

UEFI & EDK II Training

Platform Build Lab MinnowBoard Max - Linux

tianocore.org

PLATFORM BUILD LABS

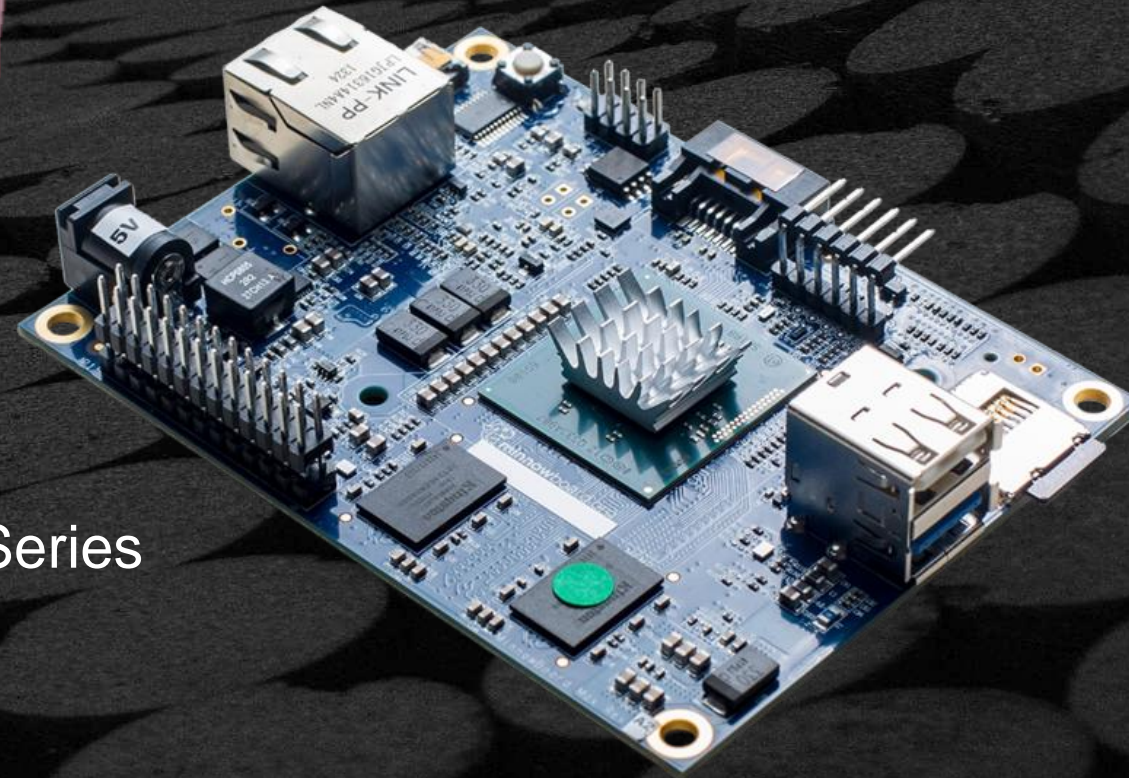
Lab Setup and Build for MinnowBoard Max/Turbot

- ★ Hardware Setup for MinnowBoard Max/Turbot
- ★ Build a EDK II Platform using MinnowBoard Max/Turbot

PLATFORM HW SETUP

Setup hardware for the MinnowBoard Max/Turbot

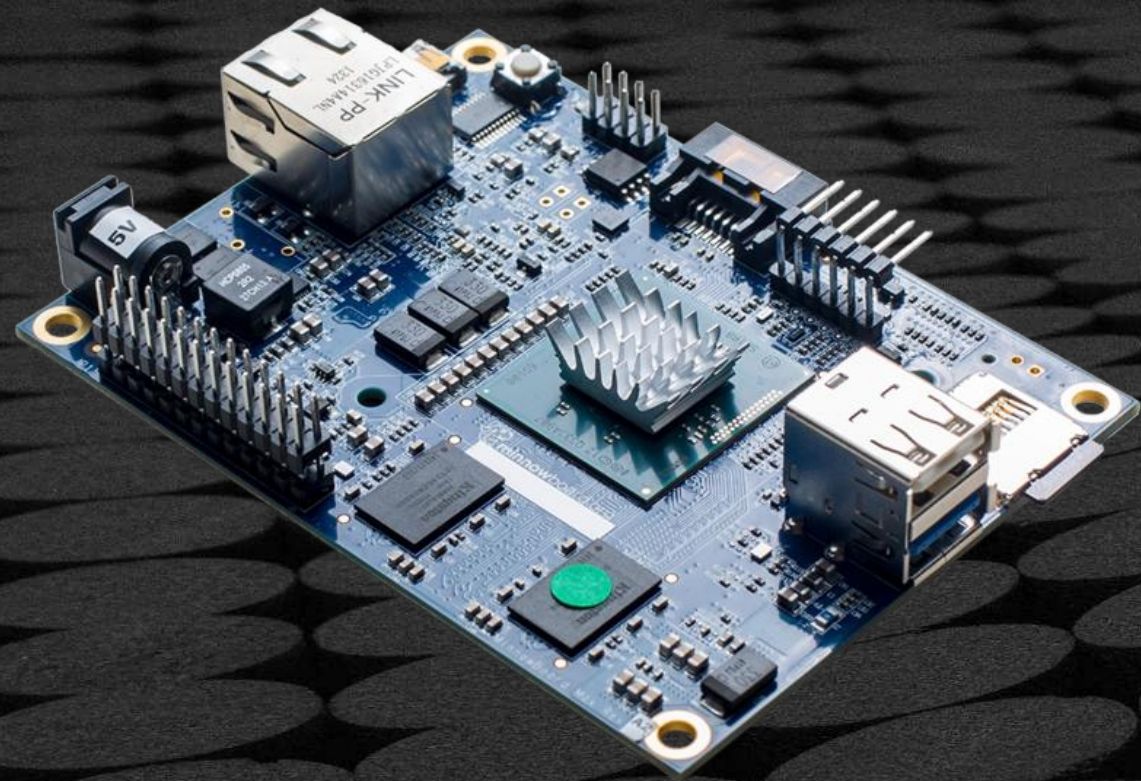
EDK II Platform – MinnowBoard Max/Turbot



Intel Atom® processor E3800 Series
(Formerly Bay Trail-I)

