

UEFI & EDK II Training

Platform Build Lab – Linux – UP Squared

tianocore.org

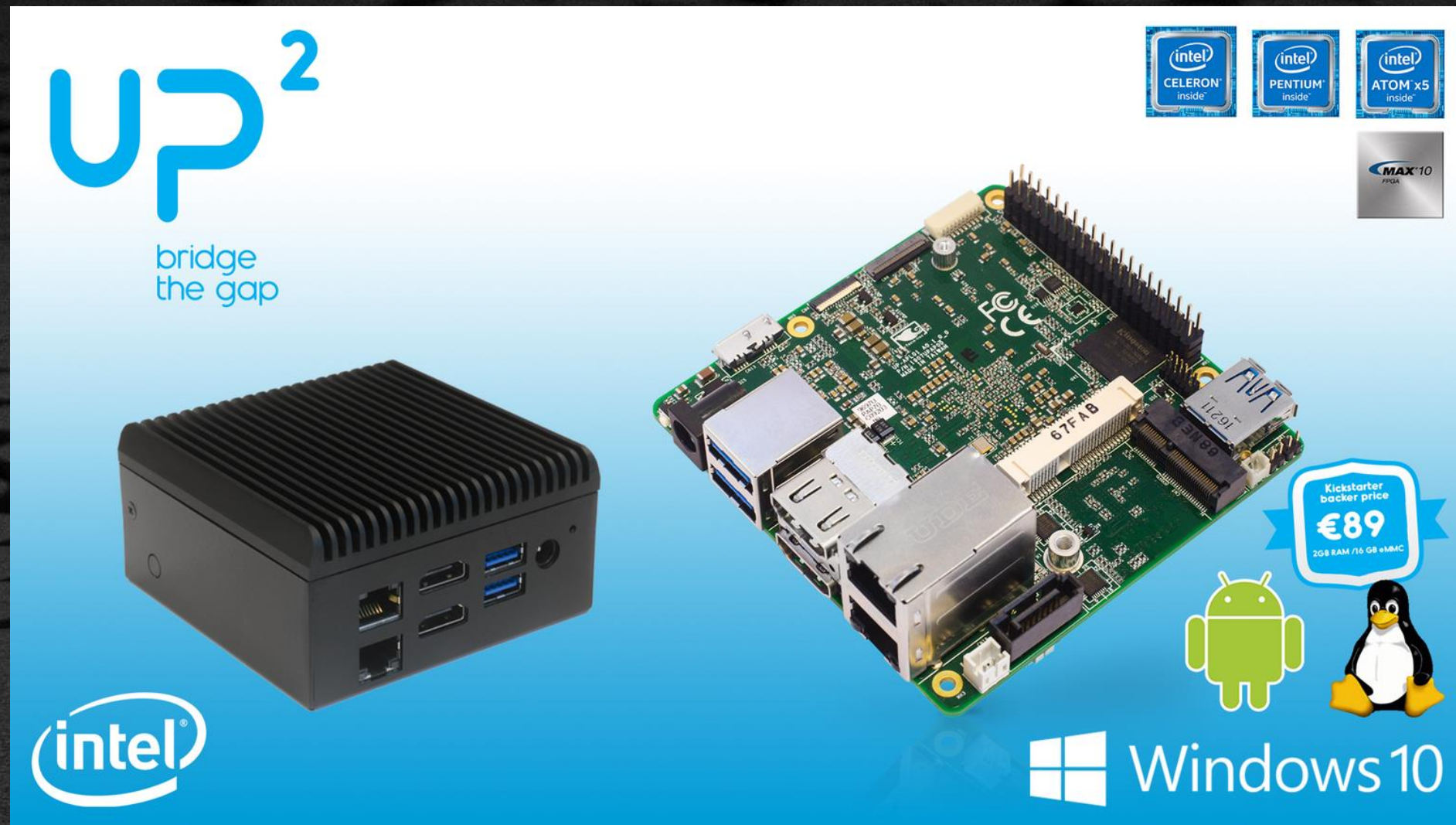
PLATFORM BUILD LABS

- ✿ Hardware Setup for UP Squared
- ✿ Build a EDK II Platform using Broxton – UP Squared

PLATFORM HW SETUP

Setup hardware for the Broxton – UP Squared

EDK II PLATFORM (UP SQUARED)



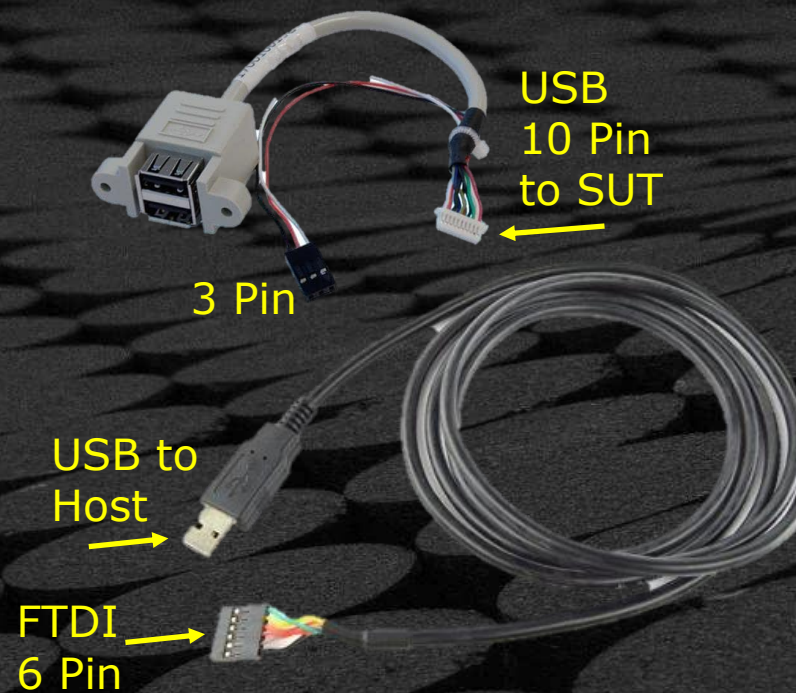
Intel® Celeron™ processor N3350 Series
(Formerly Apollo Lake)

Available from [Aaeon](#)
order at: [here](#)

UP SQUARED WORKSHOP LAB HARDWARE



FTDI & USB Cables



5V** Power Supply



USB thumb drive



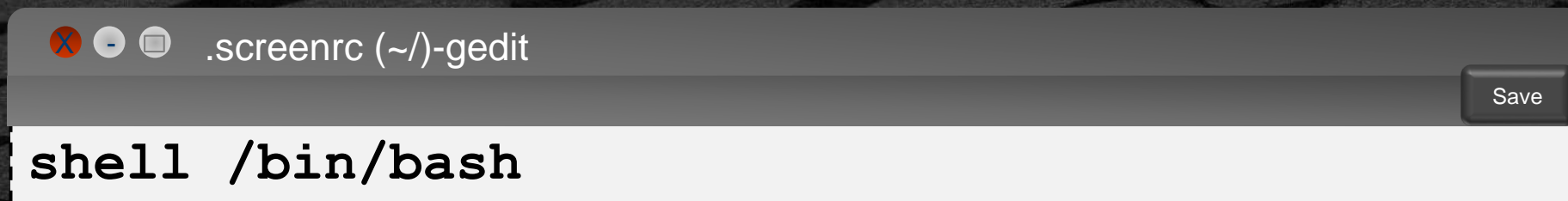
****Warning do not use any other power supply than 5V or the board will Fry**

INSTALL UBUNTU “SCREEN”

Terminal prompt (Cnt-Alt-T)

```
bash$ sudo apt-get install screen
bash$ cd $Home
bash$ gedit ~/.screenrc
```

Inside the editor, type
"shell /bin/bash" then save



Save

While in screen

Cnt-A then D goes back
to Terminal

```
bash$ screen -r
(returns to screen)
```

type

There may be other serial terminal applications that are supported.

