

UEFI & EDK II Training

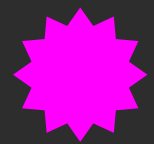



**Platform Build Lab - Simics[®] Quick Start Platform(QSP)
- Linux**

Copy and Paste see [Lab Guide.md](#)

tianocore.org

PLATFORM BUILD LABS

First Setup for Building EDK II, See [Lab Setup](#)

-  Build a EDK II Platform using OVMF package
-  Run Ovmf using Qemu
-  Build a EDK II Platform using Simics Open Source QSP Board
-  Run Simics with the QSP Board

Build the Ovmf Platform

BUILD EDK II OVMF

-Update Target.txt

What is OVMF?

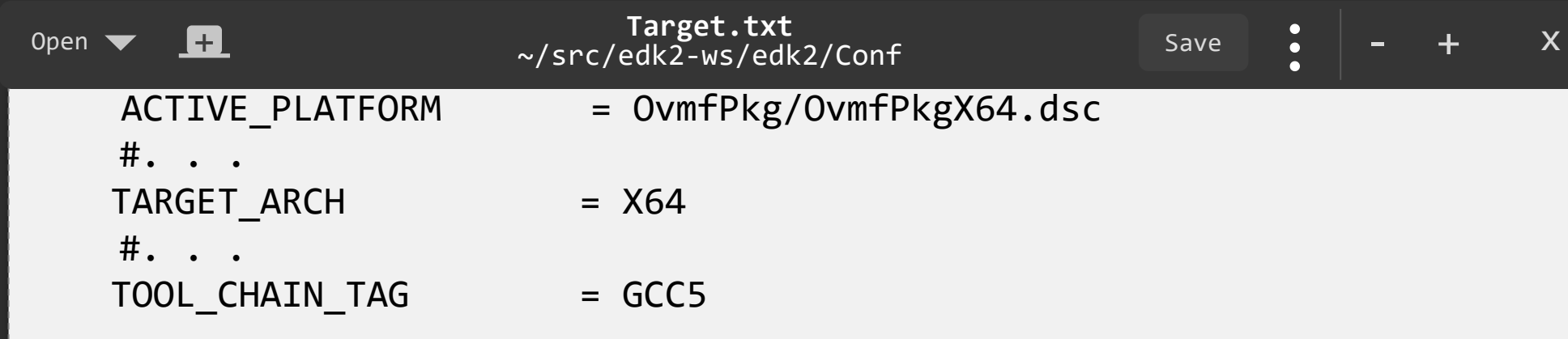
Open Virtual Machine Firmware - Build with edk2

```
$ cd ~/fw/edk-ws/edk2  
$ . edksetup.sh
```

```
uefi@clr-0~/src/edk2-ws/edk2 $ . edksetup.sh  
Loading previous configuration from /home/uefi/src/edk2-ws/edk2/Conf/Build  
WORKSPACE: /home/uefi/src/edk2-ws  
EDK_TOOLS_PATH: /home/uefi/src/edk2-ws/edk2/BaseTools  
CONF_PATH: /home/uefi/src/edk2-ws/edk2/Conf  
uefi@clr-0~/src/edk2-ws/edk2 $
```

Edit the file Conf/target.txt

```
$ gedit Conf/target.txt
```



```
Open ▼ + Target.txt  
~/src/edk2-ws/edk2/Conf Save ⋮ - + X  
1. ACTIVE_PLATFORM = OvmfPkg/OvmfPkgX64.dsc  
   #. . .  
2. TARGET_ARCH = X64  
   #. . .  
3. TOOL_CHAIN_TAG = GCC5
```

Save and build

```
$ build -D ADD_SHELL_STRING
```

More info: [tianocore - wiki/OVMF](https://tianocore.org/wiki/OVMF)