MinnowBoard Max/Turbot Workshop

Lab Hardware



FTDI USB Cable



5V** Power Supply



USB thumb drive



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

Install “Screen” on Ubuntu

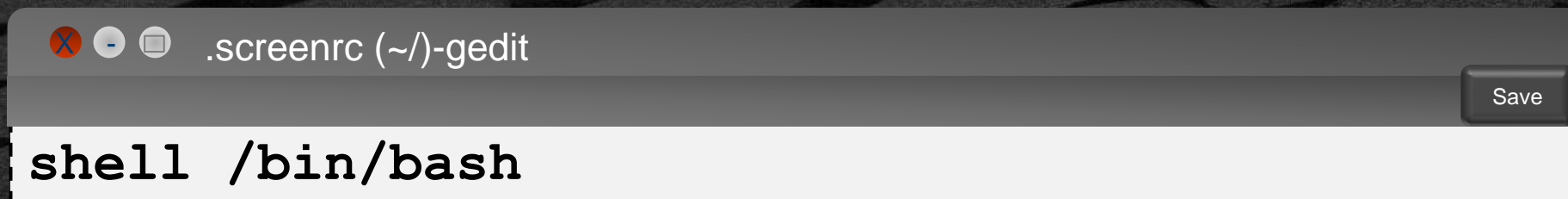
- skip for Clear Linux* Project



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

Skip if using Clear Linux* Project, Screen is part of install
There may be other serial terminal applications that are supported.

Setup MinnowBoard Max Test System

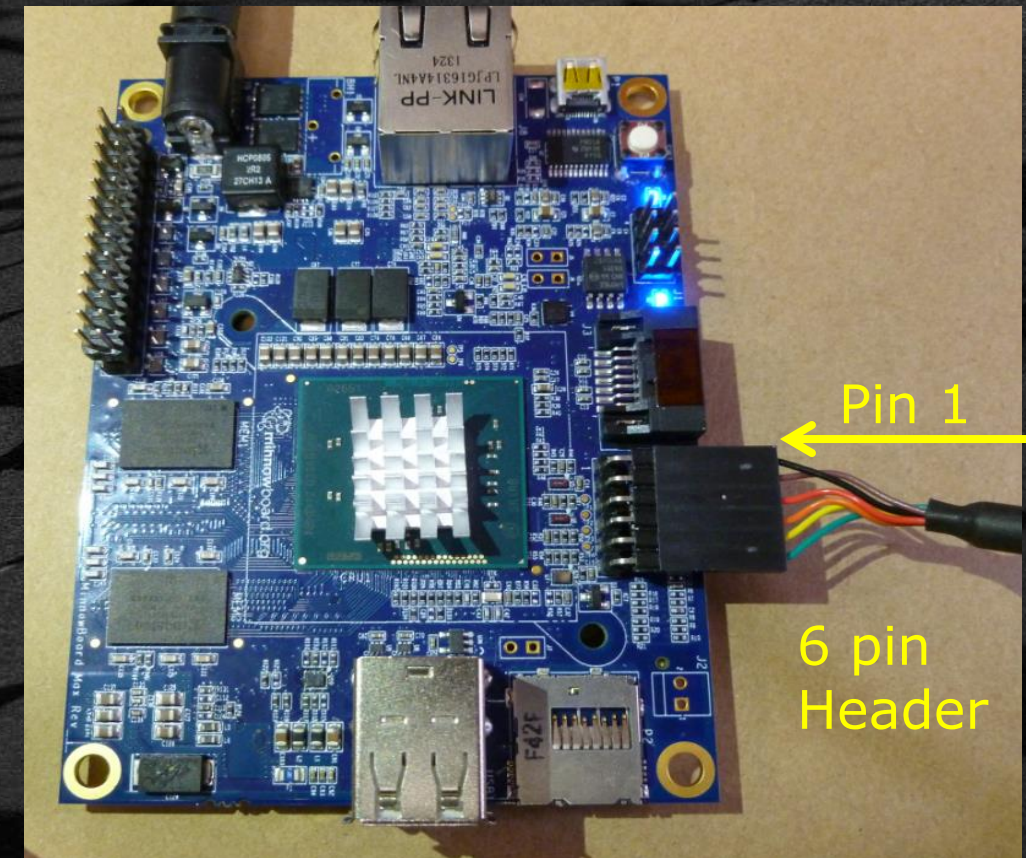
Hardware:

- System Under Test (SUT) – MinnowBoard Max /Turbot
- USB to 3.3V TTL Cable (6 pin to USB Type A)
- 5V** power supply

Connect the USB w/ 6 pin header to SUT

- black wire(pin 1) is closest to the SATA connector

Connect the USB Type A connector to Host



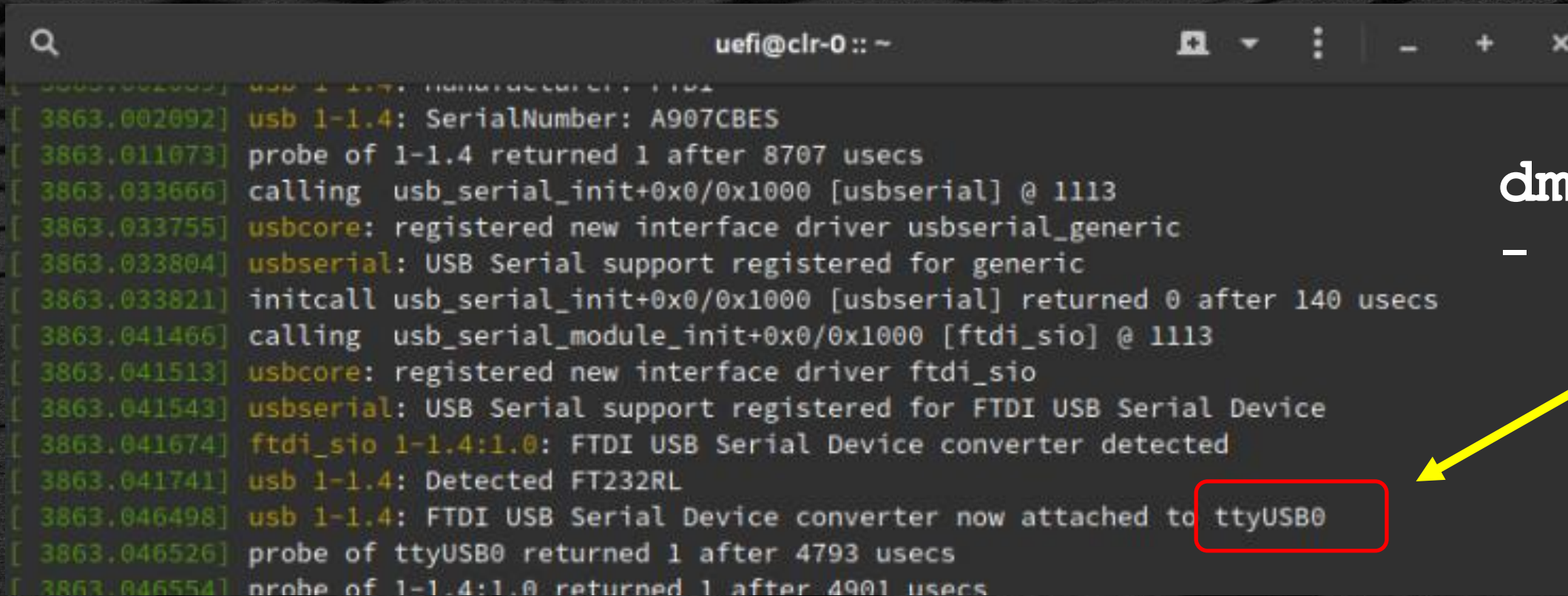
****Warning do not use any other power supply than 5V or the board will Fry**