Setup UP Squared Test System

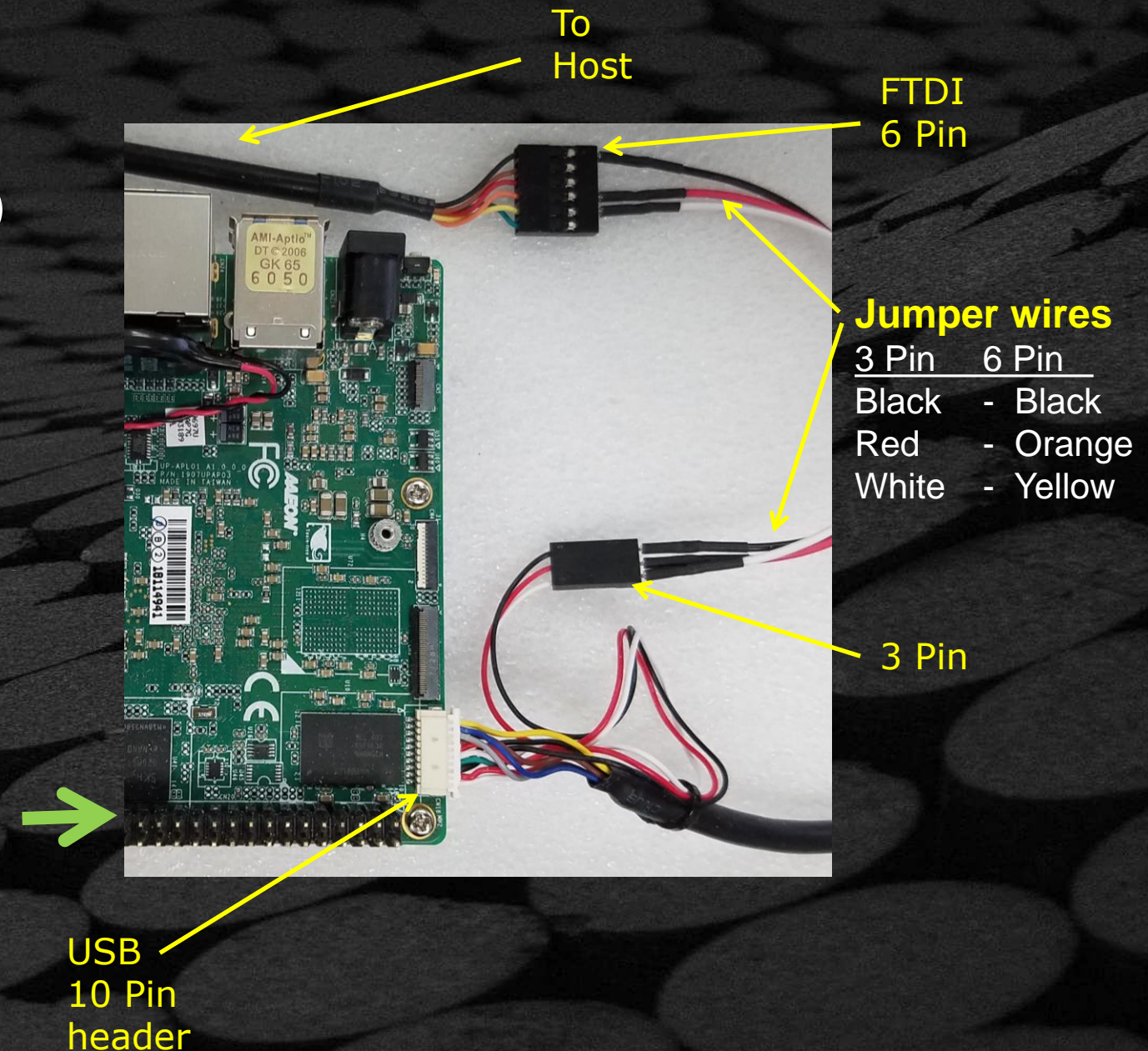
Hardware:

- System Under Test (SUT) – UP Squared
- FTDI USB to 3.3V TTL Cable (6 pin)
- USB / Uart EP-CBUSB10PFL01 (3 pin & 10 pin)
- 5V 6 amp power supply
- 3 jumper wires (black, red, white)

Connect the USB 10 pin header to SUT

Connect the FTDI USB w/ 6 pin to 3 pin connector using jumper wires

Connect the FTDI USB Type A connector to Host (Laptop)



SETUP UP SQUARED TEST SYSTEM

Open Terminal Prompt (Cnt-Alt-T)

```
bash$ dmesg  
bash$ sudo chmod 666 /dev/ttyUSB $n$ 
```

(to check which USB port is assigned)
(where n is the FTDI number)

```
u-uefi@uuefi-TPad: ~  
[ 679.341361] usb 1-1.2: New USB device strings: Mfr=1, Product=2, SerialNumber=3  
[ 679.341364] usb 1-1.2: Product: TTL232R-3V3  
[ 679.341367] usb 1-1.2: Manufacturer: FTDI  
[ 679.341370] usb 1-1.2: SerialNumber: FTHC5EM3  
[ 680.383129] usbcore: registered new interface driver usbserial  
[ 680.383162] usbcore: registered new interface driver usbserial_generic  
[ 680.383195] usbserial: USB Serial support registered for generic  
[ 680.391318] usbcore: registered new interface driver ftdi_sio  
[ 680.391342] usbserial: USB Serial support registered for FTDI USB Serial Device  
[ 680.391478] ftdi_sio 1-1.2:1.0: FTDI USB Serial Device converter detected  
[ 680.391539] usb 1-1.2: Detected FT232RL  
[ 680.392685] usb 1-1.2: FTDI USB Serial Device converter now attached to ttyUSB0  
u-uefi@uuefi-TPad:~$ dmesg
```

