CSC 456/591
Tutorial of DE1-SoC

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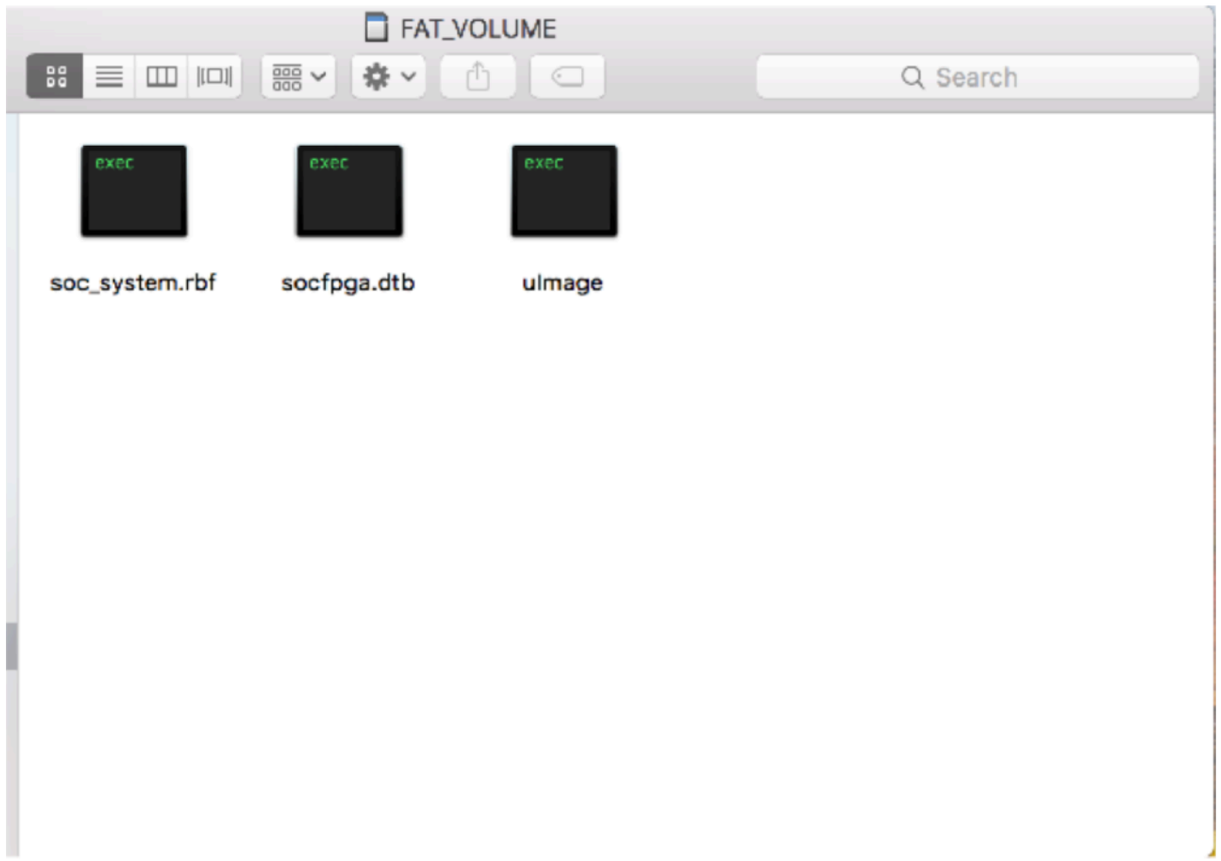
Outline

1. **Create MicroSD card image**
2. **Connect to DE1-SoC**
3. **Transfer files to De1-SoC**
4. **Using VCL**
5. **Demo**