Setup MinnowBoard Max Test System

Open Terminal Prompt (Cnt-Alt-T)

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

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



```
uefi@clr-0 :: ~  
[ 3863.002092] usb 1-1.4: Manufacturer: FTDI  
[ 3863.002092] usb 1-1.4: SerialNumber: A907CBES  
[ 3863.011073] probe of 1-1.4 returned 1 after 8707 usecs  
[ 3863.033666] calling usb_serial_init+0x0/0x1000 [usbserial] @ 1113  
[ 3863.033755] usbcore: registered new interface driver usbserial_generic  
[ 3863.033804] usbserial: USB Serial support registered for generic  
[ 3863.033821] initcall usb_serial_init+0x0/0x1000 [usbserial] returned 0 after 140 usecs  
[ 3863.041466] calling usb_serial_module_init+0x0/0x1000 [ftdi_sio] @ 1113  
[ 3863.041513] usbcore: registered new interface driver ftdi_sio  
[ 3863.041543] usbserial: USB Serial support registered for FTDI USB Serial Device  
[ 3863.041674] ftdi_sio 1-1.4:1.0: FTDI USB Serial Device converter detected  
[ 3863.041741] usb 1-1.4: Detected FT232RL  
[ 3863.046498] usb 1-1.4: FTDI USB Serial Device converter now attached to ttyUSB0  
[ 3863.046526] probe of ttyUSB0 returned 1 after 4793 usecs  
[ 3863.046554] probe of 1-1.4:1.0 returned 1 after 4901 usecs
```

dmesg command
- **ttyUSB0**

Power on MinnowBoard Max

Connect the Power supply cable to the MinnowBoard Max

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

MinnowBoard Max should boot to the UEFI Shell in the Terminal – Screen .



```
uefi@clr-0 :: ~
UEFI Interactive Shell v2.287477C2-69C7-11D2-8E39-00A0C969723B 78372020
EDK II\ProtocolInterface: 752F3136-4E16-4FDC-A22A-E5F46812F4CA 78371F98
UEFI v2.70 (EDK II, 0x00010000)008-7F9B-4F30-87AC-60C9FEF5DA4E 7820CB10
Mapping table
FS0: Alias(s):HD0a0b:;BLK1:
      PciRoot(0x0)/Pci(0x14,0x0)/USB(0x0,0x0)/HD(1,MBR,0x00000000,0x20,0xEE7FE0)
BLK0: Alias(s):
      PciRoot(0x0)/Pci(0x14,0x0)/USB(0x0,0x0)
Press ESC in 3 seconds to skip startup.nsh or any other key to continue.MnpSyncSendPacket: No net
Shell> Type Here when ready to type commands to MinnowBoard MAX/Turbot
```

While in screen

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

bash\$ screen -r
(returns to screen)