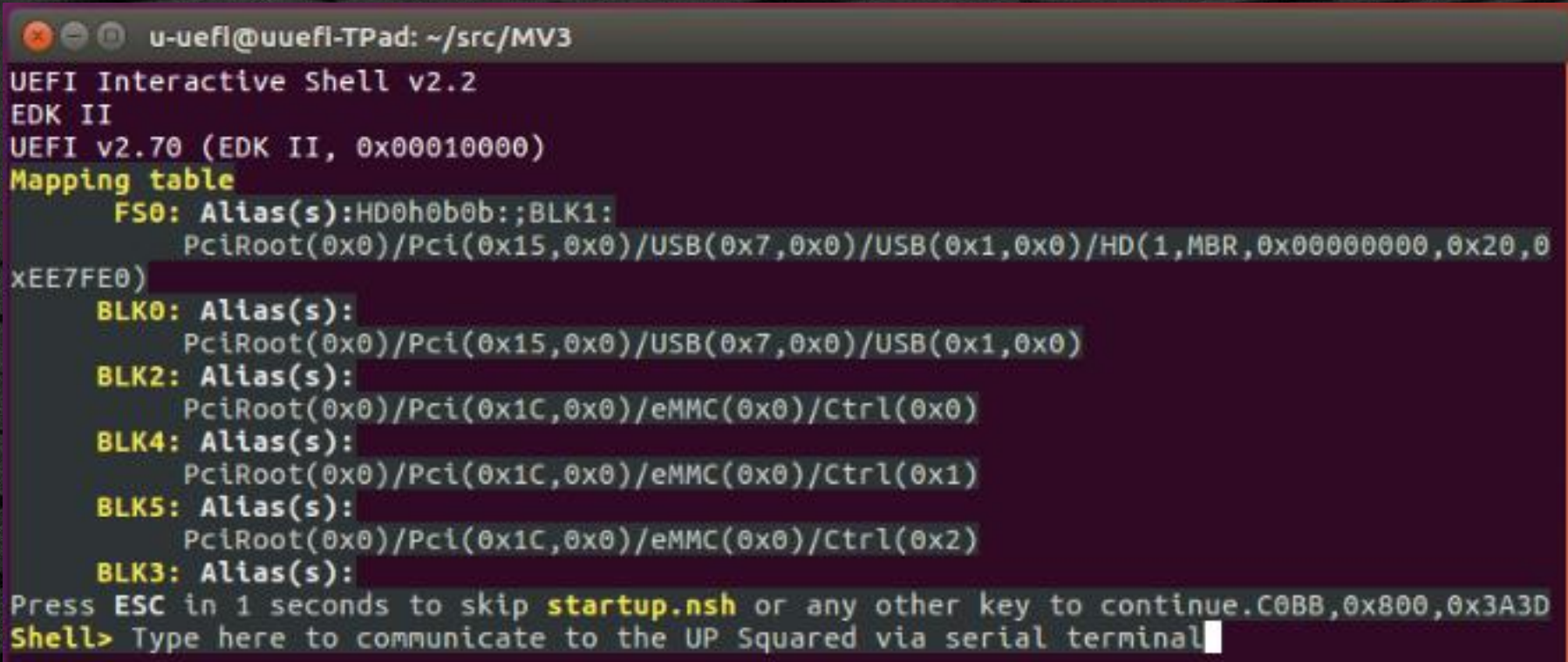
dmesg command
- **ttyUSB0**

POWER ON UP SQUARED

Connect the Power supply cable to the UP Squared

```
bash$ screen /dev/ttyUSBn 115200
```

UP Squared should boot to the UEFI Shell in the Terminal – Screen .



```
u-uefi@uuefi-TPad: ~/src/MV3
UEFI Interactive Shell v2.2
EDK II
UEFI v2.70 (EDK II, 0x00010000)
Mapping table
  FS0: Alias(s):HD0h0b0b:;BLK1:
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x7,0x0)/USB(0x1,0x0)/HD(1,MBR,0x00000000,0x20,0
xEE7FE0)
  BLK0: Alias(s):
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x7,0x0)/USB(0x1,0x0)
  BLK2: Alias(s):
        PciRoot(0x0)/Pci(0x1C,0x0)/eMMC(0x0)/Ctrl(0x0)
  BLK4: Alias(s):
        PciRoot(0x0)/Pci(0x1C,0x0)/eMMC(0x0)/Ctrl(0x1)
  BLK5: Alias(s):
        PciRoot(0x0)/Pci(0x1C,0x0)/eMMC(0x0)/Ctrl(0x2)
  BLK3: Alias(s):
        PciRoot(0x0)/Pci(0x1C,0x0)/eMMC(0x0)/Ctrl(0x2)
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.C0BB,0x800,0x3A3D
Shell> Type here to communicate to the UP Squared via serial terminal
```

While in screen

Cnt-A then **D** goes back to terminal

bash\$ screen -r
(returns to screen)

