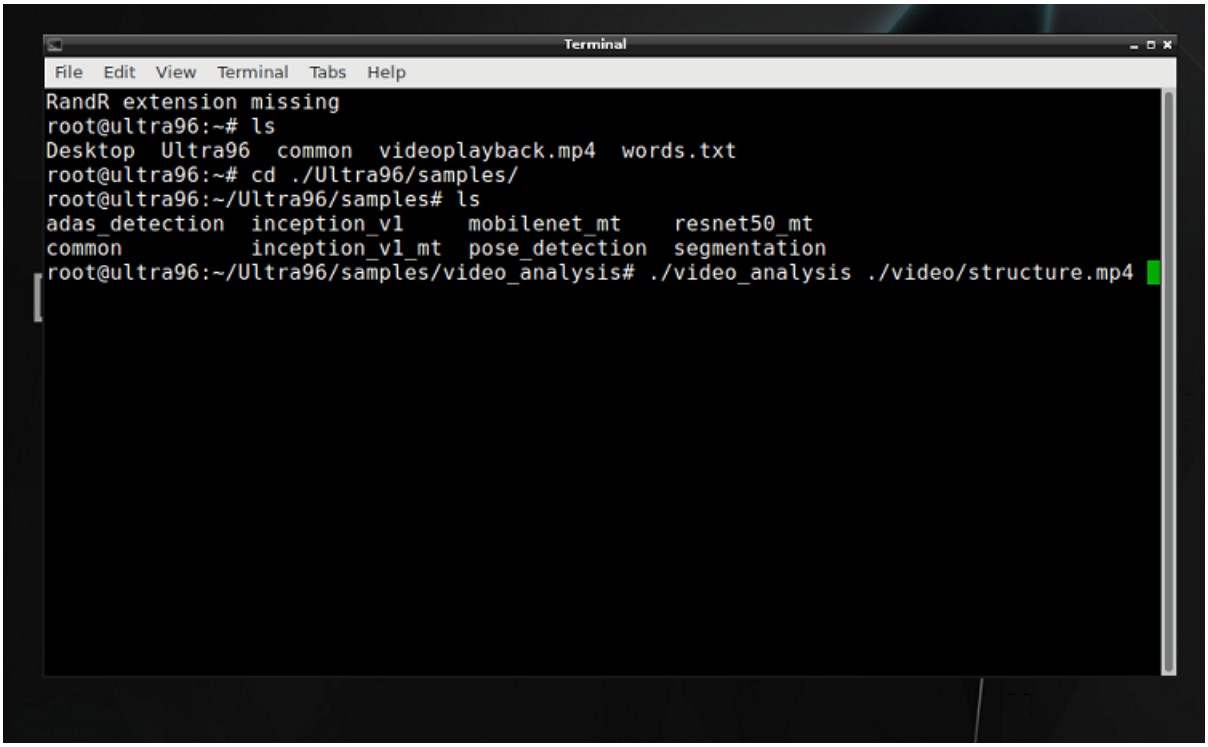
22. First we need to compile them. To compile goto each example folder and run 'make' command.
23. Lets goto resnet50 folder and run make command.