BUILD EDK II OVMF

-Inside Terminal

```

uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/src/edk2-ws/edk2
Generate Region at Offset 0xF000
Region Size = 0x1000
Region Name = None
Generate Region at Offset 0x10000
Region Size = 0x10000
Region Name = None
Generate Region at Offset 0x20000
Region Size = 0xE0000
Region Name = FV
Generate Region at Offset 0x100000
Region Size = 0xC00000
Region Name = FV
GUID cross reference file can be found at /home/uefi/src/edk2-ws/Build/OvmfX64/DEBUG_GCC5/SECDEFV/SecDefV.xref
FV Space Information
SECFV [20%Full] 212992 (0x34000) total, 42688 (0xa6c0) used, 170304 (0x29940) free
PEIFV [23%Full] 917504 (0xe0000) total, 211112 (0x338a8) used, 706392 (0xac758) free
DXEFV [35%Full] 12582912 (0xc00000) total, 4419600 (0x437010) used, 8163312 (0x7c1ff0) free
FVMAIN_COMPACT [36%Full] 3440640 (0x348000) total, 1251760 (0x1319b0) used, 2188880 (0x216650) free
Done -
Build end time: 11:40:47, Apr.05 2022
Build total time: 00:06:02
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/src/edk2-ws/edk2$
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/src/edk2-ws/edk2$

Active Platform = /home/uefi/src/edk2-ws/edk2/OvmfPkg/OvmfPkgX64.dsc

```

Finished build

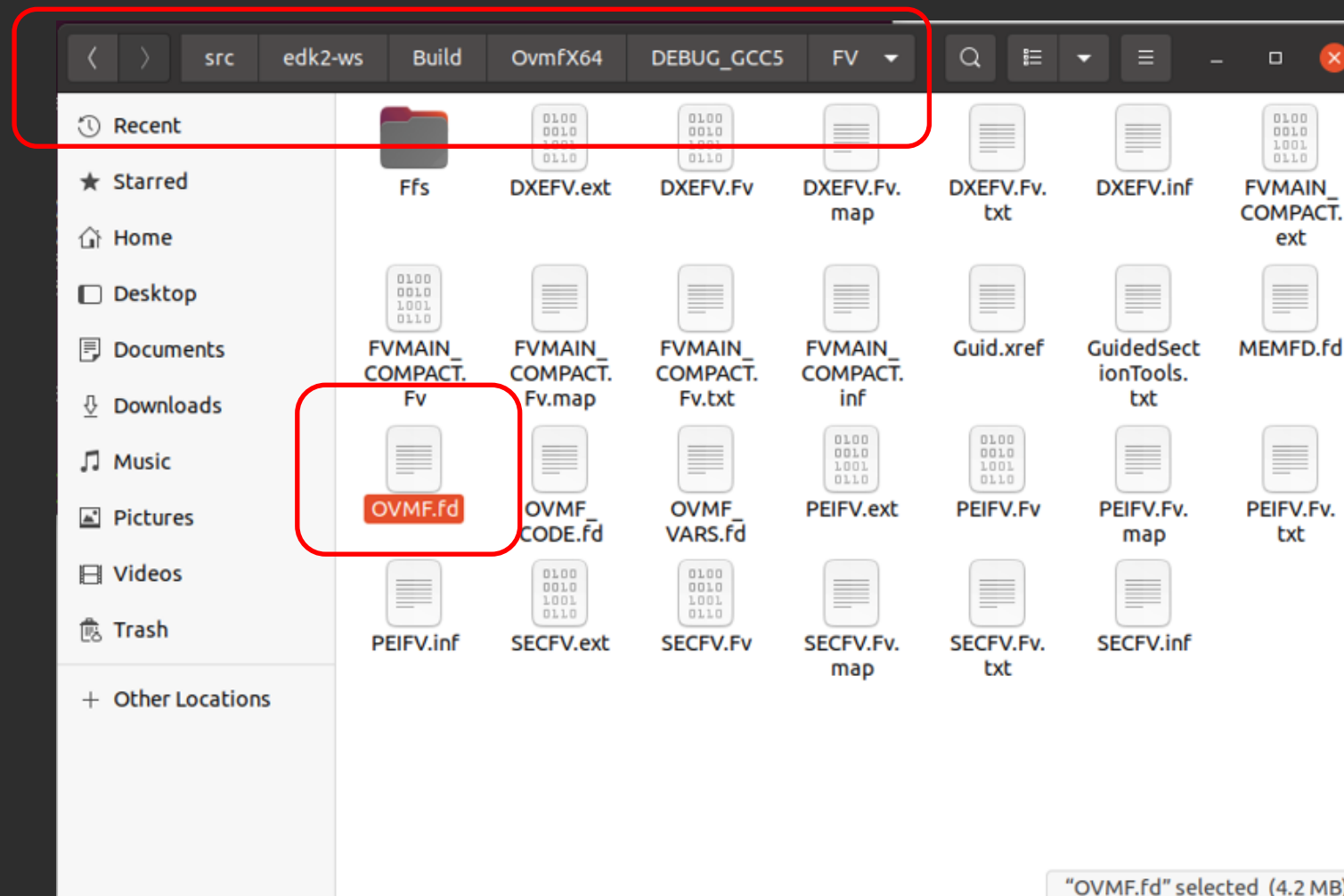
BUILD EDK II OVMF

-Verify Build Succeeded

OVMF.fd should be in the Build directory

- For GCC5 with X64, it should be located at

```
~/fw/edk2-ws/Build/OvmfX64/DEBUG_GCC5/FV/OVMF.fd
```