Note: Cnt-H for Backspace

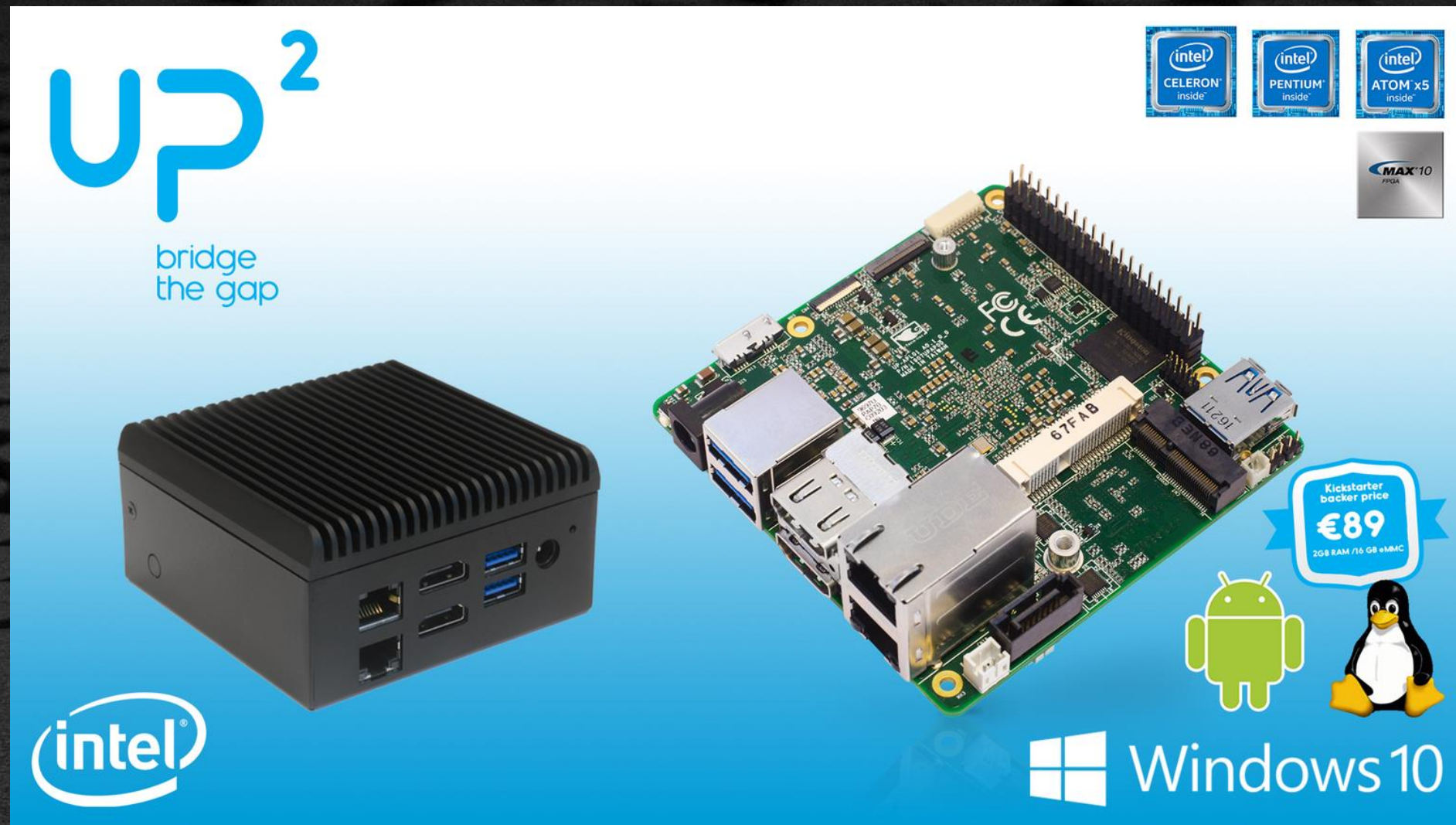
END OF LAB

Return to the Beginning or ➤ to continue



BUILD UP SQUARED

EDK II PLATFORM (UP SQUARED)