NC STATE

Create SD card Image



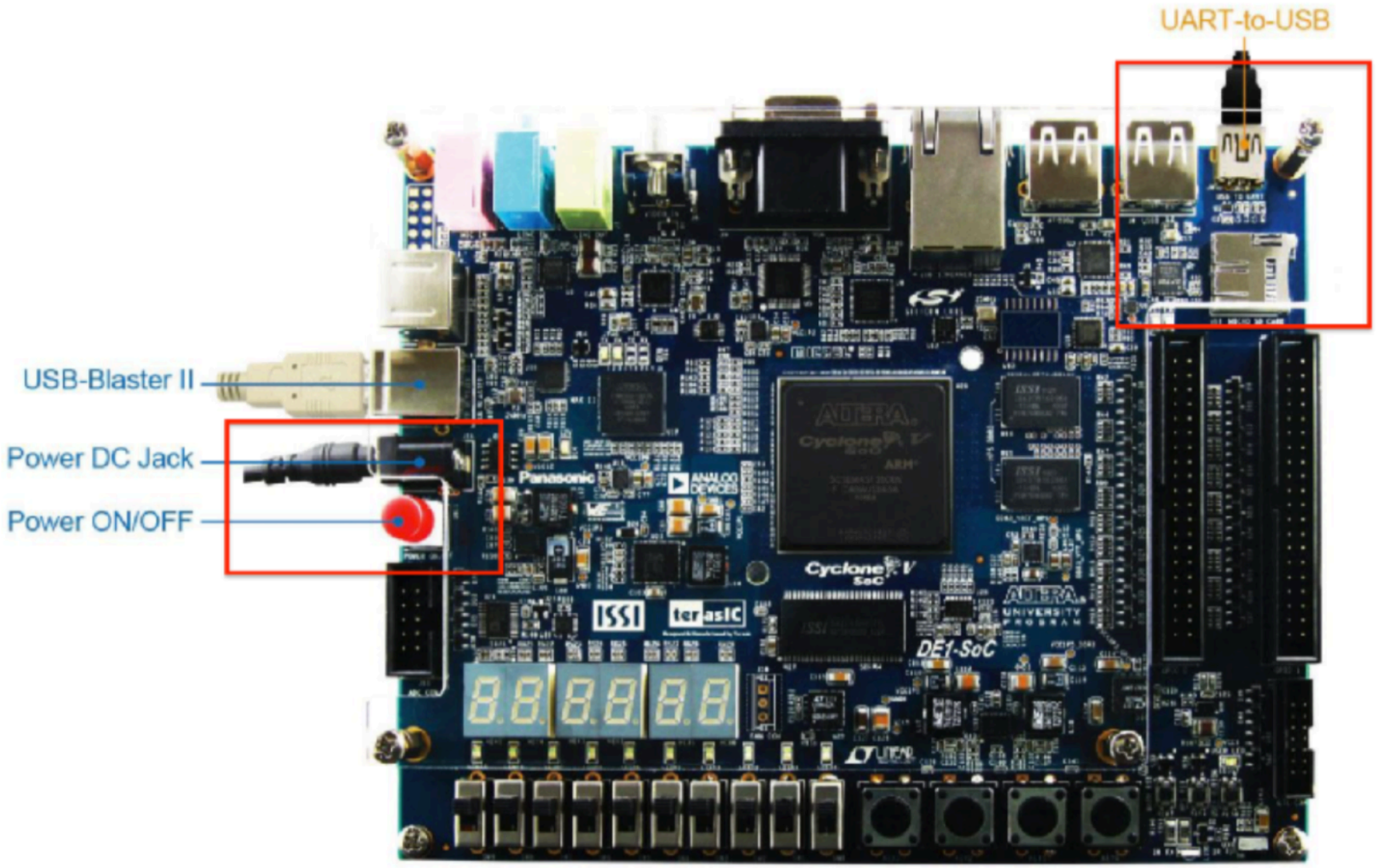
Download the Linux image from

https://drive.google.com/file/d/1zYaghec_3_7DdQODqQ3alNN_7tWnHuKz/view

Choose a tool to write the image to the SD card

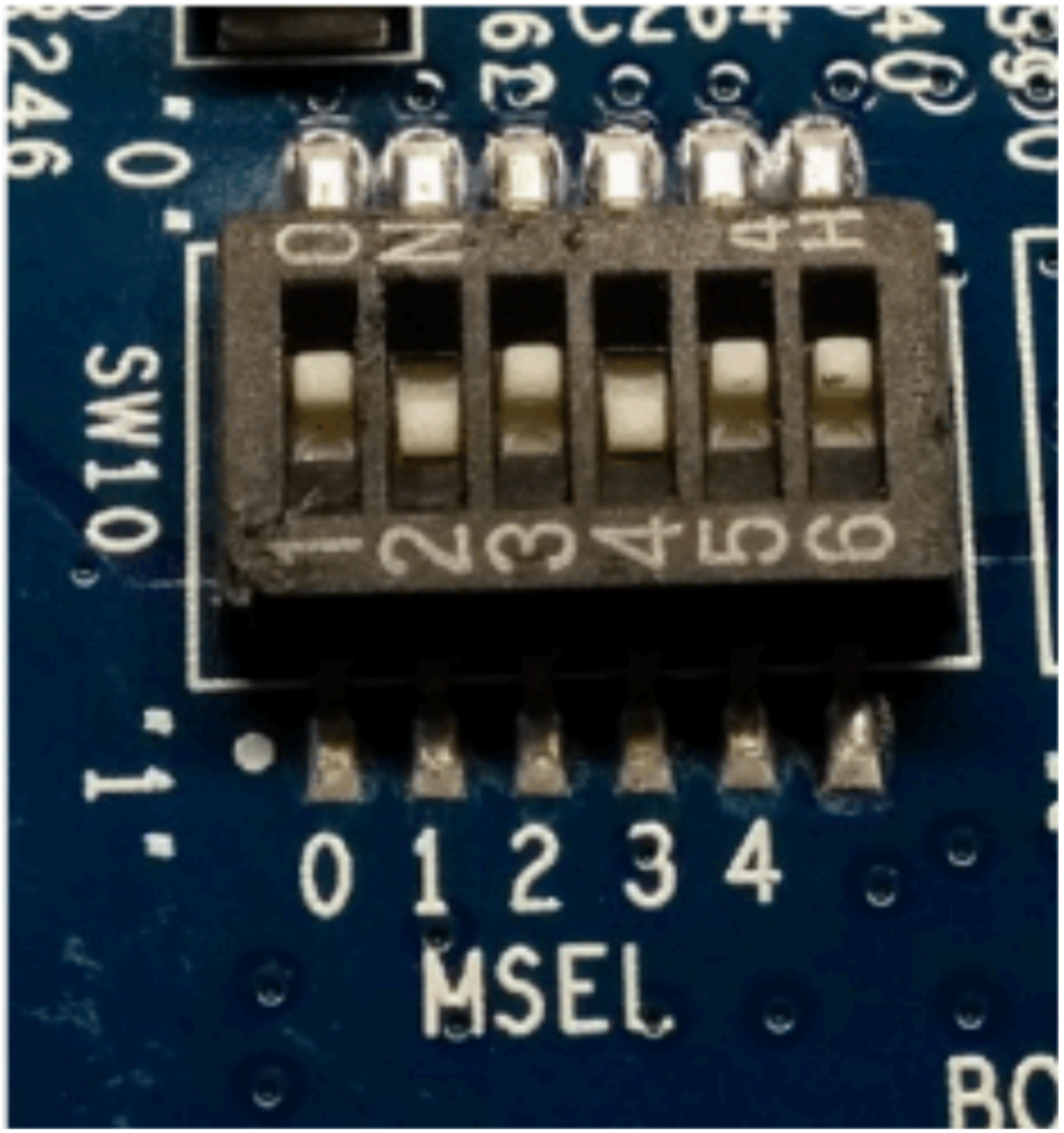
When the write finishes, you should see these three files in the SD card