Note: Cnt-H for Backspace

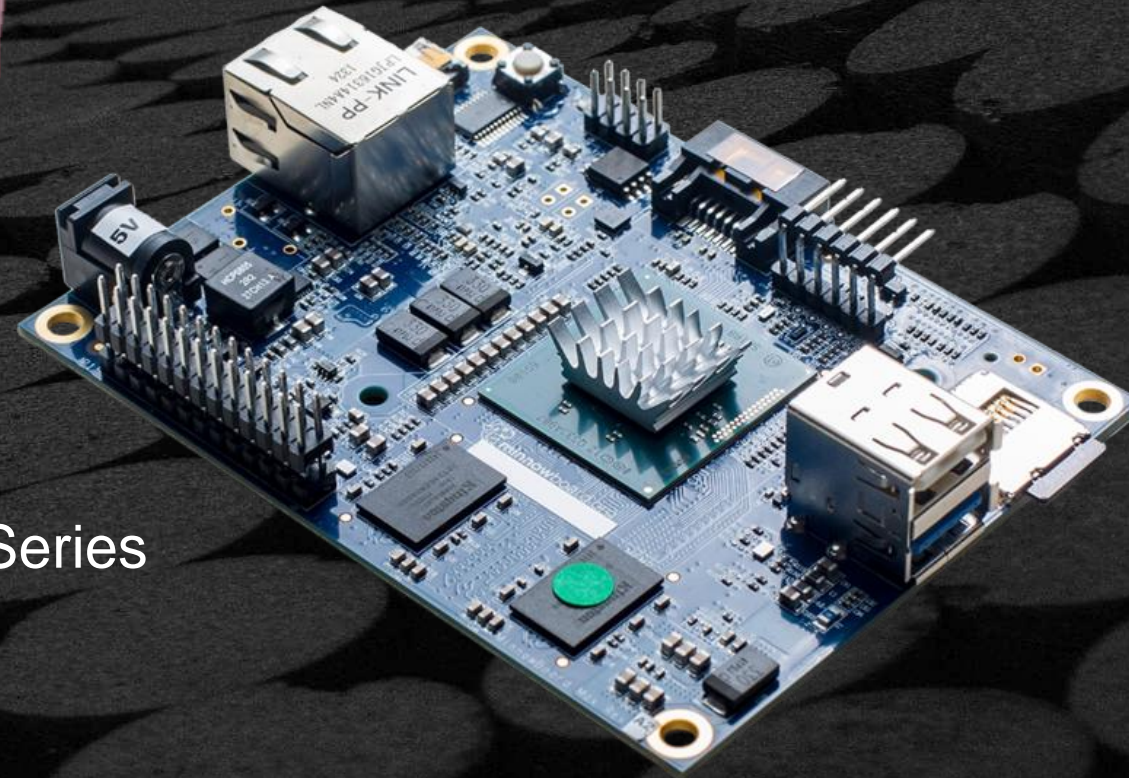
Cnt-A then Z to exit screen

END OF LAB

Return to the Beginning or ➤ to continue

BUILD MINNOWBOARD MAX / TURBOT

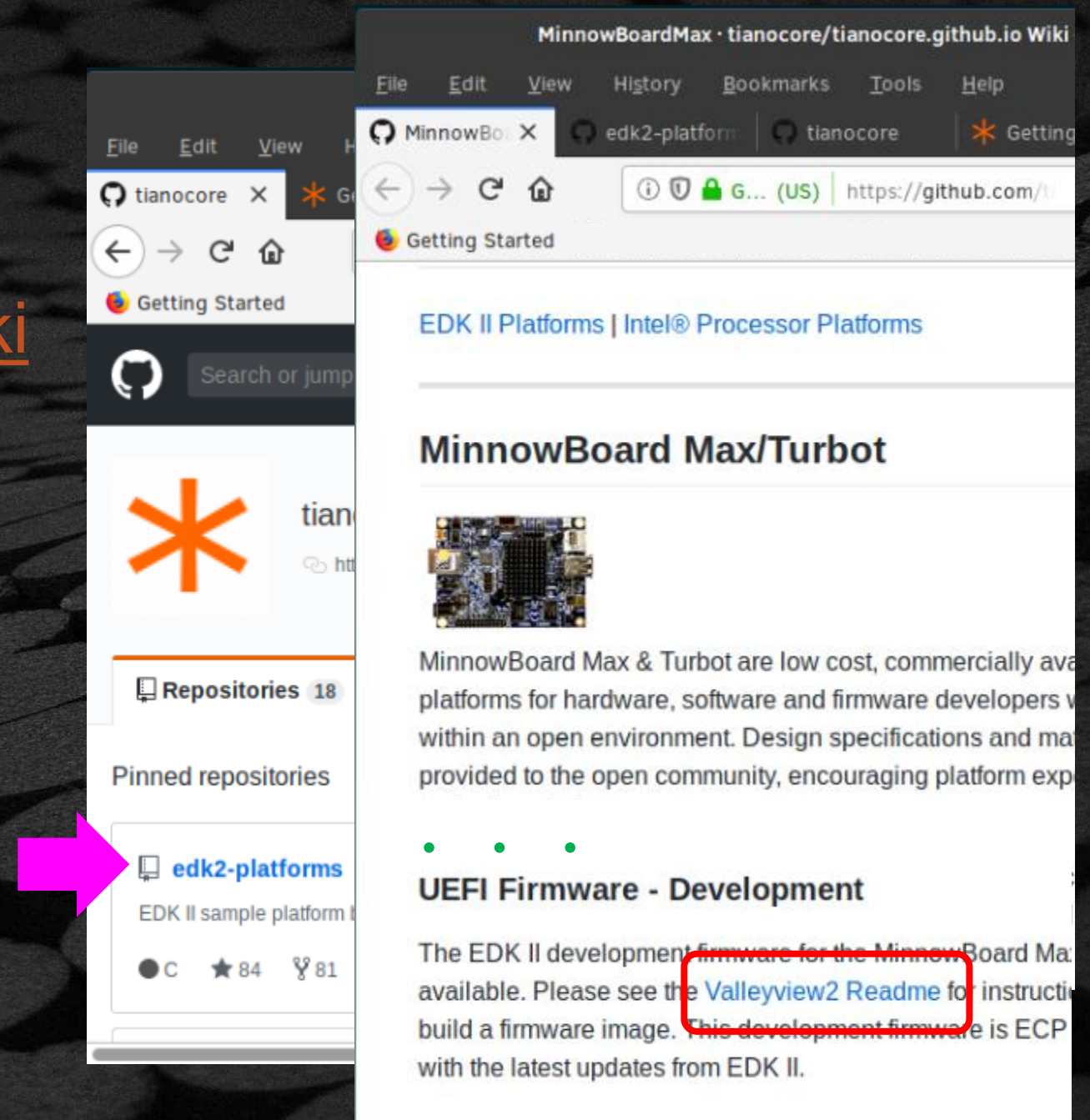
EDK II Platform – MinnowBoard Max/Turbot




Intel® Atom processor E3800 Series
(Formerly Bay Trail-I)

Where to get Open Source MinnowBoard Max

- Open Source [Max Development Wiki](#)
- How to Download & Build:
[Readme.md](#)



Down Load Max Lab Source

Download the PlatformBuildLab2_FW.zip from :  [github.com](https://github.com/tianocore-training/PlatformBuildLab2_FW.zip)
[PlatformBuildLab2_FW.zip](https://github.com/tianocore-training/PlatformBuildLab2_FW.zip)

OR

Use `git clone` to download the PlatformBuildLab2_FW

```
bash$ cd $HOME
bash$ git clone https://github.com/tianocore-training/PlatformBuildLab2_FW.git
```

Directory PlatformBuildLab2_FW will be created

FW

- PlatformBuildLab
 - MaxWS
 - . . .
- Minnowboard Max Source for the Labs

Linux setup for MinnowBoard Max Lab



ubuntu

Lab Setup Requirements – Ubuntu 16.04

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



Clear Linux*
Project

Lab Setup Requirements – Clear Linux* Project

```
bash$ sudo swupd bundle-add devpkg-util-linux  
bash$ sudo swupd bundle-add devpkg-gcab
```