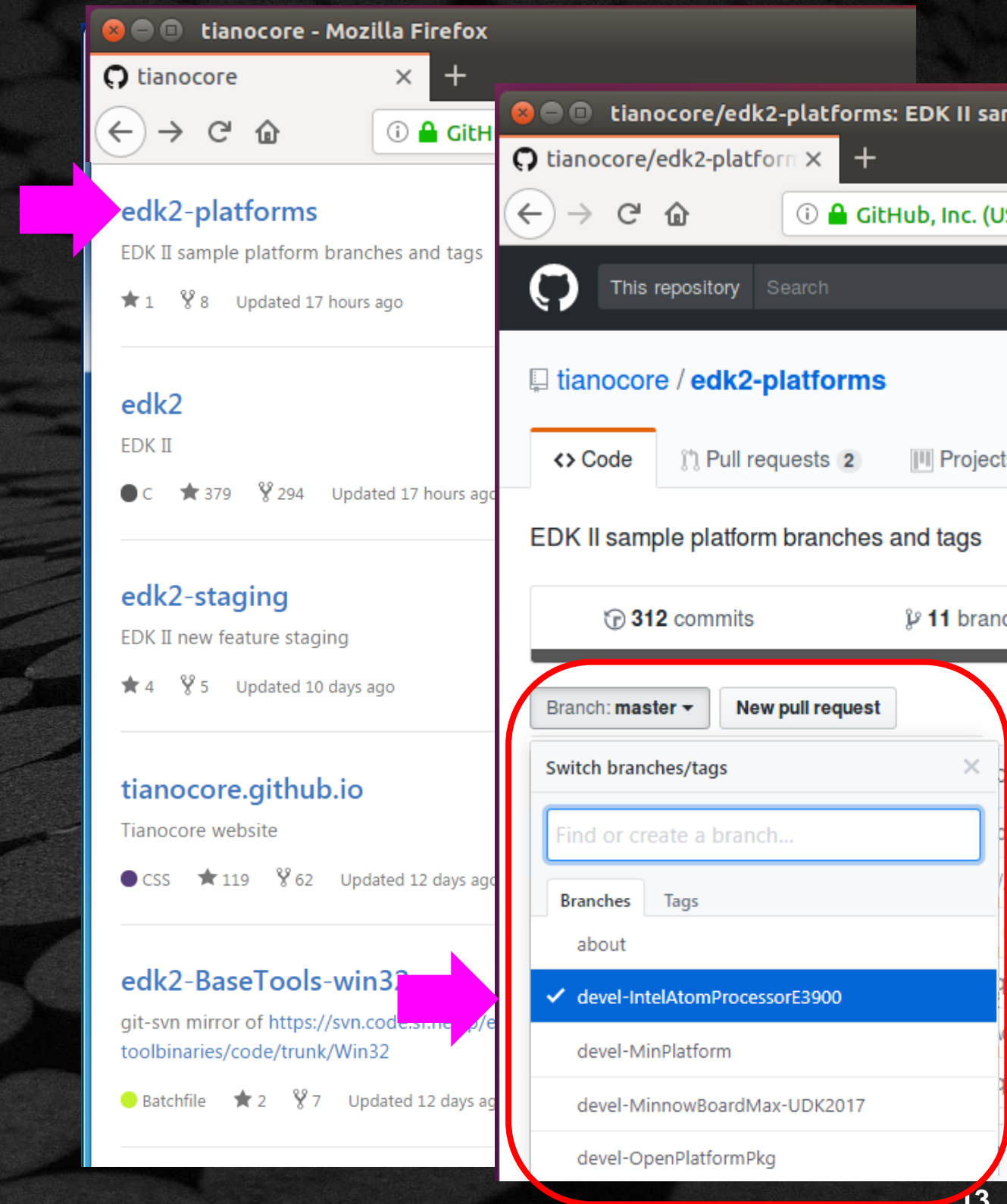


Intel® Celeron™ processor N3350 Series
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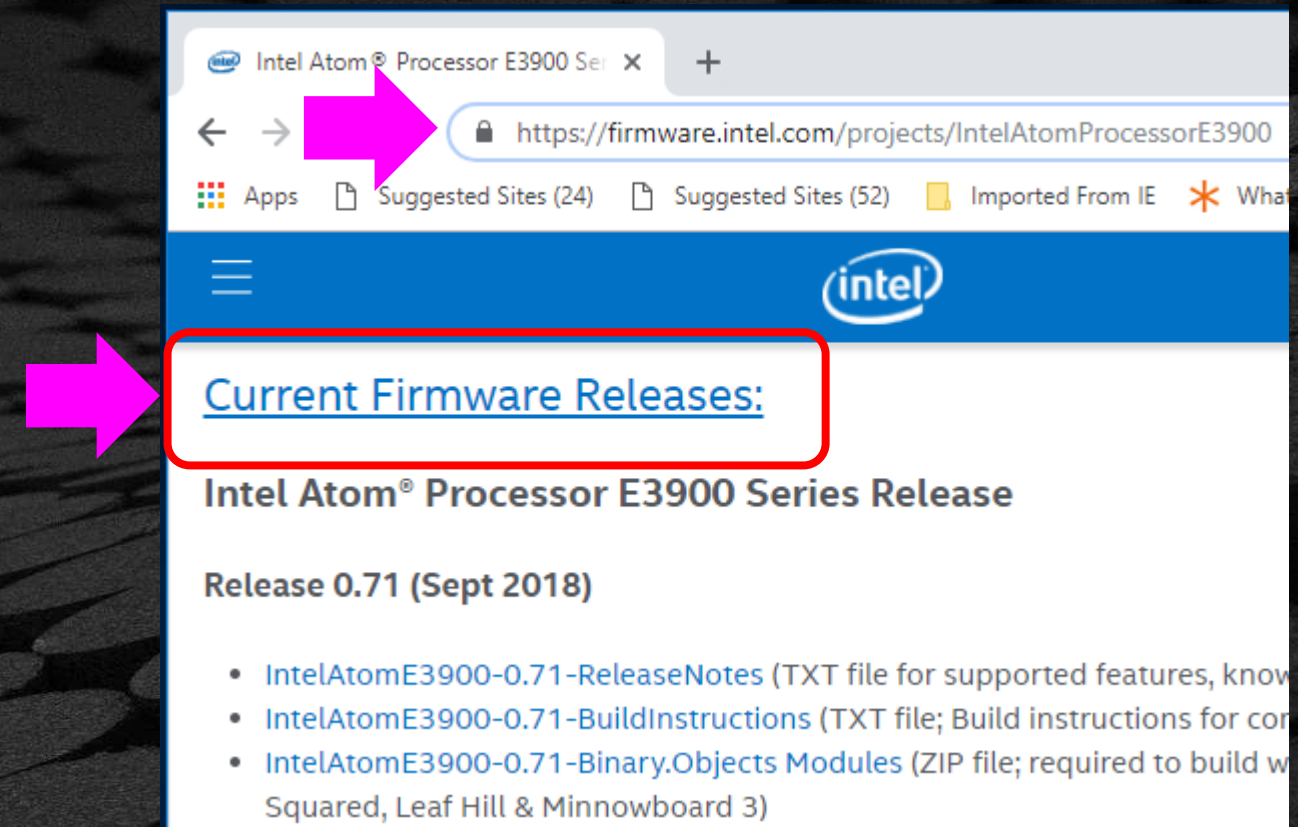
Where to get Open Source UP Squared

- Open Source Up² Wiki
- V .71 - Github Link
- Binary Object Modules
firmware.intel.com
- How to Build: Release Notes



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Download UP Squared Lab Source

Download the lab material .zip from :  [github.com](https://github.com/tianocore-training/PlatformBuildLab_UP2_FW.zip)
[PlatformBuildLab_UP2_FW.zip](https://github.com/tianocore-training/PlatformBuildLab_UP2_FW.zip)

OR

Use git clone to download the PlatformBuildLab_UP2_FW

```
bash$ cd $HOME  
bash$ git clone https://github.com/tianocore-training/PlatformBuildLab_UP2_FW.git
```

Directory PlatformBuildLab_UP2_FW will be created

/FW

/PlatformBuildLab

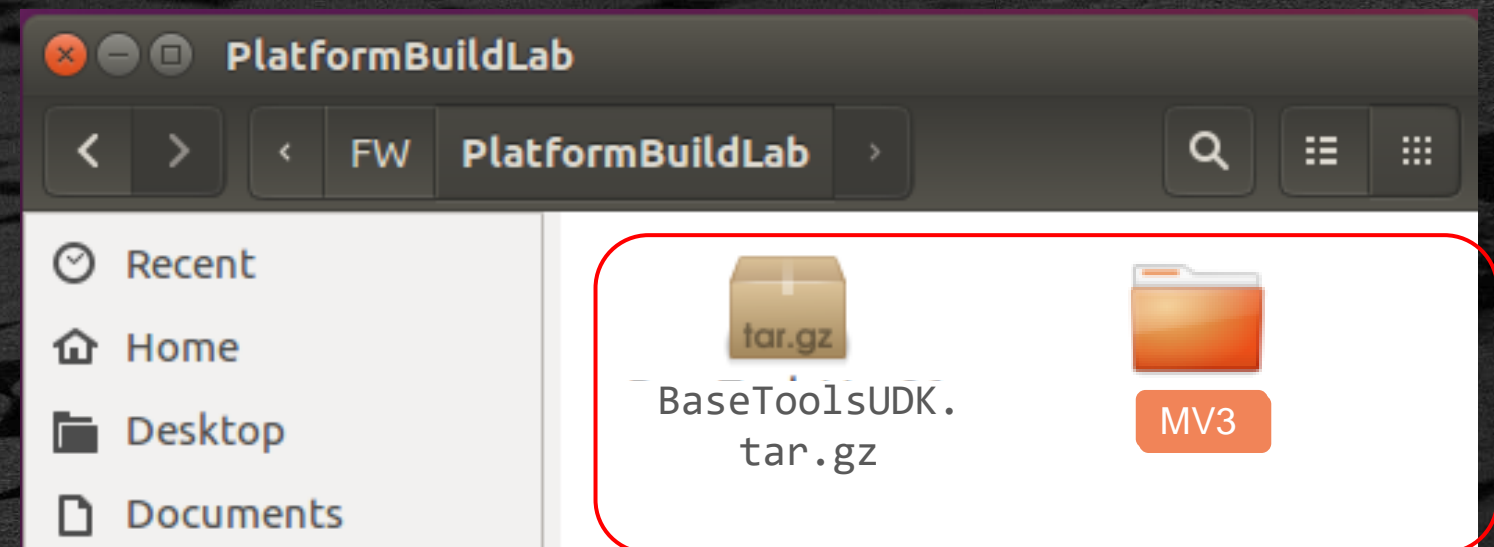
- MV3
- BaseToolsUDK.tar.gz
- FirmwareUpdateX64.efi
- UP Squared Source for the Labs
- BaseTools for Linux GCC5 build
- UEFI App to flash

UP SQUARED LAB SETUP

Previous Lab Setup Requirements

```
bash$ sudo apt-get install build-essential uuid-dev iasl git gcc-5 nasm
```

Additional Lab Setup –/FW/PlatformBuildLab



- MV3 – UP Squared Project source code
- BuildToolsUDK.tar.gz – build tools for GCC compiler

At Terminal prompt - Install Screen utility for Serial Console to run UEFI Shell

```
bash$ sudo apt-get install screen
```