Connect to DE1-SoC



Plug in the power jack
Plug in the USB port
Put sd card in the slot

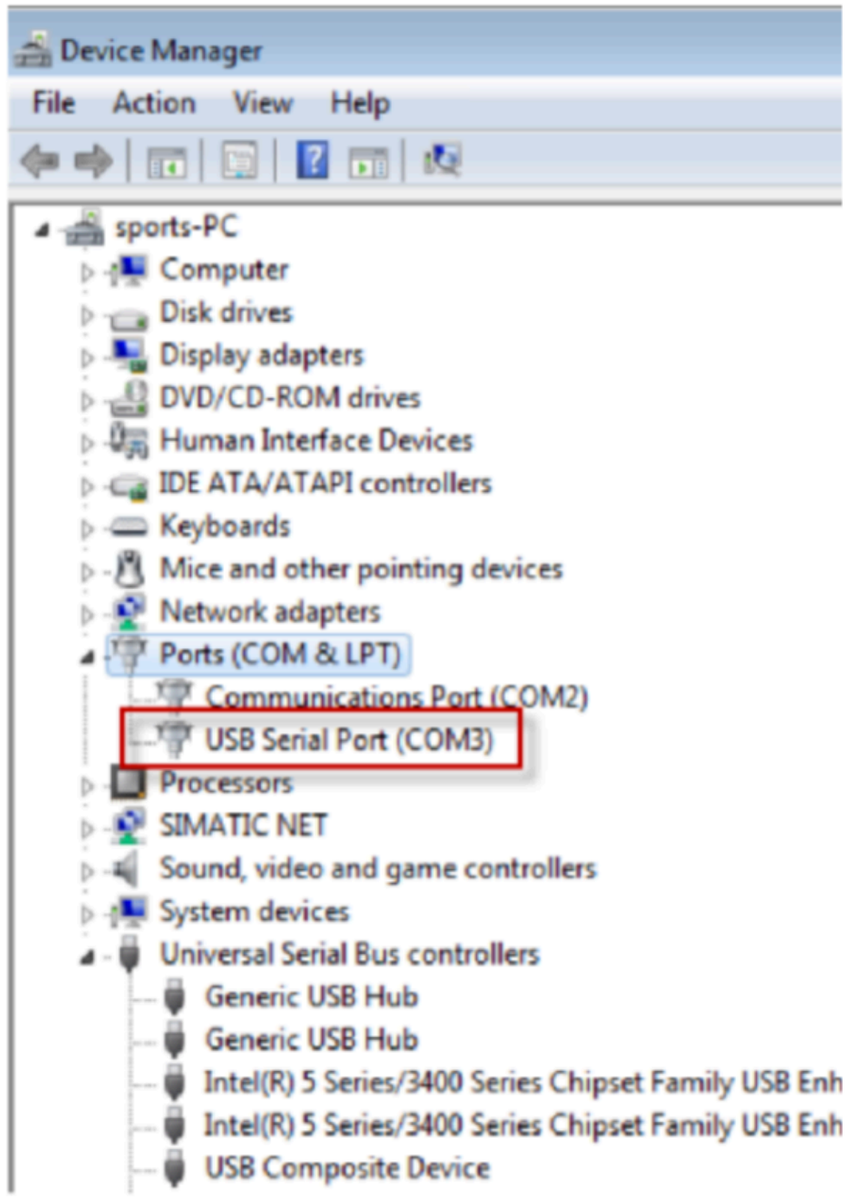
Connect to DE1-SoC

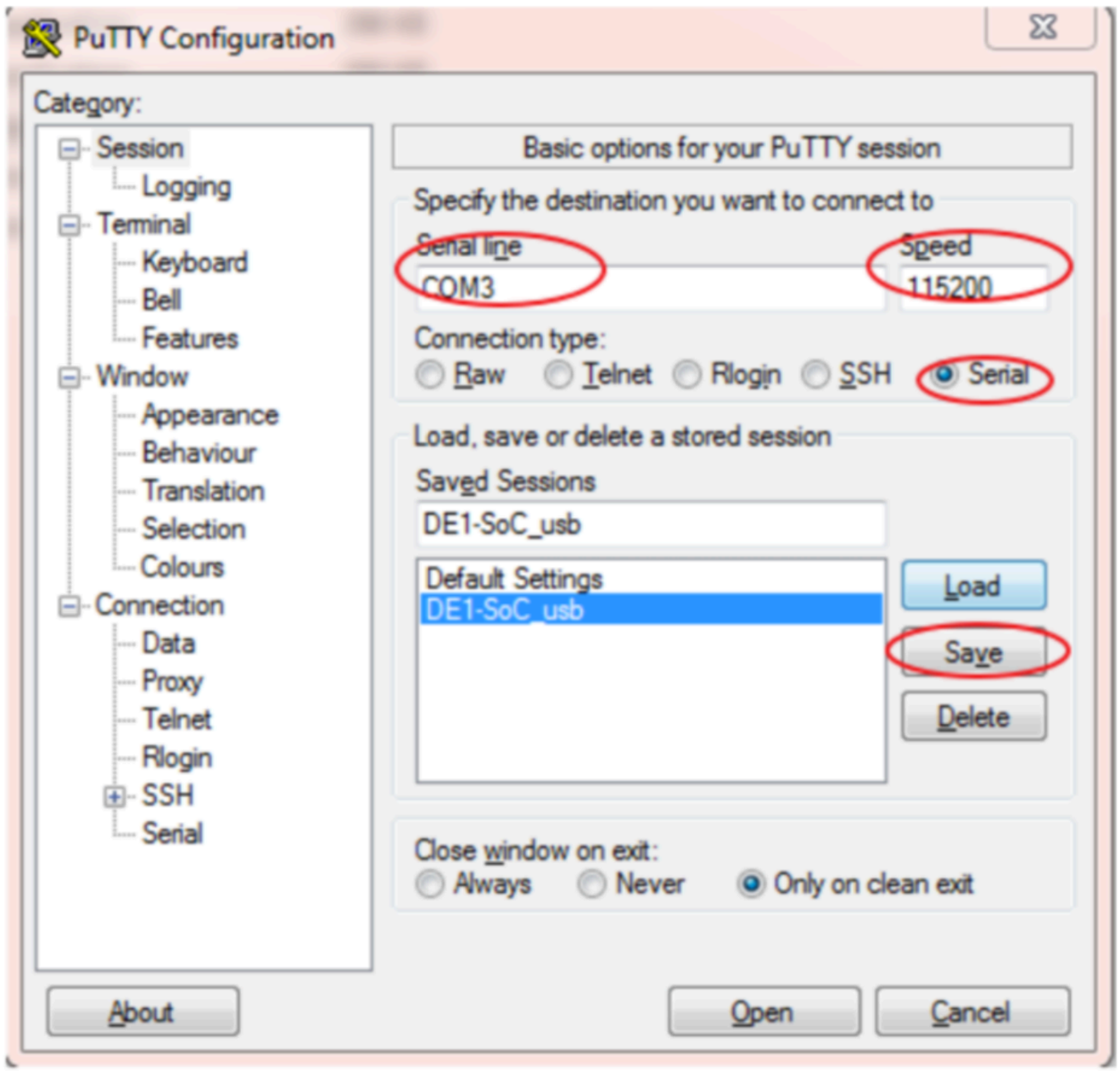


configure the MSEL switch at the back of the board before booting

only 2 and 4 are turned to 1

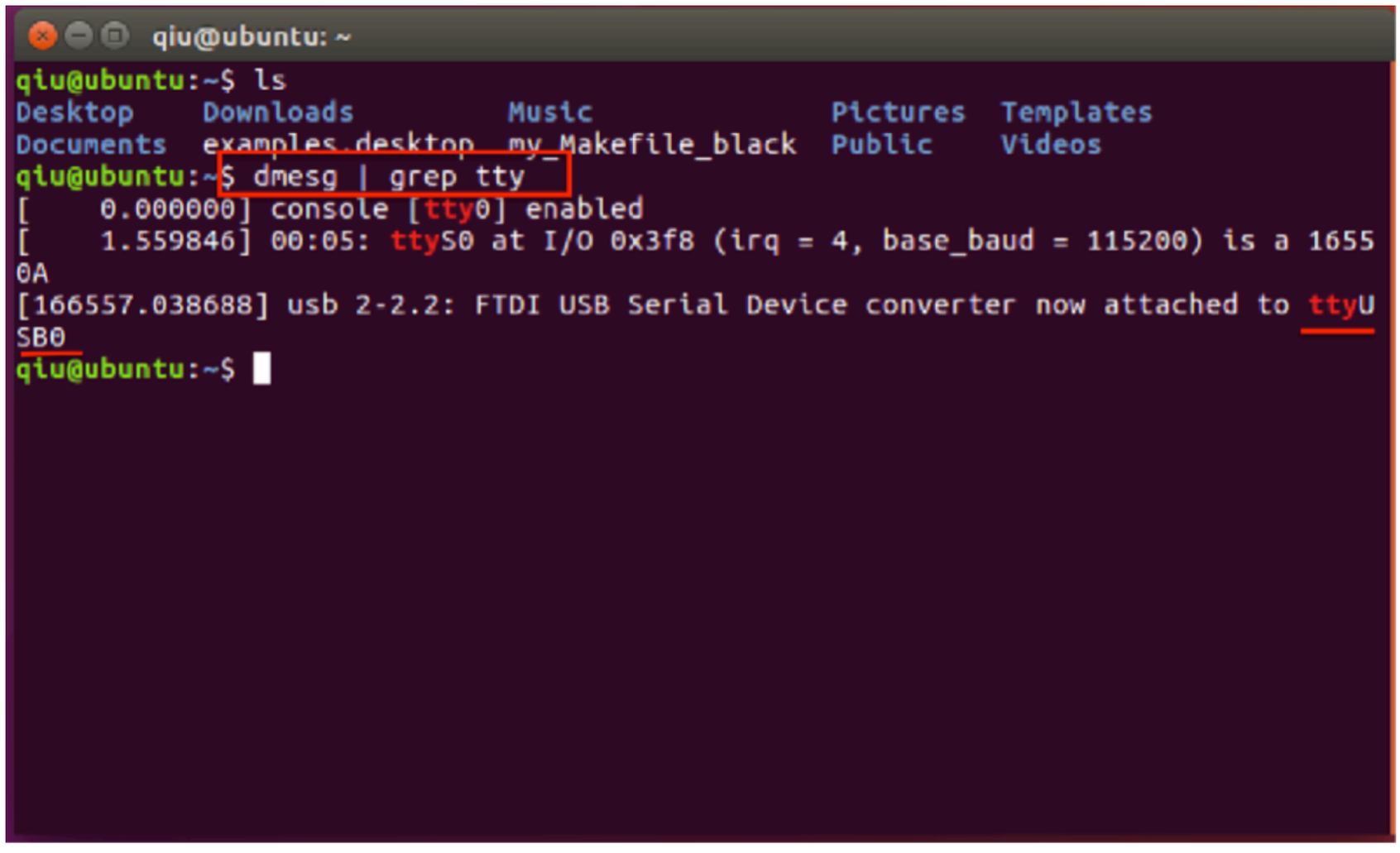
Connect to DE1-SoC in Windows





NC STATE

Connect to DE1-SoC in Linux



If you are using mac, you can create a linux vm.