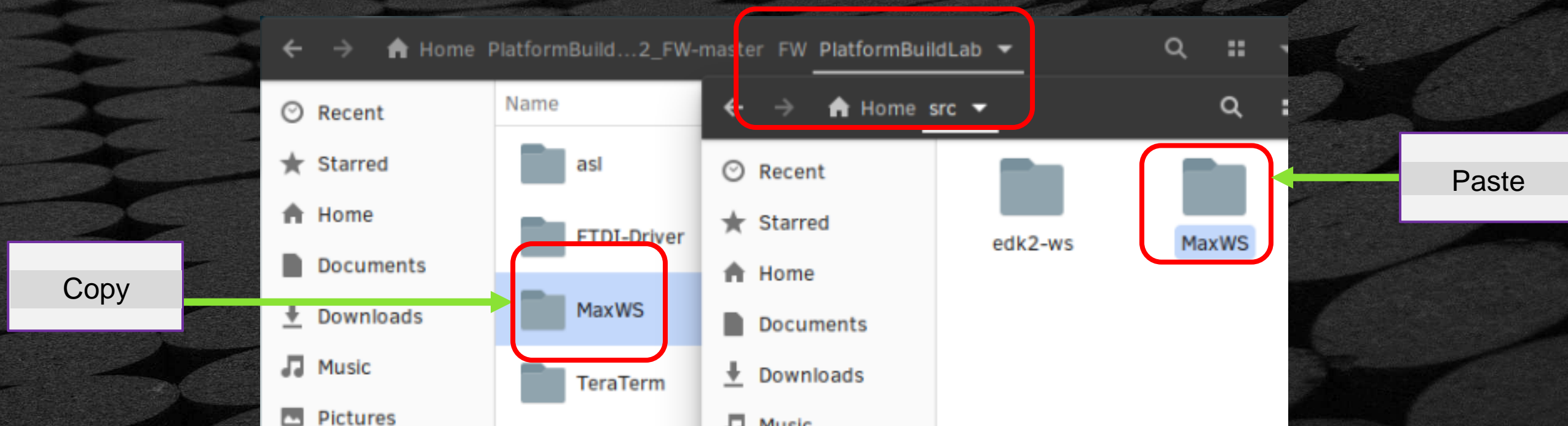

Copy MinnowBoard Max Source

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/MaxWS” to ~src

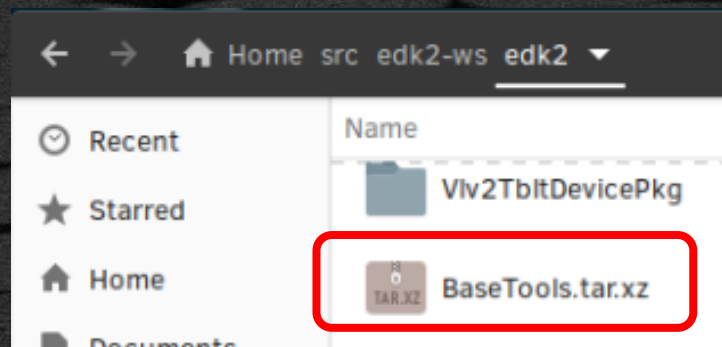


Get the BaseTools for Max

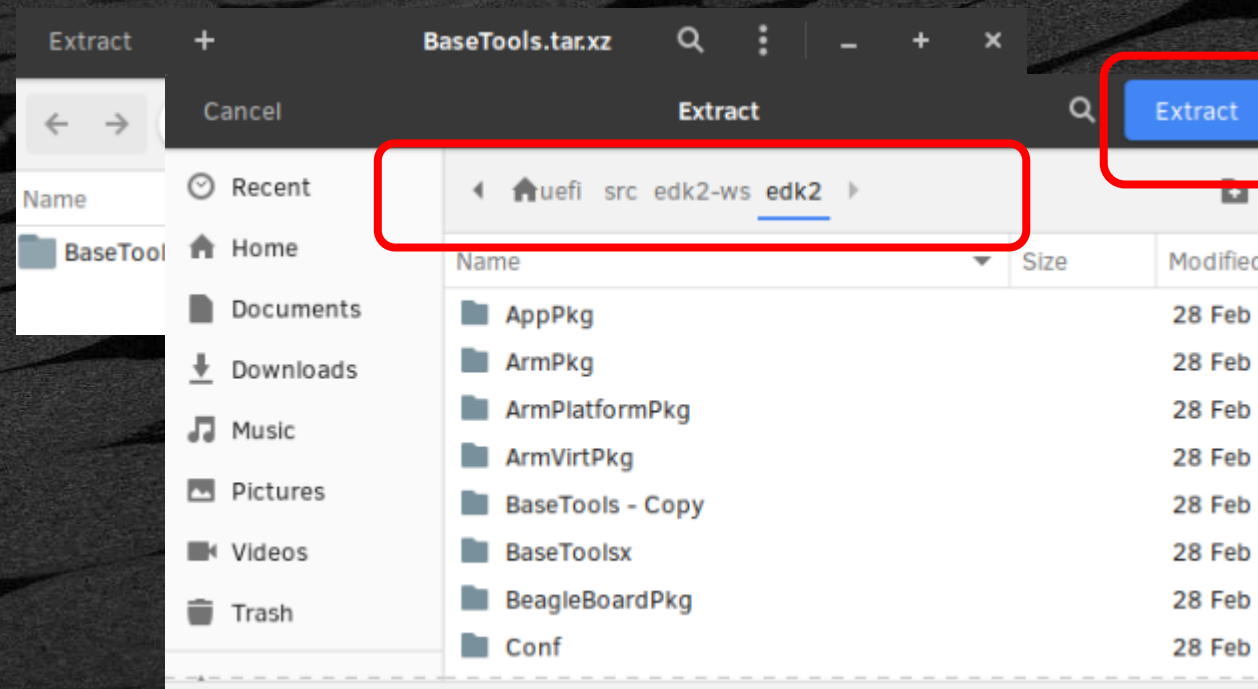
Rename or `mv` the directory “`~src/MaxWS/edk2/BaseTools`”

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

Extract the file `BaseTools.tar.xz` to `~src/MaxWS/edk2`



Double click



Select Extract directory
`$HOME/src/MaxWS/edk2`

Platform Source Directory Structure

./MaxWs/
edk2/

Invoke the Build from here

(EDK II common packages)

BaseTools/
edk2-platforms/

Platform/Intel/

Vlv2TbltDevicePkg /

Platform DSC here

Silicon/Intel/

Vlv2DeviceRefCodePkg/

edk2-non-os/

Steps to Build & Install Firmware

- 1 Open Terminal prompt & Cd ~/src/MaxWS/
- 2 Set up local build environment, edksetup.sh
- 3 Build BaseTools
- 4 Invoke the build process
- 5 Locate build output (.cap files for BIOS image)
- 6 Flash capsule image onto the platform
- 7 Reset and verify the new firmware