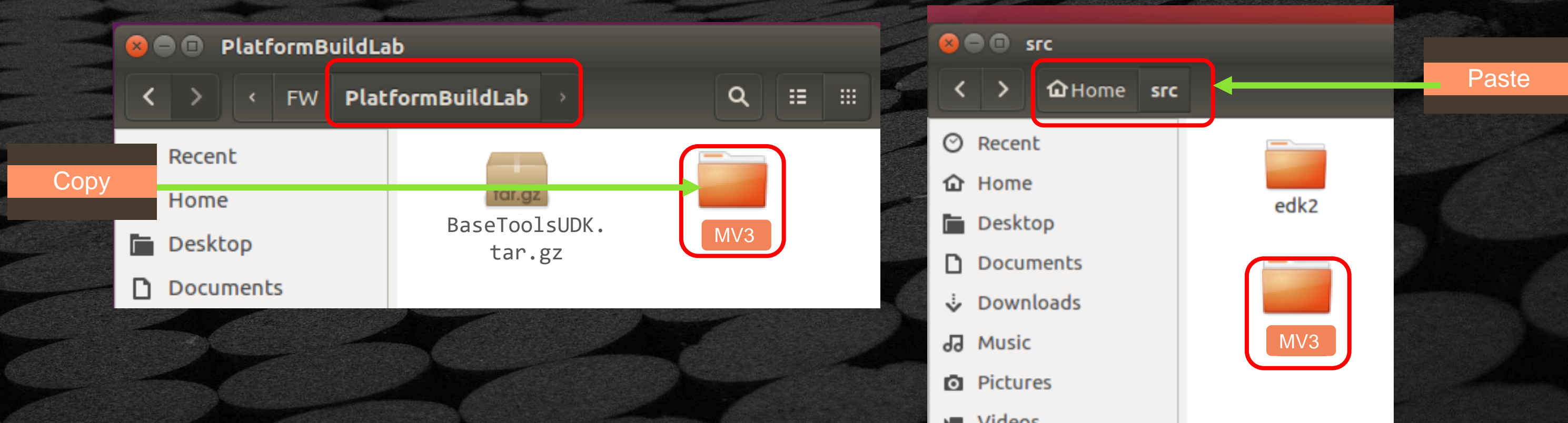

COPY UP SQUARED SOURCE

Open a terminal prompt (Alt-Cnt-T)

Create a working space source directory under the home directory

```
bash$ mkdir ~src
```

From the FW/PlatformBuildLab folder, copy and paste folder “~FW/MV3” to ~src

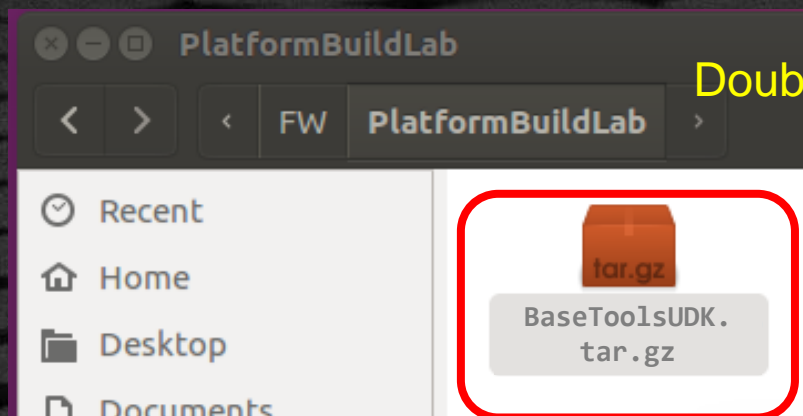


Get the BaseTools for UP Squared

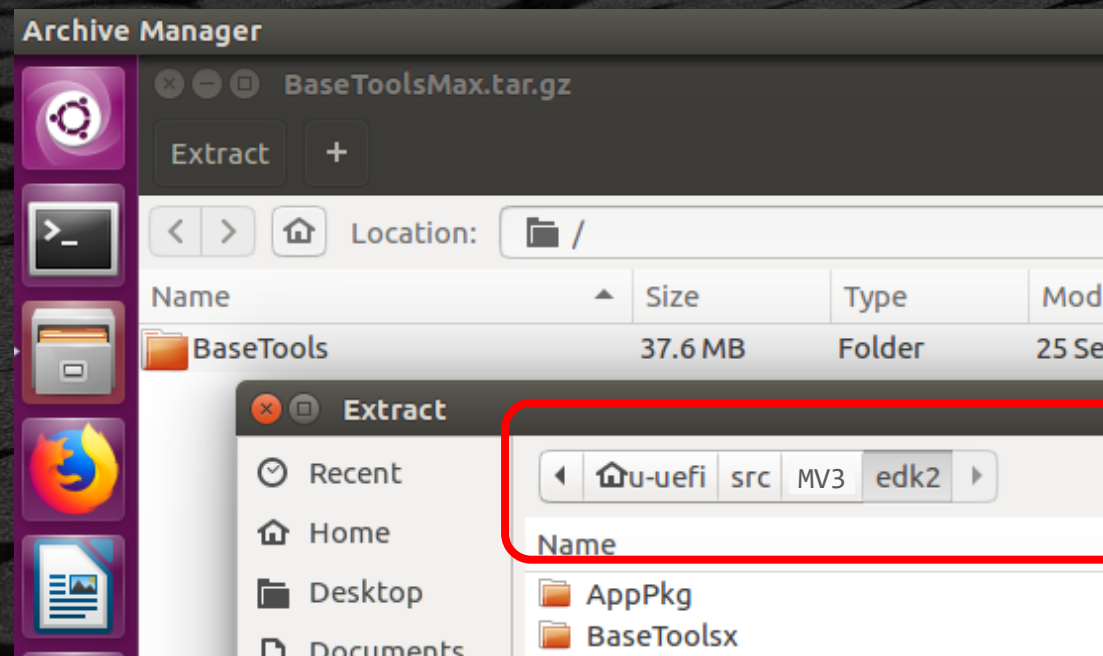
Rename or `mv` the directory “~src/MV3/edk2/BaseTools”

```
bash$ cd ~src/MV3/edk2
bash$ mv BaseTools BaseToolsX
bash$ tar -xf BaseToolsUDK.tar.xz
```

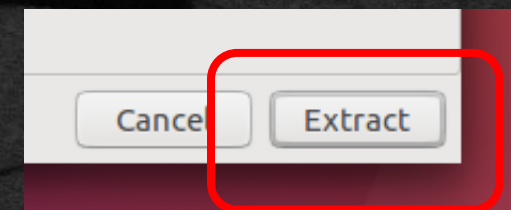
Extract the file ~FW/PlatformBuildLab/BaseToolsUDK.tar.gz to ~src/MV3/edk2



Double click



Select Extract directory \$HOME/src/MV3/edk2



click

PLATFORM SOURCE DIRECTORY STRUCTURE

/MV3 (work space dir)

/edk2

/(UDK2018 Directories)

/BaseTools (from BaseToolsUDK.tar.gz)

/edk2-platforms



Invoke the Build script from here

BuildBIOS script

/Platform

/BroxtonPlatformPkg

(Platform Dirs)

PlatformPkg.dec, fdf, dsc

/Silicon

/BroxtonSoC

/BroxtonFspPkg

/BroxtonSiPkg



Platform Project directory

(includes platform build scripts `BuildIFWI` → `BuildBxtBios` called from above `BuildBIOS` above)

STEPS TO BUILD & INSTALL FIRMWARE

- 1 Open Terminal prompt (Cnt-Alt-T) & Cd \$HOME/src/MV3/edk2-platforms
- 2 Fix-up “chmod” bin executable files
- 3 Invoke the build process
- 4 Locate build output (.BIN file for BIOS image)
- 5 Flash binary image onto the platform
- 6 Reset and verify the new firmware

Next slide will follow the above steps

Fix-up Script Properties to Execute

- 1 Terminal prompt (Cnt-Alt-T) & CD to work space directory
- 2 Fix Binary tools to “execute” with `chmod +x`

```
bash$ cd ~src/MV3/edk2-platforms/BroxtonPlatformPkg/Common/Tools
```

```
bash$ chmod +x GenBiosID/GenBIosId
```

```
bash$ chmod +x FCE/FCE
```

```
bash$ chmod +x FCE/BfmLib
```