Get the divice ID

use command:

dmesg | grep tty

The device ID in the figure is ttyUSB0

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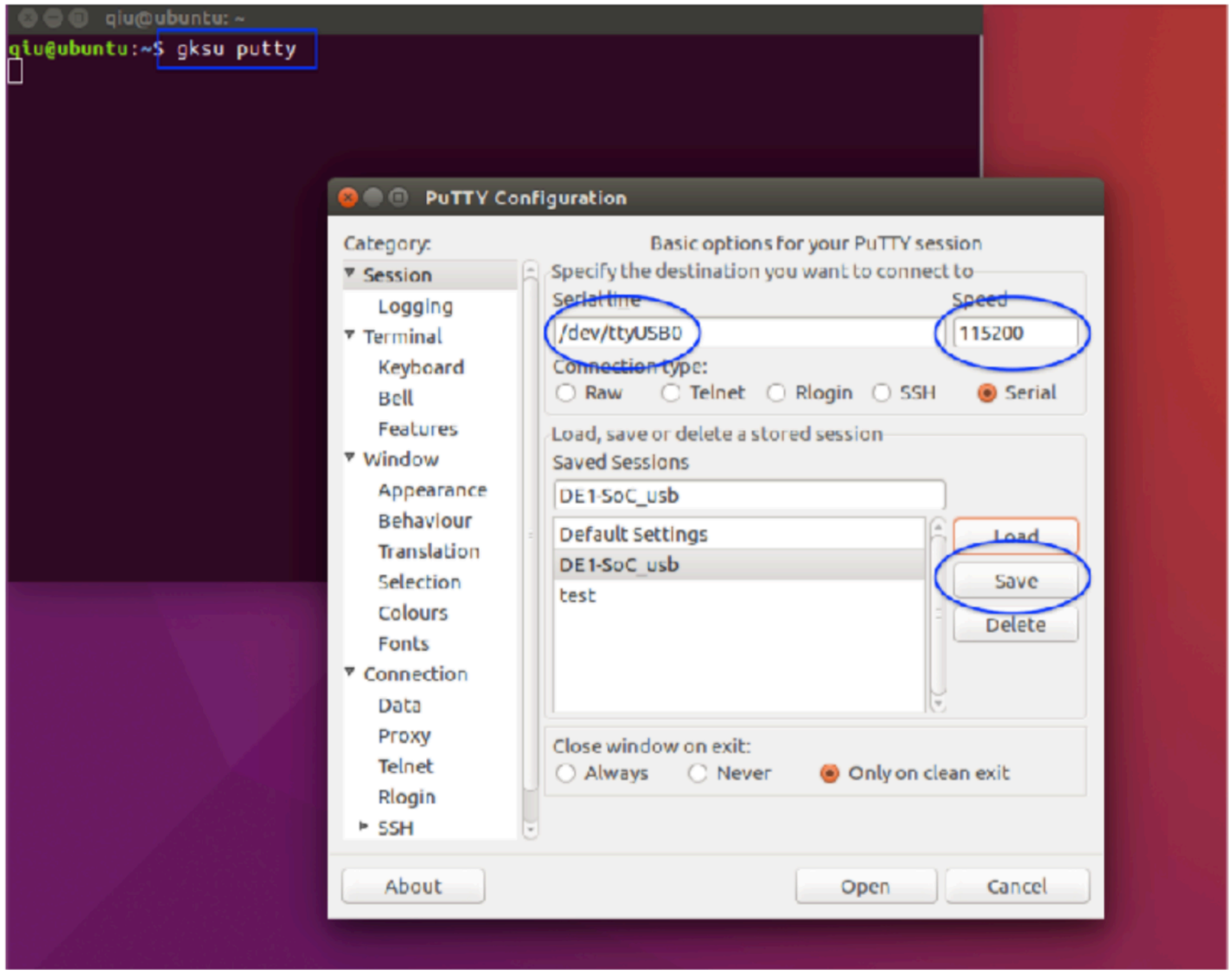
Connect to DE1-SoC in Linux



Connect to board

use command:

putty (might need sudo)

NC STATE

Connect to DE1-SoC

When boot successfully, you will see this window

Transfer files to DE1-SoC using SD card

You can drag your file to the SD card directly.