Next slide will follow the above steps

Setup Local Environment from Terminal

- 1 Terminal prompt (Cnt-Alt-T) & CD to work space directory
- 2 Set up Local environment (PACKAGES_PATH)

```
bash$ cd ~src/MaxWS
```

```
bash$ export WORKSPACE=$PWD
```

```
bash$ export PACKAGES_PATH=$WORKSPACE/edk2:\
$WORKSPACE/edk2-platforms/Silicon/Intel:\
$WORKSPACE/edk2-platforms/Platform/Intel:\
$WORKSPACE/edk2-non-os/Intel
```

```
bash$ cd edk2/
```

```
bash$ chmod +x edksetup.sh
```

```
bash$ . edksetup.sh
```

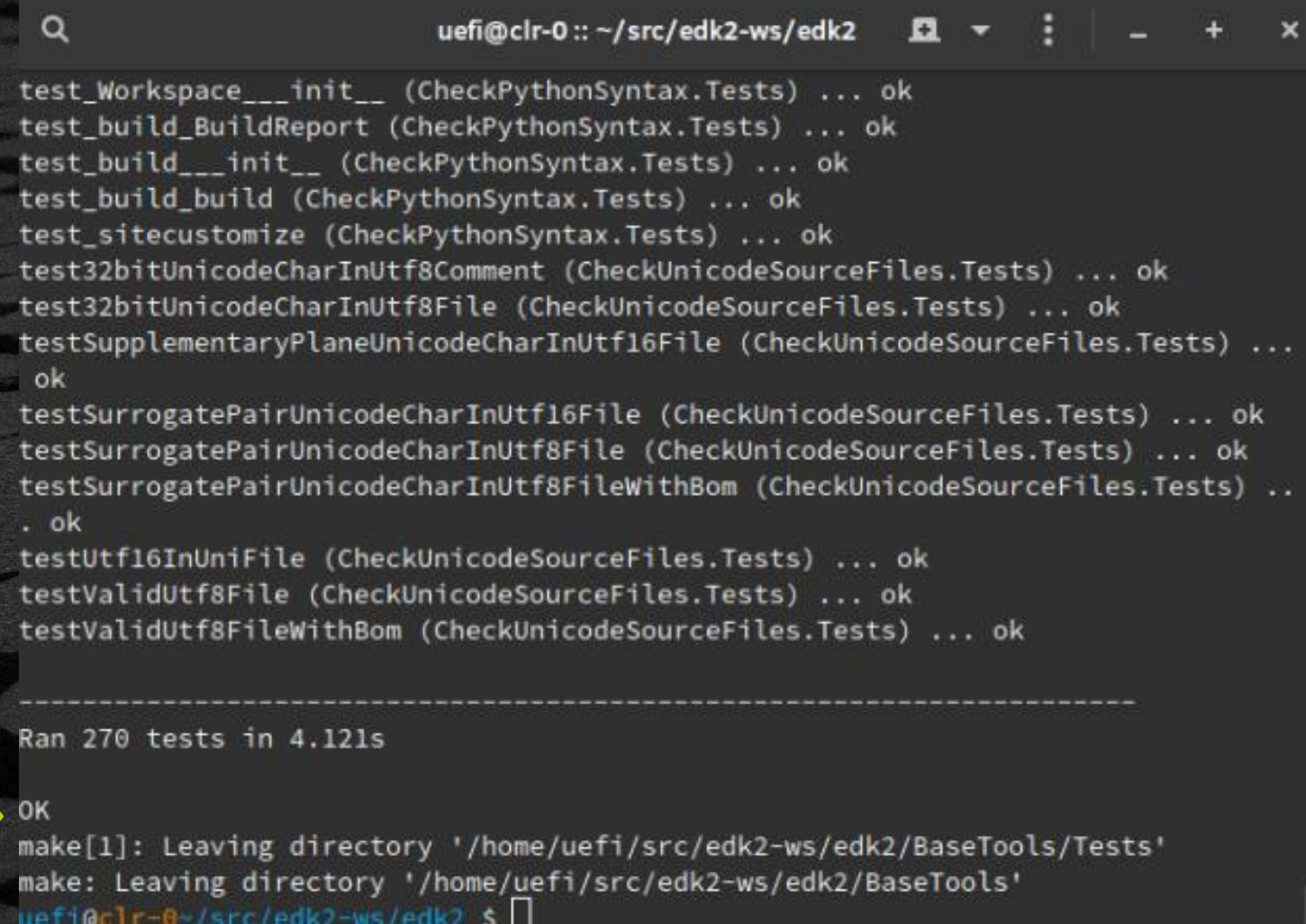

Building BaseTools

3

Run Make

```
bash$ cd ~/src/MaxWS/edk2
bash$ make -C BaseTools/
```

Make sure the tests pass OK



A terminal window titled 'uefi@clr-0 :: ~/src/edk2-ws/edk2' displays the output of running 'make' in the 'BaseTools' directory. The output shows a series of test results, all of which are 'ok'. The tests include 'test_Workspace___init__', 'test_build_BuildReport', 'test_build___init__', 'test_build_build', 'test_sitecustomize', and several 'test32bitUnicodeCharInUtf8' and 'testValidUtf8File' tests. A summary line indicates 'Ran 270 tests in 4.121s'. The final output is 'OK', followed by 'make[1]: Leaving directory \'/home/uefi/src/edk2-ws/edk2/BaseTools/Tests\'' and 'make: Leaving directory \'/home/uefi/src/edk2-ws/edk2/BaseTools\''.

```
uefi@clr-0 :: ~/src/edk2-ws/edk2
test_Workspace___init__ (CheckPythonSyntax.Tests) ... ok
test_build_BuildReport (CheckPythonSyntax.Tests) ... ok
test_build___init__ (CheckPythonSyntax.Tests) ... ok
test_build_build (CheckPythonSyntax.Tests) ... ok
test_sitecustomize (CheckPythonSyntax.Tests) ... ok
test32bitUnicodeCharInUtf8Comment (CheckUnicodeSourceFiles.Tests) ... ok
test32bitUnicodeCharInUtf8File (CheckUnicodeSourceFiles.Tests) ... ok
testSupplementaryPlaneUnicodeCharInUtf16File (CheckUnicodeSourceFiles.Tests) ...
ok
testSurrogatePairUnicodeCharInUtf16File (CheckUnicodeSourceFiles.Tests) ... ok
testSurrogatePairUnicodeCharInUtf8File (CheckUnicodeSourceFiles.Tests) ... ok
testSurrogatePairUnicodeCharInUtf8FileWithBom (CheckUnicodeSourceFiles.Tests) ..
. ok
testUtf16InUniFile (CheckUnicodeSourceFiles.Tests) ... ok
testValidUtf8File (CheckUnicodeSourceFiles.Tests) ... ok
testValidUtf8FileWithBom (CheckUnicodeSourceFiles.Tests) ... ok

-----
Ran 270 tests in 4.121s

OK
make[1]: Leaving directory '/home/uefi/src/edk2-ws/edk2/BaseTools/Tests'
make: Leaving directory '/home/uefi/src/edk2-ws/edk2/BaseTools'
uefi@clr-0 :: ~/src/edk2-ws/edk2 $
```