Change to run-ovmf directory under the home directory

```
bash$ cd $HOME/run-ovmf
```

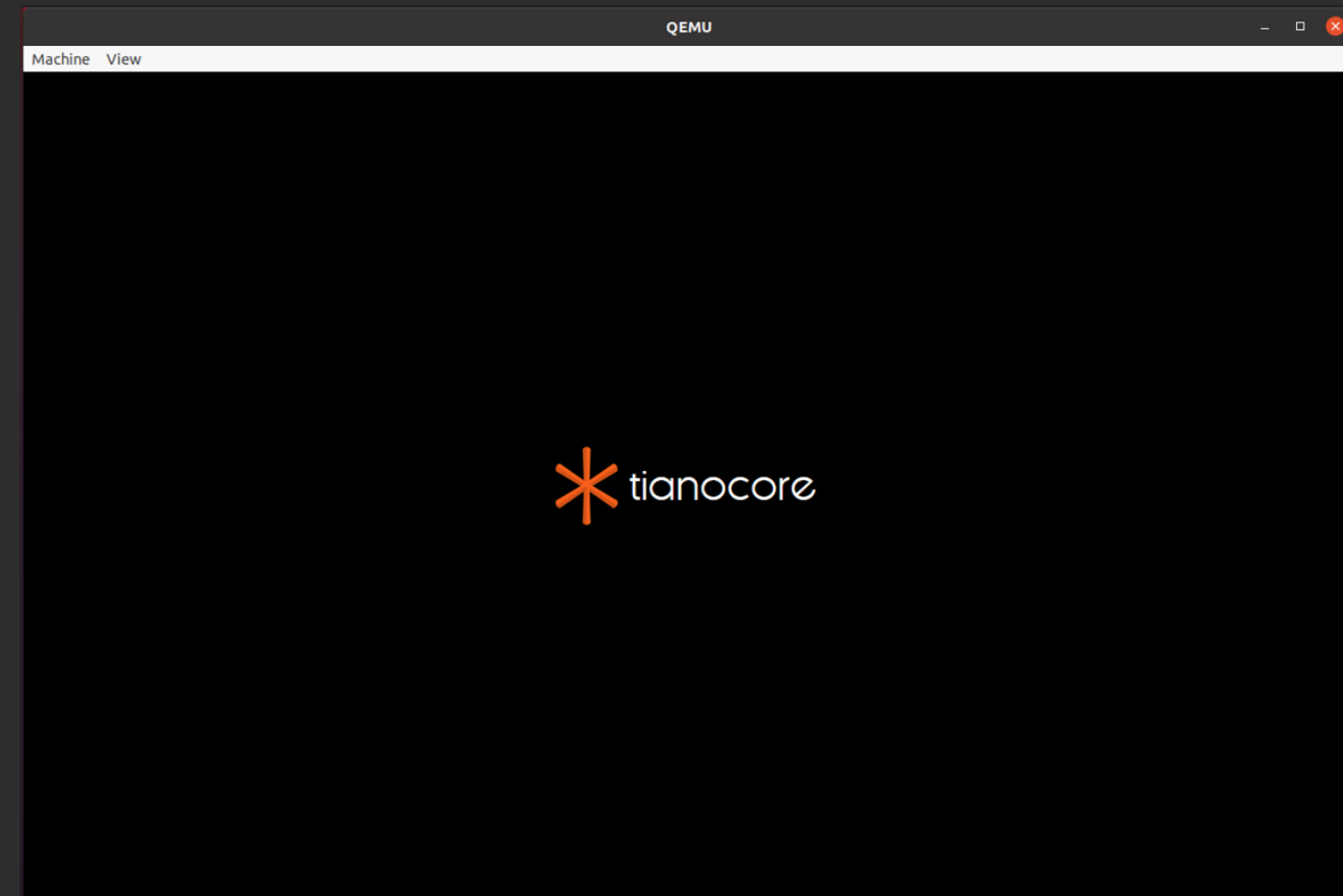
Copy the OVMF.fd BIOS image created from the build to the run-ovmf directory naming it bios.bin

```
bash$ cp ~/fw/edk2-  
ws/Build/OvmfX64/DEBUG_GCC5/FV/OVMF.fd  
bios.bin
```