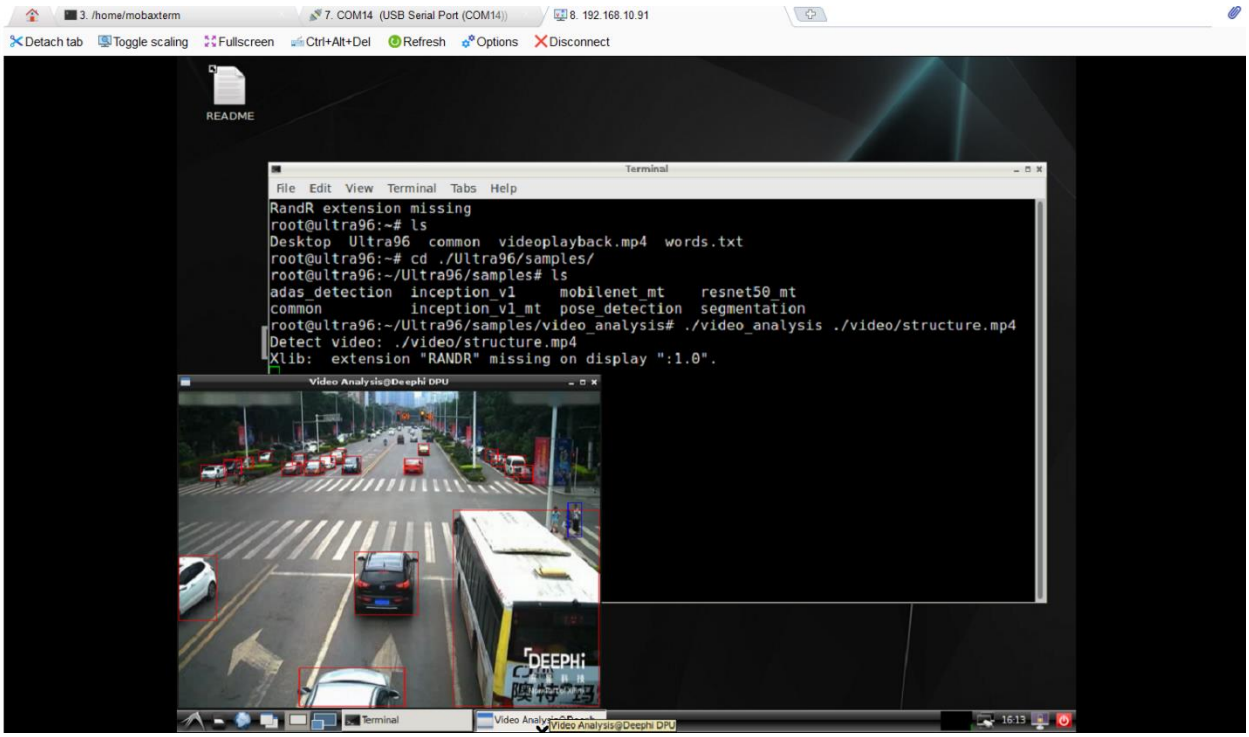
```
root@ultra96:~# ls
Desktop  Ultra96  common  videoplayback.mp4  words.txt
root@ultra96:~# cd ./Ultra96/
root@ultra96:~/Ultra96# ls
install.sh  pkgs  samples
root@ultra96:~/Ultra96# ./install.sh
Begin to install DeePhi DNNDK ...
Install DeePhi DPU Driver ...
[ 7825.452745] [DPU][11353]Checking DPU signature at addr = 0x8ff00000,
[ 7825.459260] [DPU][11353]DPU signature checking done!
Install DeePhi tools, runtime & libraries ...
Complete installation successfully.
root@ultra96:~/Ultra96# ls
install.sh  pkgs  samples
root@ultra96:~/Ultra96# cd ./samples/
root@ultra96:~/Ultra96/samples# ls
adas_detection  inception_v1     mobilenet_mt    resnet50_mt
common          inception_v1_mt  pose_detection  segmentation
face_detection  mobilenet        resnet50        video_analysis
root@ultra96:~/Ultra96/samples# cd ./resnet50
root@ultra96:~/Ultra96/samples/resnet50# ls
Makefile  build  model  resnet50  src
root@ultra96:~/Ultra96/samples/resnet50# make
g++ -c -O2 -Wall -Wpointer-arith -std=c++11 -ffast-math -mcpu=cortex-a53 /root/U
ltra96/samples/resnet50/src/main.cc -o /root/Ultra96/samples/resnet50/build/main
.o
g++ -O2 -Wall -Wpointer-arith -std=c++11 -ffast-math -mcpu=cortex-a53 /root/Ultr
a96/samples/resnet50/build/main.o /root/Ultra96/samples/resnet50/model/dpu_resne
t50_0.elf -o resnet50 -L/usr/local/lib -lopencv_highgui -lopencv_shape -lopencv_
video -lopencv_videoio -lopencv_imgcodecs -lopencv_imgproc -lopencv_core -lhineo
n -ln2cube -ldputils
root@ultra96:~/Ultra96/samples/resnet50#
```

24. Now enter following commands to set the display
    export DISPLAY=:0.0
    xrandr --output DP-1 --mode 800x600
    xset -dpms
25. Run ./resnet50 to test.
26. After completion you will see following screen:



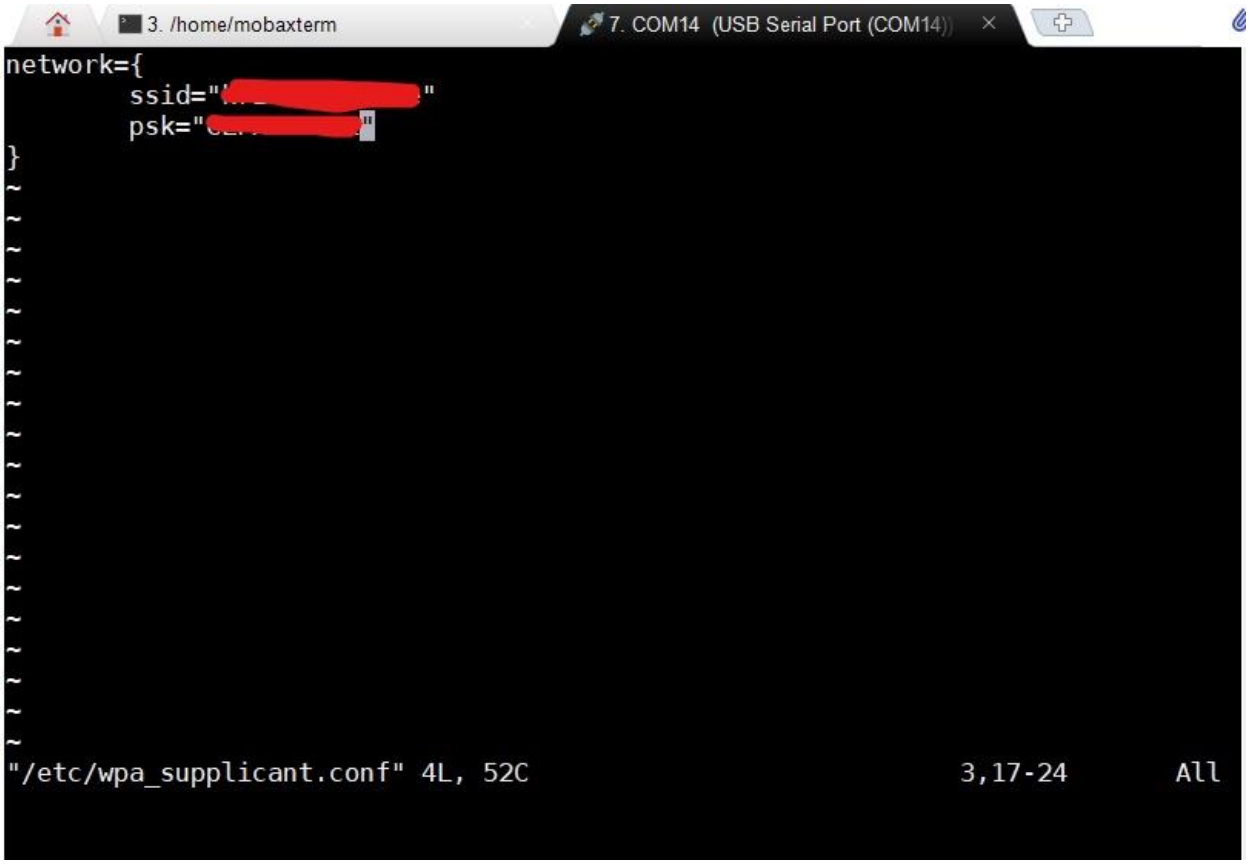
27. Simlarly you can also run application like video_analysis, adas_detection. For these we require GUI to see its execution.
28. We have setup VNC viewer for that purpose. Setting up VNC viewer is shown at the end of this tutorial.
29. To run video_analysis app, change the directory to ~/Ultra96/samples/video_analysis
30. Run 'make' command
31. Then run command
    ./video_analysis ./video/structure.mp4
32. You will see Video display with object detection.


Terminal
File Edit View Terminal Tabs Help
RandR extension missing
root@ultra96:~# ls
Desktop Ultra96 common videoplayback.mp4 words.txt
root@ultra96:~# cd ./Ultra96/samples/
root@ultra96:~/Ultra96/samples# ls
adas_detection inception_v1 mobilenet_mt resnet50_mt
common inception_v1_mt pose_detection segmentation
root@ultra96:~/Ultra96/samples/video_analysis# ./video_analysis ./video/structure.mp4


3. /home/mobaxterm
7. COM14 (USB Serial Port (COM14))
8. 192.168.10.91
Detach tab
Toggle scaling
Fullscreen
Ctrl+Alt+Del
Refresh
Options
Disconnect
README
Terminal
File Edit View Terminal Tabs Help
RandR extension missing
root@ultra96:~# ls
Desktop Ultra96 common videoplayback.mp4 words.txt
root@ultra96:~# cd ./Ultra96/samples/
root@ultra96:~/Ultra96/samples# ls
adas_detection inception_v1 mobilenet_mt resnet50_mt
common inception_v1_mt pose_detection segmentation
root@ultra96:~/Ultra96/samples/video_analysis# ./video_analysis ./video/structure.mp4
Detect video: ./video/structure.mp4
Xlib: extension "RANDR" missing on display ":1.0".
Video Analysis@Deephi DPU
DEEPHI
Terminal
Video Analysis@Deephi DPU
16:13