After put SD card in the slot on the board and correctly boot the board, the files can be accessed in /media/fat_partition directory.

use command:

cd /media/fat_partition

and copy files to your desired position

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Transfer files to DE1-SoC using SSH

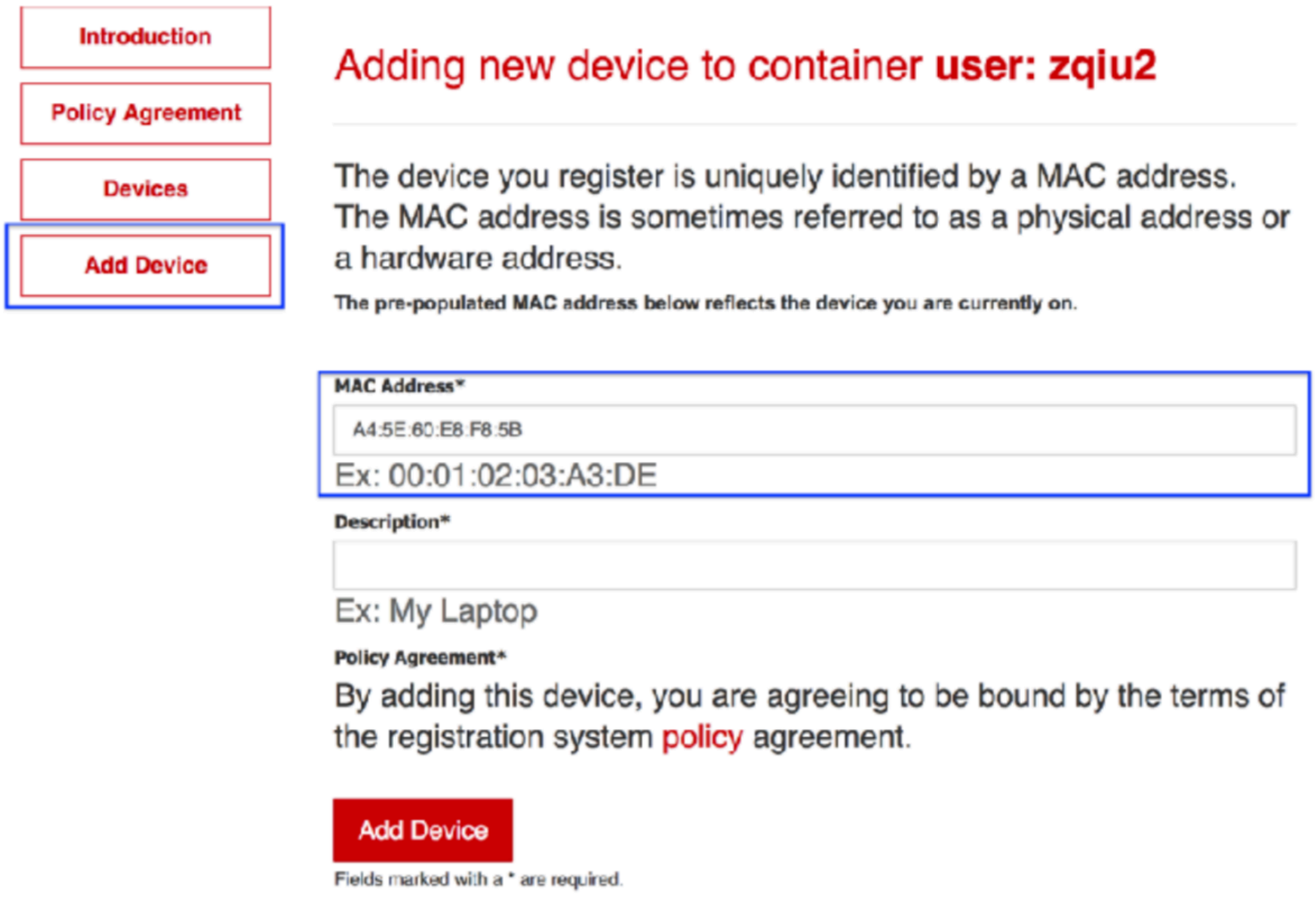
/dev/ttyUSB0 - PuTTY

```
          inet6 addr: fe80::1034:56ff:fe78:9012/64 Scope:Link
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:23 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:4385 (4.3 KB)
          Interrupt:152

eth0:1    Link encap:Ethernet  HWaddr 12:34:56:78:90:12
          inet addr:192.168.1.123  Bcast:192.168.1.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          Interrupt:152

eth0:2    Link encap:Ethernet  HWaddr 12:34:56:78:90:12
          inet addr:192.168.0.123  Bcast:192.168.0.255  Mask:255.255.255.0
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          Interrupt:152

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:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

wlan0     Link encap:Ethernet  HWaddr 74:da:38:d5:f4:cf
          UP 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@de1soclinux:~/misc#
```

type command:
ifconfig

NC STATE

Transfer files to DE1-SoC using SSH



https://nomad.ncsu.edu/nmr/dynamic/device_add.py

NC STATE

Transfer files to DE1-SoC using SSH

```
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:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:360 (360.0 B)  TX bytes:360 (360.0 B)

wlan0     Link encap:Ethernet  HWaddr 74:da:38:d5:f4:cf
          inet addr:10.139.70.5  Bcast:10.139.71.255  Mask:255.255.248.0
          inet6 addr: fe80::76da:38ff:fed5:f4cf/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:15060 errors:0 dropped:0 overruns:0 frame:0
          TX packets:98 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2915631 (2.9 MB)  TX bytes:20015 (20.0 KB)

root@de1soclinux:~/misc#
```