Platform Pre & Post Build Scripts

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

For MinnowBoard Max :

Pre build processing:

Python script Vlv2TbltDevicePkg/**PreBuild.py** – determines date and creates BiosId.bin in build output directory

Post build processing:

Python script Vlv2TbltDevicePkg/Feature/Capsule/GenerateCapsule/**GenCapsuleAll.py** – creates .CAP files for updating

Build Process for DEBUG Target

4

From the edk2/ directory invoke the “build” command to build MinnowBoard Max

```
bash$ build -a IA32 -a X64 -t GCC5 -p Vlv2TbлтDevicePkg/PlatformPkgX64.dsc -y Vlv.report -v
```

```
uefi@clr-0 :: ~/src/MaxWs/edk2
uefi@clr-0~/src/MaxWs/edk2 $ build -a IA32 -a X64 -n 5 -t GCC5 -b DEBUG -p Vlv2TbлтDevicePkg/PlatformPkgX64.dsc -y Vlv.report
Build environment: Linux-5.2.9-823.native-x86_64-with-glibc2.29
Build start time: 10:12:47, Aug.21 2019

WORKSPACE      = /home/uefi/src/MaxWs
PACKAGES_PATH   = /home/uefi/src/MaxWs/edk2:/home/uefi/src/MaxWs/edk2-platforms/Silicon/Intel:/home/uefi/src/MaxWs/edk2-platforms/Platform/Intel:/home/uefi/src/MaxWs/edk2-non-os/Intel

PreBuild: python /home/uefi/src/MaxWs/edk2-platforms/Platform/Intel/Tools/GenBiosId/GenBiosId.py -i /home/uefi/src/MaxWs/Build/Vlv2TbлтDevicePkgX64/DEBUG_GCC5/BiosId.env -o /home/uefi/src/MaxWs/Build/Vlv2TbлтDevicePkgX64/DEBUG_GCC5/BiosId.bin -ot /home/uefi/src/MaxWs/Build/Vlv2TbлтDevicePkgX64/DEBUG_GCC5/BiosId.txt
PreBuild:
End of Pre-BUILD
Press Enter key to continue
```

Press Enter to
Continue the build

Examine Build Parameters

```
build -a IA32 -a X64 -t GCC5 -p
      Vlv2TbltDevicePkg\PlatformPkgX64.dsc -y Vlv.report -v
```

TARGET	= DEBUG
TARGET_ARCH	= IA32 X64
TOOL_CHAIN_TAG	= GCC5
ACTIVE_PLATFORM	= Vlv2TbltDevicePkg /PlatformPkgX64
Report file created	= Vlv.report

Build Mode

CPU Architecture

GCC Tool Chain

Platform DSC file

PCDs, Libs, etc.

Platform Build and PCD Parameters

Platform Parameters

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

For MinnowBoard Max : v1v2Tb1tDevicePkg/PlatformPkgConfig.dsc

Example:

```
#
# TRUE is ENABLE. FALSE is DISABLE.
#
// . . .
DEFINE SECURE_BOOT_ENABLE = TRUE
DEFINE USER_IDENTIFICATION_ENABLE = FALSE
DEFINE VARIABLE_INFO_ENABLE = FALSE
DEFINE S3_ENABLE = TRUE
DEFINE CAPSULE_ENABLE = TRUE
DEFINE CAPSULE_RESET_ENABLE = TRUE
// . . .
```


Build Process for RELEASE Target

From the edk2/ directory invoke the “build” command to build MinnowBoard Max

```
$bash build -a IA32 -a X64 -t GCC5 -b RELEASE -p Vlv2TbлтDevicePkg/PlatformPkgX64.dsc -v
```

```
uefi@clr-0 :: ~/src/MaxWs/edk2
g/PreBuild.py -a IA32 -a X64 -n 5 -t GCC5 -b RELEASE -p Vlv2TbлтDevicePkg/PlatformPkgX64.dsc
-y Vlv-R.report -v --conf=/home/uefi/src/MaxWs/edk2/Conf all
POSTBUILD      = python /home/uefi/src/MaxWs/edk2-platforms/Platform/Intel/Vlv2TbлтDevicePk
g/Feature/Capsule/GenerateCapsule/GenCapsuleAll_EDKII_TEST.py -a IA32 -a X64 -n 5 -t GCC5 -b
RELEASE -p Vlv2TbлтDevicePkg/PlatformPkgX64.dsc -y Vlv-R.report -v --conf=/home/uefi/src/MaxW
s/edk2/Conf all

- Prebuild Start -

PreBuild: RelativePath/home/uefi/src/MaxWs/Build/Vlv2TbлтDevicePkgX64/RELEASE_GCC5
PreBuild: mkdir Build/Vlv2TbлтDevicePkgX64/RELEASE_GCC5
PreBuild: python /home/uefi/src/MaxWs/edk2-platforms/Platform/Intel/Tools/GenBiosId/GenBiosId
.py -i /home/uefi/src/MaxWs/Build/Vlv2TbлтDevicePkgX64/RELEASE_GCC5/BiosId.env -o /home/uefi/
src/MaxWs/Build/Vlv2TbлтDevicePkgX64/RELEASE_GCC5/BiosId.bin -ot /home/uefi/src/MaxWs/Build/V
lv2TbлтDevicePkgX64/RELEASE_GCC5/BiosId.txt
PreBuild:
PreBuild:
End of Pre-BUILD
Press Enter key to continue
```