Run the RunQemu.sh Linux shell script

```
bash$ . RunQemu.sh
```

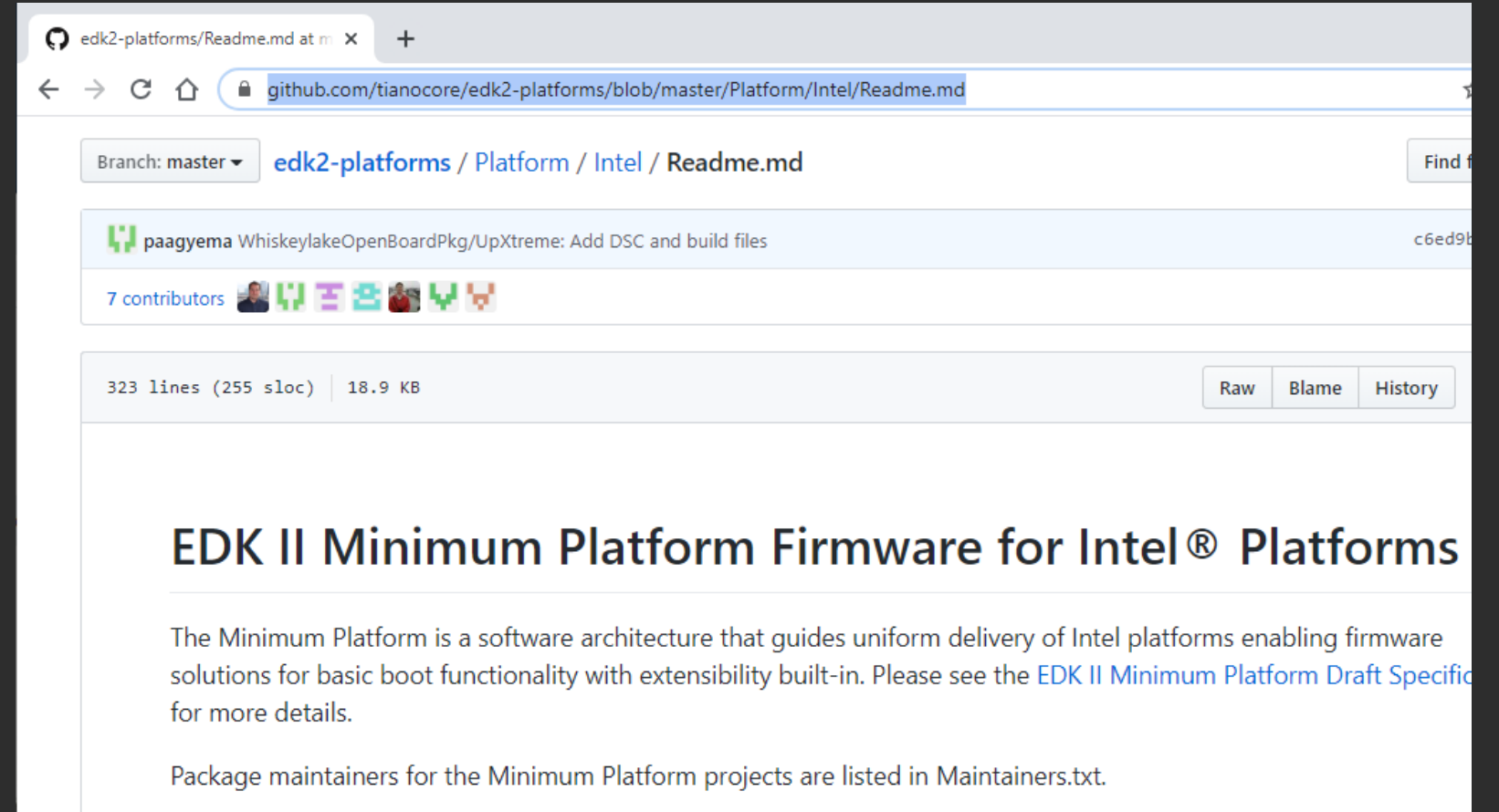
Exit QEMU



Build QSP Simics Open Board

Where to get Open Source Simics

How to Download & Build: Open Source MinPlatform [Readme.md](#)



MinPlatform Open Board Tree Structure

edk2/ <https://github.com/tianocore/edk2>

. . .

edk2-platforms/ <https://github.com/tianocore/edk2-platforms>

Platform/

Intel/

BoardModulePkg

SimicsOpenBoardPkg

BoardX58Ich10

MinPlatformPkg

Silicon/

Intel/

SimicsIch10Pkg

SimicsX58ktPkg

. . .