Platform Build Scripts

Many Platforms have a bash or bat script file to pre or post process the EDK II build process

For UP Squared Broxton Platform: `BuildBIOS.bat` or `BuildBIOS.sh` calls: `BuildIFWI` from the platform package directory

- pre build processing
- calls `BuildBxtBios` - a platform script to preform the EDK II build
- determines date
- board ID
- post build stitching

BUILD PROCESS FOR DEBUG

From Terminal Prompt enter:

Note: *the Build will Pause*

3 bash\$ cd ~/src/MV3/edk2-platforms
bash\$. BuildBIOS.sh /UP /A Broxton Debug

2.
Check MAKE for
BaseTools OK

```
u-uefi@uuefi-TPad: ~/src/MV3/edk2-platforms
testValidUtf8File (CheckUnicodeSourceFiles.Tests) ... ok
testValidUtf8FileWithBom (CheckUnicodeSourceFiles.Tests) ... ok
-----
Ran 267 tests in 1.146s
OK
make[1]: Leaving directory '/home/u-uefi/src/MV3/edk2/BaseTools/Tests'
make: Leaving directory '/home/u-uefi/src/MV3/edk2/BaseTools'
```

3.
Check config... →

```

DEFINE PPV_BIOS_ENABLE = FALSE
DEFINE RVVP_BIOS_ENABLE = FALSE
DEFINE RVV_BIOS_ENABLE = FALSE
DEFINE UP2_BOARD = TRUE
DEFINE MINNOW3_MODULE_BOARD = FALSE
DEFINE X64_CONFIG = TRUE
DEFINE LOGGING = TRUE
Check the above target.txt for correct platform
...
Current directory is /home/u-uefi/src/MV3
...
```

4.
Press ENTER to
Continue

```

Invoking EDK2 build...
build -t GCC5 -D LOGGING=TRUE -D UP2_BOARD=TRUE
Press ENTER to continue OR Control-C to abort
_
```

1.
Scroll up

EXAMINE BUILD PARAMETERS

```
build -D LOGGING=TRUE -D UP2_BOARD = TRUE
        . . . -D Option (n)
```

MACROS

Logging

UP² Board

Properties from Conf\Target.txt

| | | |
|------------------------------|--|-------------------|
| TARGET | = DEBUG | Build Mode |
| TARGET_ARCH | = IA32 X64 | CPU Architecture |
| TOOL_CHAIN_TAG | = GCC5 | VS Tool Chain |
| ACTIVE_PLATFORM | = .. BroxtonPlatformPkg /PlatformPkgX64 | Platform DSC file |
| MAX_CONCURRENT_THREAD_NUMBER | = 1 | Thread Count |

Platform Build and PCD Parameters

Platform Parameters

Many Platform Parameters are defined in a top .DSC file that controls PCD and build switches

For UP Squared:

Build Switches (dynamic)

DefineAtBuildMacros.dsc - Updated from BuildBIOS command line

PlatformDsc/BuildOptionsEDKII.dsc - Like PCDs on command line

EDK II and Platform feature options

PlatformDsc/Defines.dsc - Manully updated before build command

BUILD PROCESS FOR RELEASE

From Terminal Prompt enter:

3 bash\$. BuildBIOS.sh /UP /A Broxton Release

NOTE: MACROS

Logging

Symbolic Debug

Set to False

```
u-uefi@uuefi-TPad: ~/src/MV3/edk2-platforms
MAX_CONCURRENT_THREAD_NUMBER = 1
TARGET_ARCH = IA32 X64
DEFINE ENBDT_PF_BUILD = TRUE
DEFINE TABLET_PF_BUILD = FALSE
DEFINE BYTI_PF_BUILD = FALSE
DEFINE CSLE_ENABLE = FALSE
DEFINE VP_BIOS_ENABLE = FALSE
DEFINE SV_BIOS_ENABLE = FALSE
DEFINE PPV_BIOS_ENABLE = FALSE
DEFINE RVVP_BIOS_ENABLE = FALSE
DEFINE RVV_BIOS_ENABLE = FALSE
DEFINE UP2_BOARD = TRUE
DEFINE MINNOW3_MODULE_BOARD = FALSE
DEFINE X64_CONFIG = TRUE
DEFINE LOGGING = FALSE
Check the above target.txt for correct platform
. . .
Current directory is /home/u-uefi/src/MV3
. . .

Invoking EDK2 build...
build -t GCC5 -D LOGGING=FALSE -D UP2_BOARD=TRUE
Press ENTER to continue OR Control-C to abort
```


DEBUG & RELEASE DIFFERENCES

Slower boot because the time it takes to display debug info

Larger image because of debug code & embedded info

Uses the serial port for debug string output

Contains detailed debug strings that show the boot process and various ASSERT/TRACE errors

BUILD PROCESS COMPLETED

4 Locate the build .BIN image

```
u-uefi@uuefi-TPad: ~/src/MV3
Ceate FSP component file './FSP_T.Fv'
~/src/MV3
Running fce...
Get NvStorage Base and Size...
- NvStorageBase = 0xffff41000
- BaseAddress = 0xffce9000
- NvStorageSize = 0x80000
- VpdOffset = 2457600
- VpdSize= 524288
Create NvStorage.fv...
~/src/MV3/edk2-platforms/Platform/BroxtonPlatformPkg/Common/Tools/Stitch ~/src/MV3
~/src/MV3
~/src/MV3/edk2-platforms/Platform/BroxtonPlatformPkg/Common/Tools/Stitch ~/src/MV3
~/src/MV3

Check if SPI IFWI image is generated at below location and is of size 8.4MB:
/home/u-uefi/src/MV3/edk2-platforms/Platform/BroxtonPlatformPkg/Common/Tools/Stitch/UPBOA
_X64_R_0071_01_GCC.bin

Finished Building Process.
u-uefi@uuefi-TPad:~/src/MV3$
```