Press Enter to
Continue the build

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

5 Locate the build .Cap image



```
uefi@clr-0: ~/src/MaxWs/edk2
GenCapsuleAll_EDKII_TEST: Generate Capsule: 72E2945A-00DA-448E-9AA7-075AD840F9D4 00000010 000
00000 /home/uefi/src/MaxWs/Build/Vlv2TbltDevicePkgX64/Capsules/Red.bin
GenCapsuleAll_EDKII_TEST: Generate Capsule: 79179BFD-704D-4C90-9E02-0AB8D968C18A 00000020 000
00020 /home/uefi/src/MaxWs/Build/Vlv2TbltDevicePkgX64/Capsules/Green.bin
GenCapsuleAll_EDKII_TEST: Generate Capsule: 149DA854-7D19-4FAA-A91E-862EA1324BE6 00000010 000
00000 /home/uefi/src/MaxWs/Build/Vlv2TbltDevicePkgX64/Capsules/Blue.bin
GenCapsuleAll_EDKII_TEST: Generate Capsule: 4096267B-DA0A-42EB-B5EB-FEF31D207CB4 0000000c 000
00000 /home/uefi/src/MaxWs/Build/Vlv2TbltDevicePkgX64/DEBUG_GCC5/EV/VLV.fd
GenCapsuleAll_EDKII_TEST:
*** Capsule update files in directory :
*** /home/uefi/src/MaxWs/Build/Vlv2TbltDevicePkgX64/CapsulesTestCert_X64_DEBUG_GCC5
End of Post-BUILD

- Postbuild Done -

Build report can be found at /home/uefi/src/MaxWs/Vlv.report

- Done -
Build end time: 10:24:39, Aug.21 2019
Build total time: 00:11:41
```

The platform post build process will create capsule images from the multiple firmware volumes generated by the EDK II build process

6 Flash the binary image

1. Access Max .CAP files from build folder


-/Build/Vlv2TbltDevicePkgX64/Capsules/TestCert_X64_DEBUG_GCC5
- *.cap
- RELEASE/Capsules/TestCert_X64_RELEASE_GCC5

2. Copy .cap files to a USB Thumb drive

3. Copy CapsuleApp.efi to a USB thumb drive

4. Boot into the UEFI Shell on Max then type "FS0:"

using "screen" `bash$ screen /dev/ttyUSB0 115200`



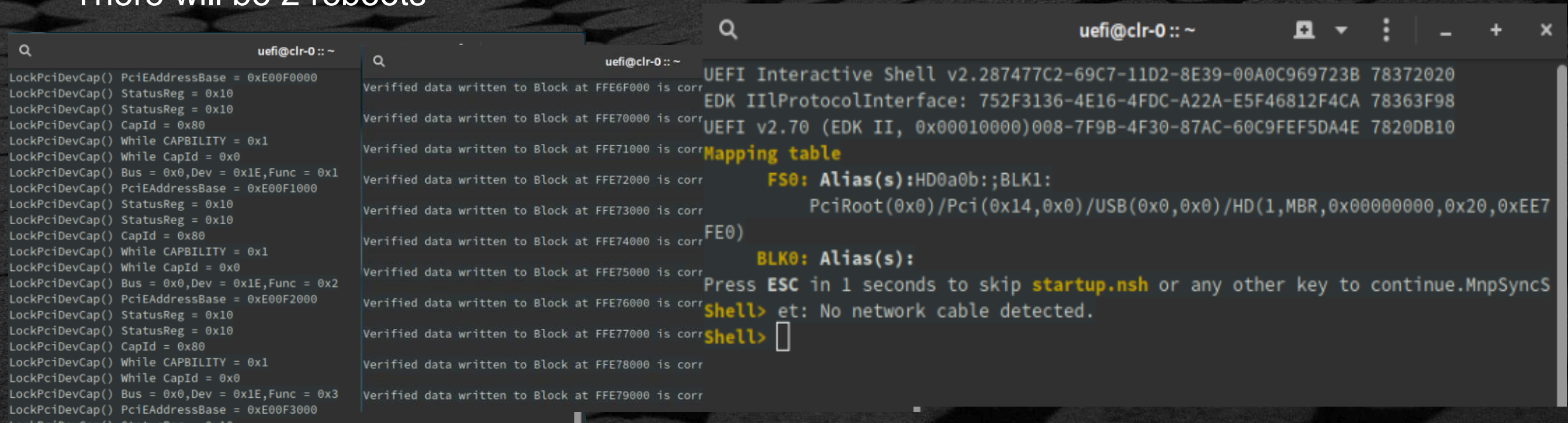
```
PciRoot(0x0)/Pci(0x14,0x0)/USB(0x0,0x0)/HD(1,MBR,0x00000000,0x20,0xEE7
FE0)
  BLK0: Alias(s):
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.MnpSyncS
Shell> et: No network cable detected.
Shell> fs0:
fs0:\> █
```


6 Run CapsuleApp.efi utility with MinnowMax. . . cap file (Note the “*TAB*” Key will fill out the command line for you)

```
FS0:\> CapsuleApp.efi MinnowMax.0.0.0.12.cap
```

System will start the Capsule update process

There will be 2 reboots



The image shows three sequential screenshots of the UEFI Interactive Shell during a firmware update process.

Left Screenshot: Shows the execution of the `LockPciDevCap()` function multiple times, verifying data written to various blocks (e.g., FFE6F000, FFE70000, FFE71000, FFE72000, FFE73000, FFE74000, FFE75000, FFE76000, FFE77000, FFE78000, FFE79000).

Middle Screenshot: Shows the completion of the update process with the message: "Verified data written to Block at FFE79000 is correct".

Right Screenshot: Shows the UEFI Interactive Shell v2.287477C2-69C7-11D2-8E39-00A0C969723B 78372020. It displays the EDK II Protocol Interface: 752F3136-4E16-4FDC-A22A-E5F46812F4CA 78363F98. The shell prompts the user to press ESC in 1 seconds to skip `startup.nsh` or any other key to continue. The user presses ESC, and the shell displays the mapping table:

```
Mapping table
FS0: Alias(s):HD0a0b::;BLK1:
PciRoot(0x0)/Pci(0x14,0x0)/USB(0x0,0x0)/HD(1,MBR,0x00000000,0x20,0xEE7
FE0)
BLK0: Alias(s):
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.MnpSyncS
Shell> et: No network cable detected.
Shell> 
```


Capsule update with external Monitor

Logo with a progress bar will display update process progress



Verify After Firmware Update

7 Reboot and Verify

- Verify that the Firmware was updated by checking the Date
- At the shell prompt type “exit”
- The EDK II front page will show the BIOS ID with Date/time stamp

```
Shell>
```

```
Shell> exit
```



SUMMARY

- ★ Hardware Setup for MinnowBoard Max/Turbot
- ★ Build a EDK II Platform using MinnowBoard Max/Turbot

Questions?



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