Make sure connect to the network ncsu

type command

cd misc

./connect_wap <ssid> <password> if you are at home

./connect_ncsu if you are at school

NC STATE

Transfer files to DE1-SoC using SSH

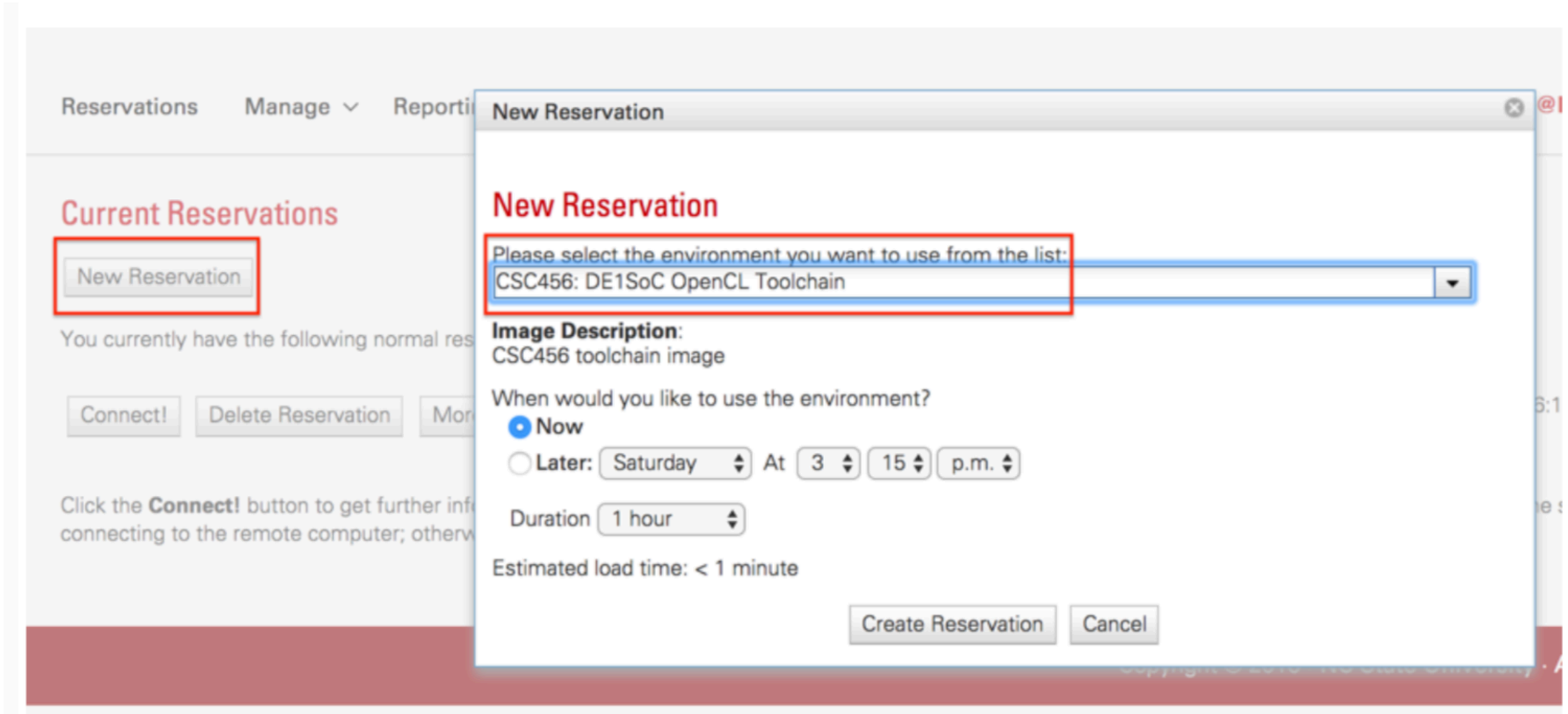
```
qiu@ubuntu: ~
qiu@ubuntu:~$ ssh root@10.139.70.5
root@10.139.70.5's password:
Last login: Wed Jan 24 16:01:19 2018 from zhengyidemacbook-pro.local
root@de1soclinux:~# ls
DE1_SoC_Computer.rbf  Music              increment_leds  opencl_arm32_rte
Desktop               OpenCL_Examples    init_opencl.sh  pushbutton_irq_handler
Documents             address_map_arm.h  interrupt_ID.h
Downloads             helloworld         misc
root@de1soclinux:~#
```

The password to log in is: password

scp /path/to/file root@host: /path/to/destination

NC STATE

Using VCL



Go the VCL website and choose the image for CSC456

NC STATE

Using VCL

Zhengyi — zqiu2@bn20-102: /opt/altera/aocl-sdk — ssh zqiu2@152.46.20.102...

```
groups: cannot find name for group ID 1097555332
zqiu2@bn20-102:~$ ls
examples.desktop
zqiu2@bn20-102:~$ cd /opt
zqiu2@bn20-102:/opt$ ls
altera  X11rdp
zqiu2@bn20-102:/opt$ cd altera/
zqiu2@bn20-102:/opt/altera$ ls
14.0  aocl-sdk
zqiu2@bn20-102:/opt/altera$ cd aocl-sdk/
zqiu2@bn20-102:/opt/altera/aocl-sdk$ ls
bin    doc   init_opencl.sh  LICENSE.txt  MANIFEST.txt  share
board  host  ip              linux64      README.txt
zqiu2@bn20-102:/opt/altera/aocl-sdk$ source init_opencl.sh
AOCL_BOARD_PACKAGE_ROOT path is not set in environment.
Setting to default s5_ref board.
If you want to target another board, do
   export AOCL_BOARD_PACKAGE_ROOT=<board_pkg_dir>
and re-run this script
Adding /opt/altera/aocl-sdk/bin to PATH
Adding /opt/altera/aocl-sdk/host/linux64/lib to LD_LIBRARY_PATH
Adding /opt/altera/aocl-sdk/board/de1soc/linux64/lib to LD_LIBRARY_PATH
zqiu2@bn20-102:/opt/altera/aocl-sdk$
```

set up OpenCL environment variables

source init_opencl.sh
export LM_LICENSE_FILE=50002@escal02.escalab.org

NC STATE

Using VCL

```
[zqiu2@bn20-102:/opt/altera$ cd 14.0/                                          ]
[zqiu2@bn20-102:/opt/altera/14.0$ ls                                           ]
embedded  ip  licenses  logs  nios2eds  quartus  uninstall
[zqiu2@bn20-102:/opt/altera/14.0$ cd embedded/                                 ]
[zqiu2@bn20-102:/opt/altera/14.0/embedded$ ls                                  ]
ds-5             embedded_command_shell.sh  env.sh    host_tools  version.txt
ds-5_installer   embeddedsw                 examples  ip
[zqiu2@bn20-102:/opt/altera/14.0/embedded$ ./embedded_command_shell.sh         ]
-----------------------------------------------
Altera Embedded Command Shell

Version 14.0
-----------------------------------------------
groups: cannot find name for group ID 1097555332
zqiu2@bn20-102:/opt/altera/14.0/embedded$
```

use the embedded shell in the EDS

./embedded_command_shell.sh

NC STATE

Using VCL

The compilation takes about 30 mins to finish.

You can install screen on the vcl and run top command on one screen to prevent you from disconnecting due to being inactive.