Setup Wifi in Ultra96 board through terminal

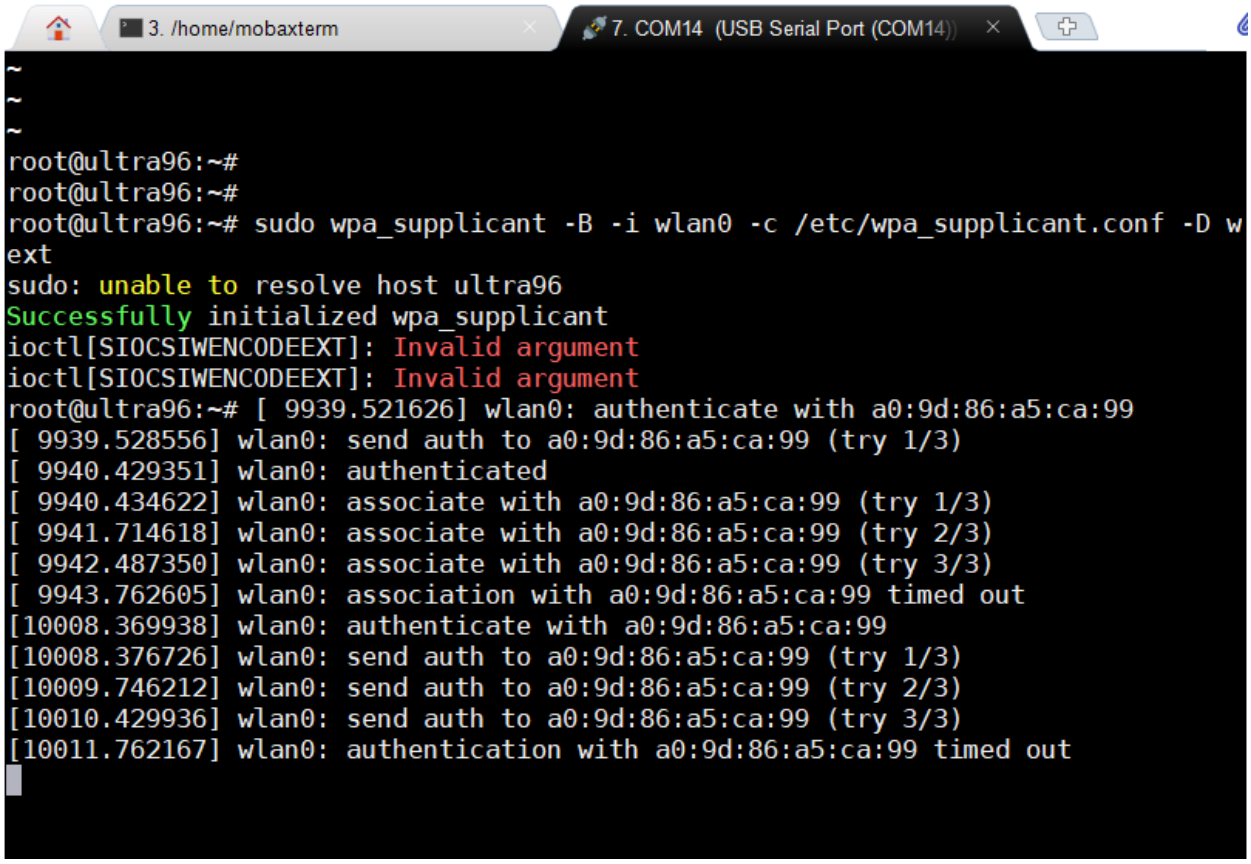
1. Create a file wpa_supplicant.conf file inside /etc.
   vi /etc/wpa_supplicant.conf
2. You put your SSID and password into /etc/wpa_supplicant.conf (requires sudo if not as root user)
   network={
   ssid= "ssid_name"
   psk= "password"
   }