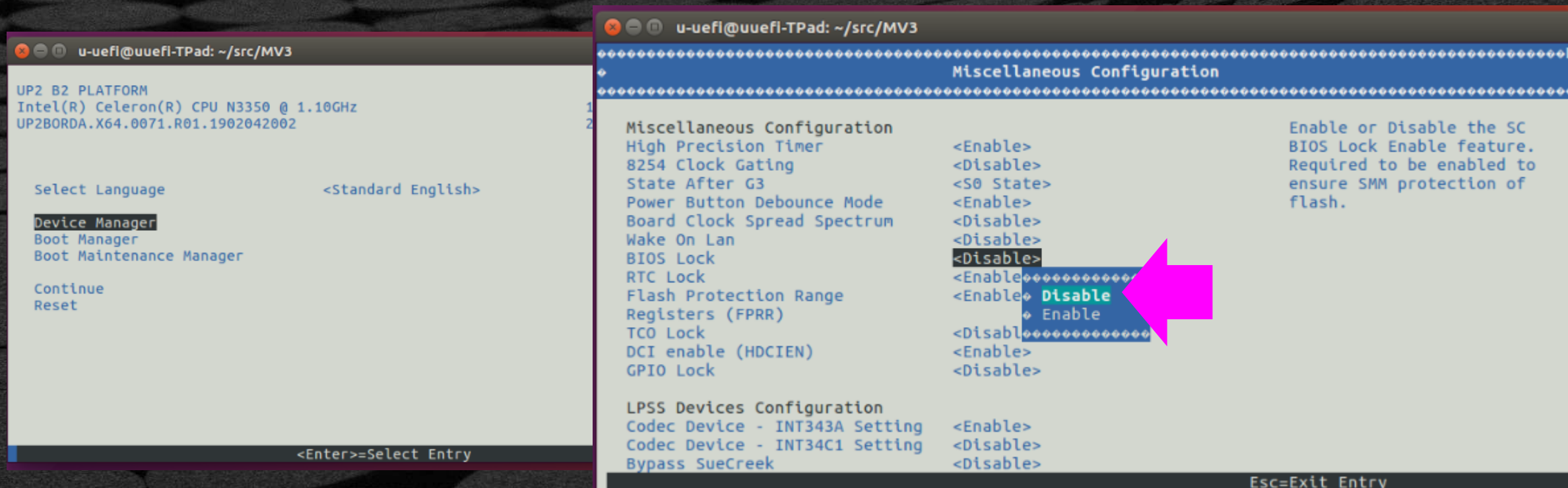
The platform build script post build process will stitch the multiple firmware volumes generated by the EDK II build process into the final .BIN image.

5 Flash the binary image

1. Access UP Squared Binary image file from build folder
 - `~src/MV3/edk2-platforms\Platform\BroxtonPlatformPkg\Common\Tools\Stitch`
 - `DEBUG UPBOARDA_X64_D_0071_01_GCC.bin`
 - `RELEASE UPBOARDA_X64_R_0071_01_GCC.bin`
2. Copy BIN files to a USB Thumb drive
3. Copy `FirmwareUpdateX64.efi` to a USB thumb drive from `~/FW/PlatformBuildLab`
4. Reset the UP Squared board and be prepared to type “F2” to enter System Setup

5. Set “BIOS Lock” to Disable in System Setup by the following:

- Inside Setup go to “Device Manager” → “System Setup” → “South Cluster Configuration” → “Miscellaneous Configuration”
- Open “BIOS Lock” and select “Disable”
- Press “F10” to save and then reboot



- ```
FS0:\> FirmwareUpdateX64.efi UPBOA_X64_R_0071_01_GCC.bin
```

Updating Firmware. This may take a few minutes.

```
Update successful
Shutdown system in 4 seconds ...
```

**NOTE for Ubuntu Screen terminal**  
Control -H for backspace  
Control A then D to return to Ubuntu  
Screen -r to return to UEFI Shell Console

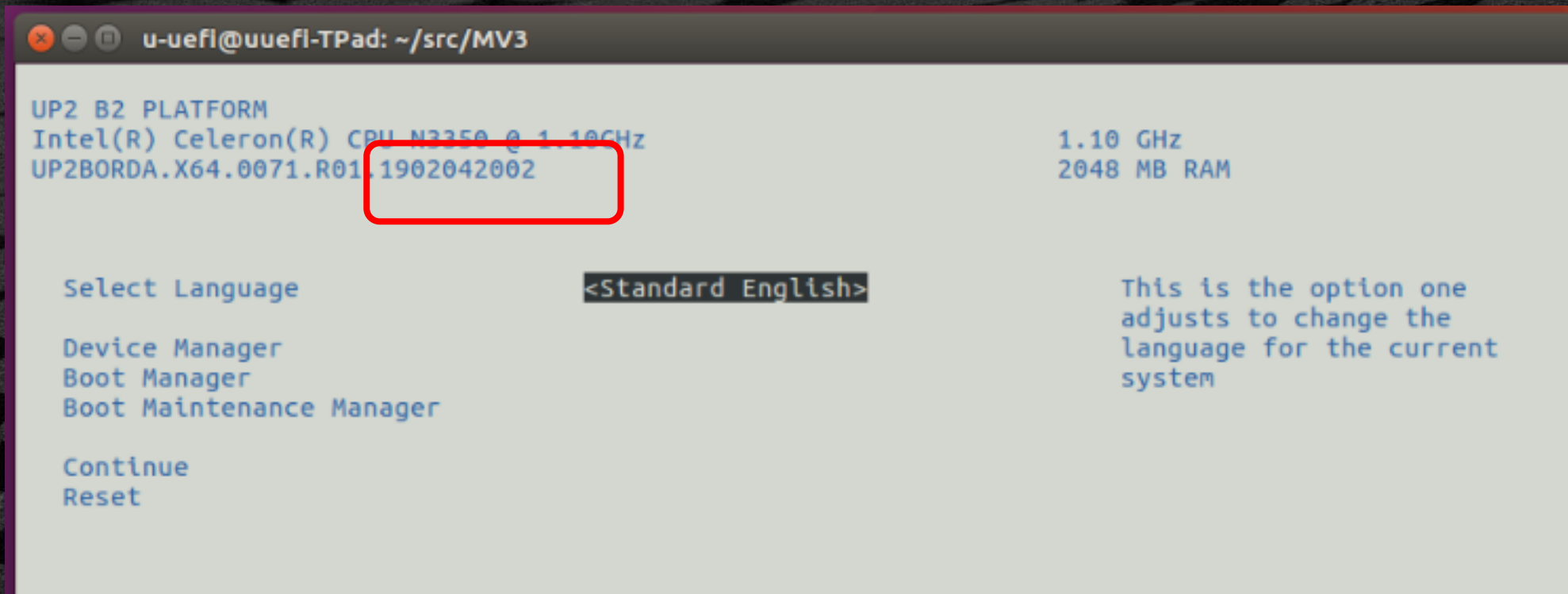
# Reset and boot new firmware



# VERIFY AFTER FIRMWARE UPDATE

## 6 Reboot and Verify

- Verify that the Firmware was updated by checking the Date
- Go into setup by pressing “F2” after reboot
- The EDK II front page will show the BIOS ID with Date/time stamp



The screenshot shows the EDK II front page in a terminal window. The title bar reads "u-uefi@uuefi-TPad: ~/src/MV3". The main content is as follows:

```
UP2 B2 PLATFORM
Intel(R) Celeron(R) CPU N3350 @ 1.10GHz
UP2BORDA.X64.0071.R01.1902042002

1.10 GHz
2048 MB RAM

Select Language <Standard English>
Device Manager
Boot Manager
Boot Maintenance Manager

Continue
Reset
```

A red rectangle highlights the BIOS ID string "UP2BORDA.X64.0071.R01.1902042002". To the right, a message states: "This is the option one adjusts to change the language for the current system".



# SUMMARY

- ✿ Hardware Setup for UP Squared
- ✿ Build a EDK II Platform using Broxton – UP Squared



# Questions?