sudo apt install screen

screen

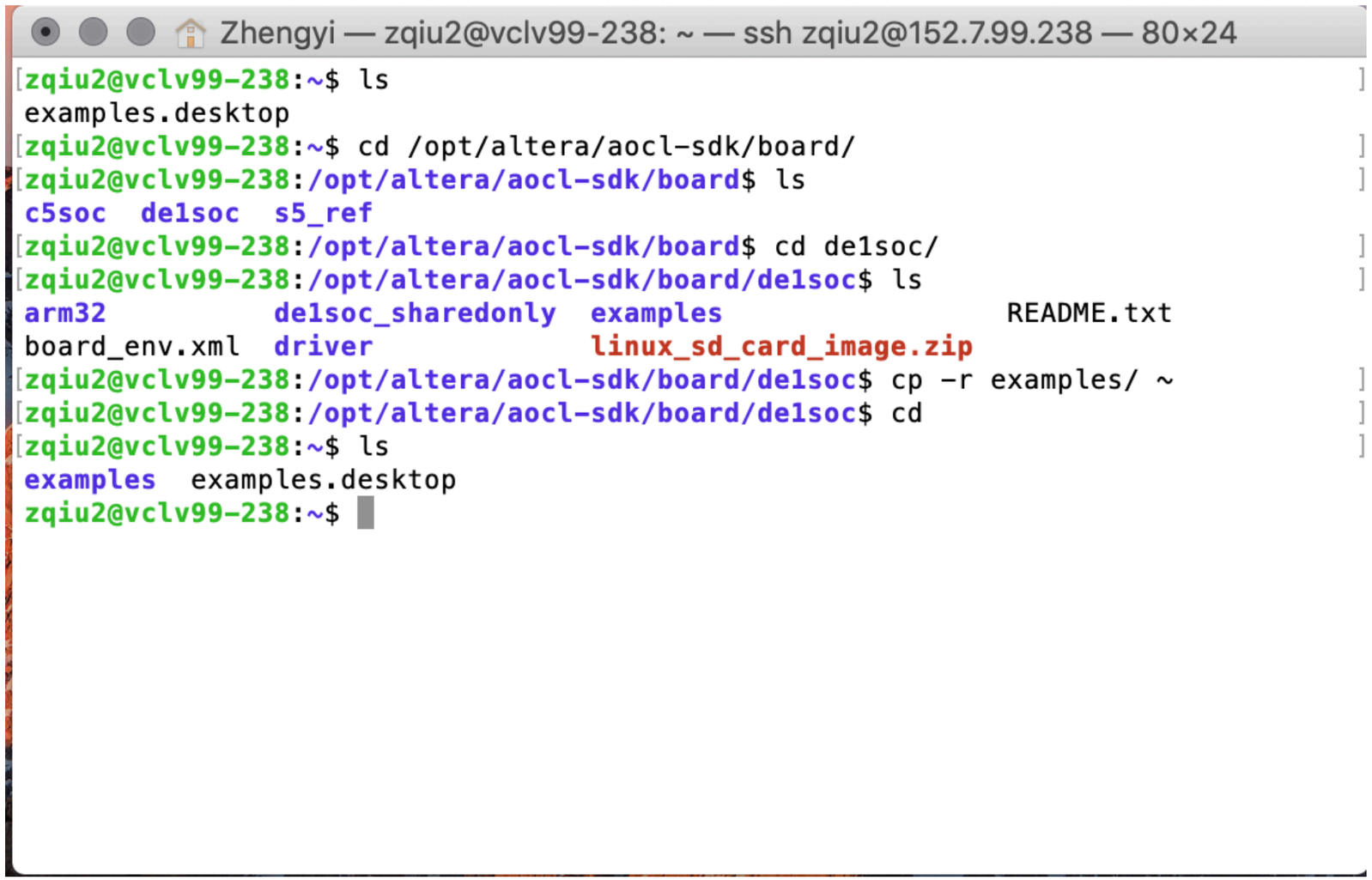
top

use Ctrl + a, Ctrl + d to detach from a screen

screen -r to re-attach to a screen

NC STATE

Demo



copy the example directory to home directory to run examples

cp -r /opt/altera/aocl-sdk/board/de1soc/examples ~

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Demo

```
[zqiu2@vclv99-238:~/examples/hello_world$ aoc device/hello_world.cl -o bin/hello_]
world.aocx --board de1soc_sharedonly
[zqiu2@vclv99-238:~/examples/hello_world$ make                                   ]
arm-linux-gnueabihf-g++  host/src/main.cpp ../common/src/AOCL_Utils.cpp -o hello
_world  -I/opt/altera/aocl-sdk/host/include  -I../common/inc -Ihost/inc -L/opt/a
ltera/aocl-sdk/board/de1soc/arm32/lib -L/opt/altera/aocl-sdk/host/arm32/lib -L/o
pt/altera/aocl-sdk/host/arm32/lib -lalteracl -ldl -lacl_emulator_kernel_rt  -lal
terahalmmd -lalterammdpcie -lelf -lrt -lstdc++
zqiu2@vclv99-238:~/examples/hello_world$
```

go to ~/examples directory

cd ~/examples

compile kernel code

aoc device/hello_world.cl -o bin/hello_world.aocx --board de1soc_sharedonly
The compiling takes about 30 mins to finish, make sure you are using screen before start compiling