3. Save the file and run following commands:

   sudo wpa_supplicant -B -i wlan0 -c /etc/wpa_supplicant.conf -D wext

   sudo dhclient wlan0



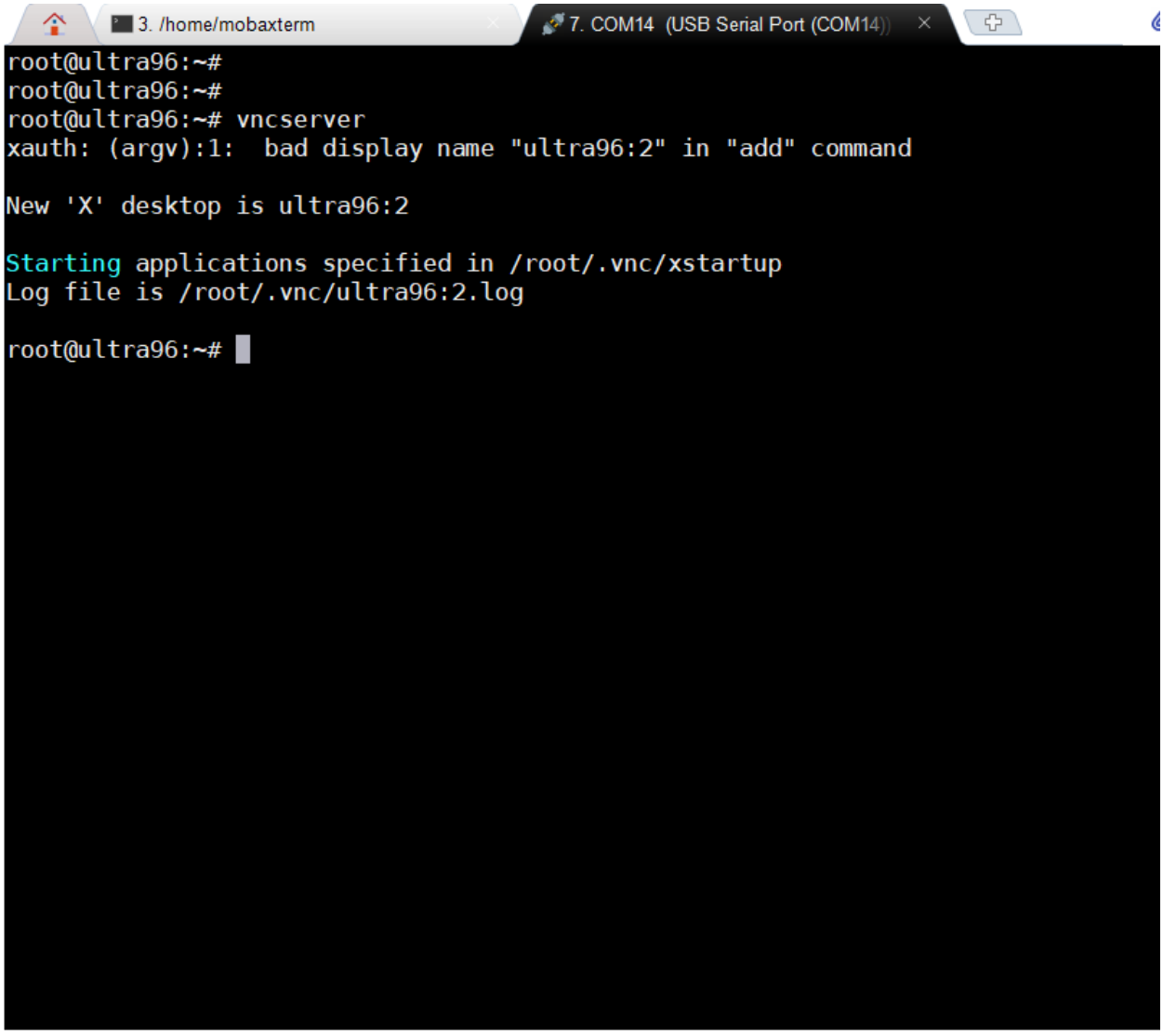
4. Wifi will be connected in few minutes.
5. Check IP by running command 'ifconfig'

Setup VNC Viewer in Ultra96 board

1. On the board execute the following commands. You will require internet connection to the board through Wifi or Ethernet before running these commands.
   apt-get update
   apt-get -y upgrade
   apt-get install xfce4 xfce4-goodies gnome-icon-theme tightvncserver xfonts-base

   Then start VNC Server with command:
   vncserver

   As it is your first time running the server, you will be asked to set a password that clients will use to connect. Keep this password in mind for later. You can also set a view-only password, which allow users to see the screen but not interact with it. Passwords should be 6-8 characters.



By default, VNC connections are served on ports starting at 5901 for the first display.

2. Now connect using a VNC Client. Here we use MobaXterm.
3. In MobaXterm choose New Session and Select VNC. Then Enter the board IP address. You can also use any other VNC Client software to connect.
4. Click Ok and you will be asked connection Password that you set before. Enter the Password and click ok.
5. You will then see the GUI Screen.

6. With this process you will not require a Monitor setup.

References:

1. UG1327, Xilinx
2. PG338
3. Hackster.io

Author: Abhidan Jung Thapa, FPGA Design Engineer, Digitronix Nepal