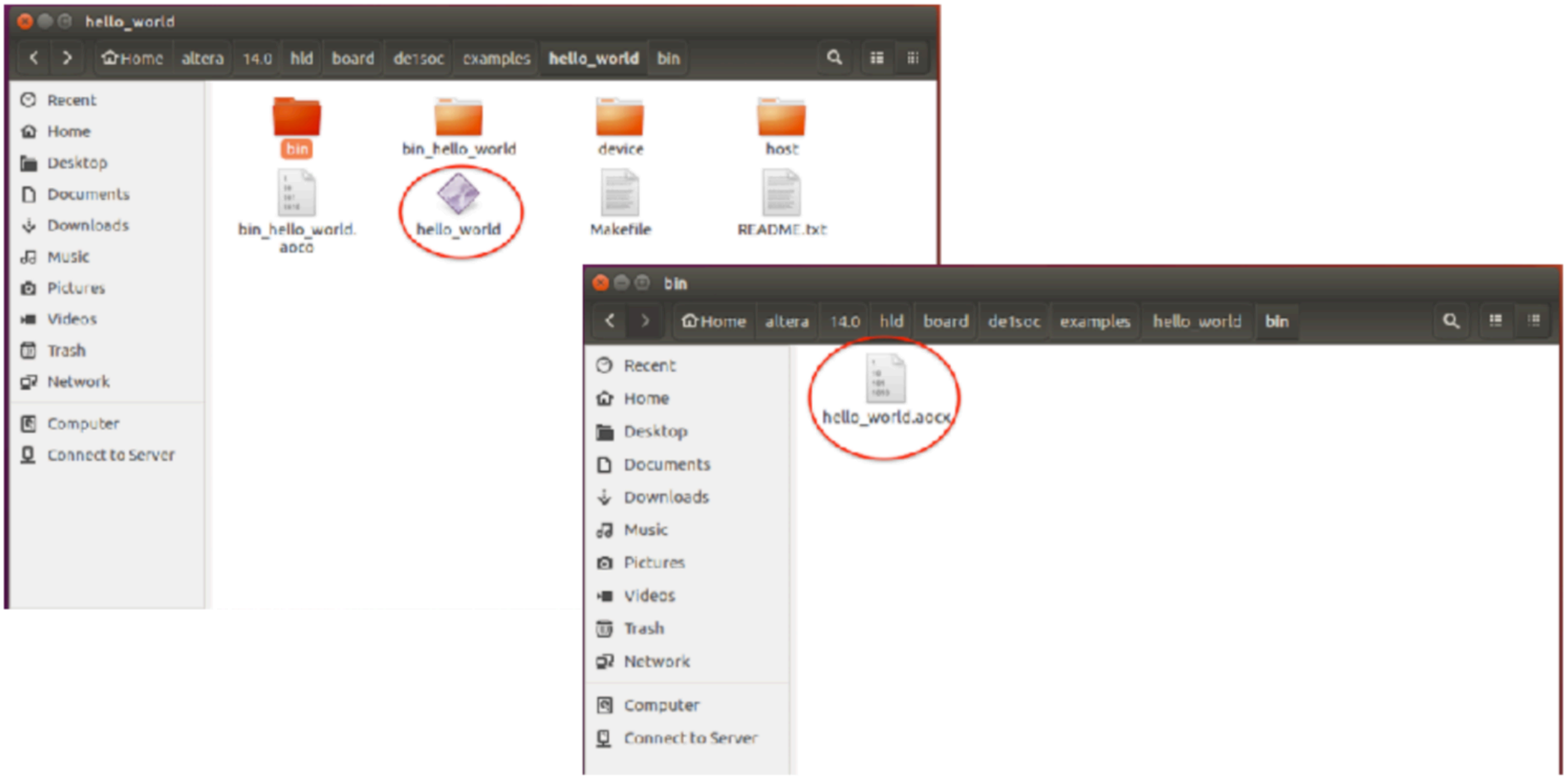
In the same directory

make to generate hello_world the executable file

use scp to download hello_world and hello_world.aocx to local

NC STATE

Demo



copy hello_world.aocx and executable hello_world to your board:

using the microSD card (/media/fat_partition) or SSH

(figure from my local toolchain, on VCL you will not see icons)

NC STATE

Demo - On De1-SoC

/dev/ttyUSB0 - PuTTY

```
root@de1soclinux:/media/fat_partition# ls
hello_world  hello_world.aocx  soc_system.rbf  socfpga.dtb  uImage
root@de1soclinux:/media/fat_partition# cd
root@de1soclinux:~# mkdir test
root@de1soclinux:~# pwd
/home/root
root@de1soclinux:~# cd /media/fat_partition/
root@de1soclinux:/media/fat_partition# cp hello_world /home/root/test/
root@de1soclinux:/media/fat_partition# cp hello_world.aocx /home/root/test/
root@de1soclinux:/media/fat_partition# cd
root@de1soclinux:~# cd test/
root@de1soclinux:~/test# cd
root@de1soclinux:~# ls
DE1_SoC_Computer.rbf  Music              helloworld      misc
Desktop               OpenCL_Examples    increment_leds  opencl_arm32_rte
Documents             address_map_arm.h  init_opencl.sh  pushbutton_irq_handler
Downloads             hello_world        interrupt_ID.h  test
root@de1soclinux:~# source init_opencl.sh
root@de1soclinux:~# cd test/
root@de1soclinux:~/test# aocl program /dev/acl0 hello_world.aocx
aocl program: Running reprogram from /home/root/opencl_arm32_rte/board/c5soc/arm
32/bin
Reprogramming was successful!
root@de1soclinux:~/test#
```

in root directory:

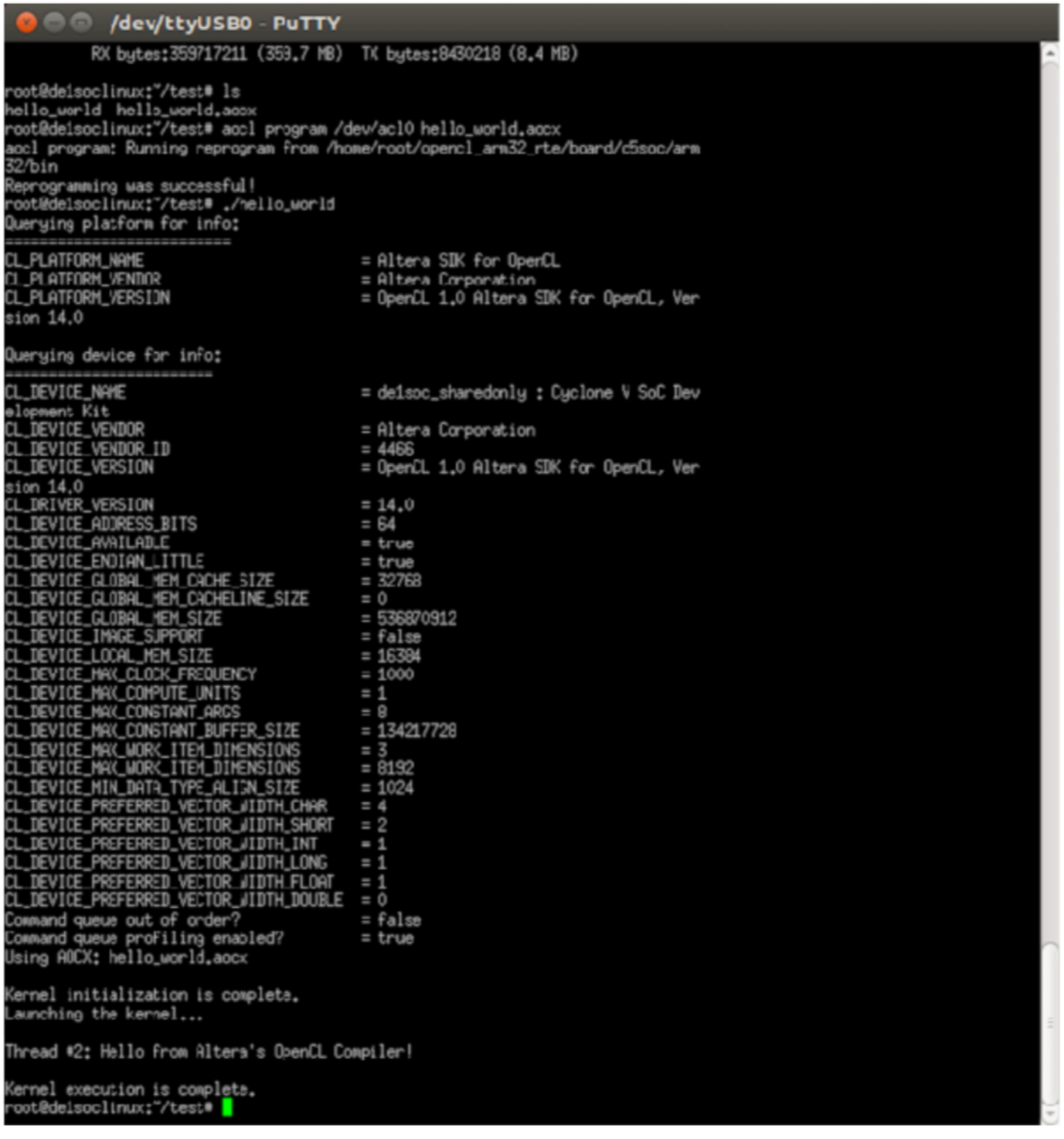
source init_opencl.sh

in program directory:

aocl program /dev/acl0 hello_world.aocx

NC STATE

Demo - On De1-SoC



Invoke the host program:

./hello_world

NC STATE