Features/Intel

AdvancedFeaturePkg

edk2-non-os/ <https://github.com/tianocore/edk2-non-os>

Silicon/

Intel/

SimicsIch10BinPkg

FSP/ <https://github.com/IntelFsp/FSP>

Invoke the Build .py from here

Platform DSC & FDF here

Open Another Terminal Prompt

1. Open another Terminal Prompt in \$HOME/fw/edk2-ws

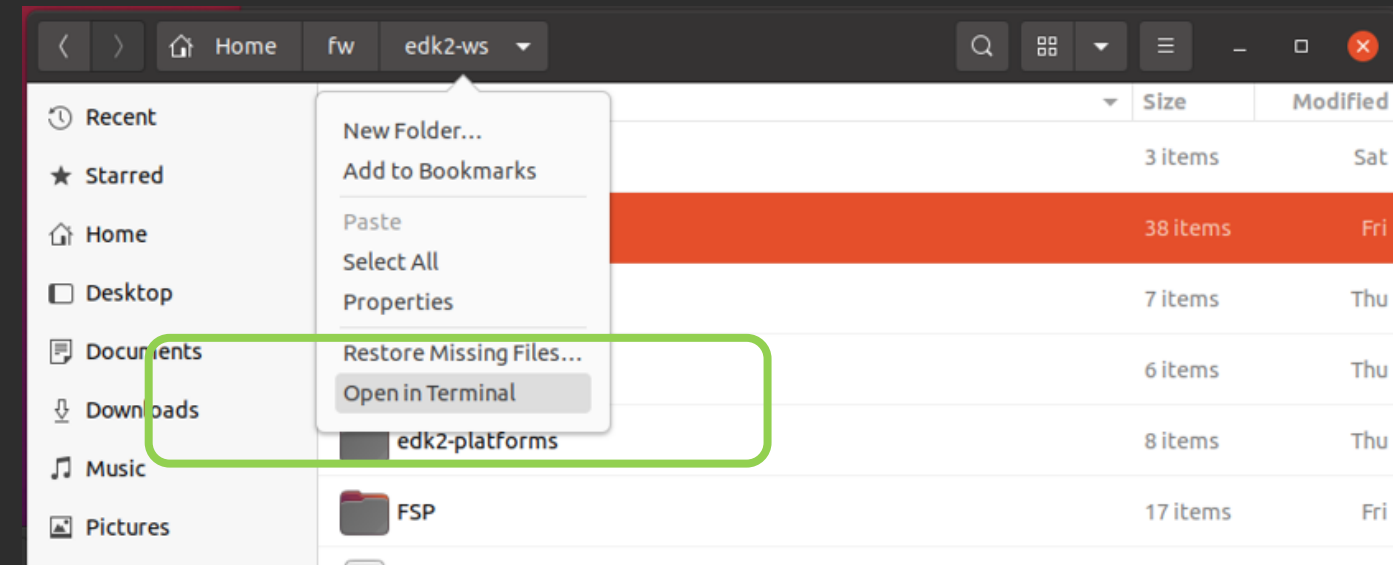
2. Then CD to edk2 to do edksetup.sh

```
$ cd ~/fw/edk2-ws/edk2
```

```
$ . edksetup.sh
```

3. Then CD to:

```
$ cd ~/fw/edk2-ws/edk2-  
platforms/Platform/Intel
```



```
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/fw/edk2-w...
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws$ cd edk2
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws/edk2$ . edksetup.sh
Loading previous configuration from /home/uefi/fw/edk2-ws/edk2/Conf/BuildEnv.sh
Using EDK2 in-source Basetools
WORKSPACE: /home/uefi/fw/edk2-ws/edk2
EDK_TOOLS_PATH: /home/uefi/fw/edk2-ws/edk2/BaseTools
CONF_PATH: /home/uefi/fw/edk2-ws/edk2/Conf
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws/edk2$ cd ..
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws$ cd edk2-platforms/Platform/Intel/
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws/edk2-platforms/Platform/Intel$
```

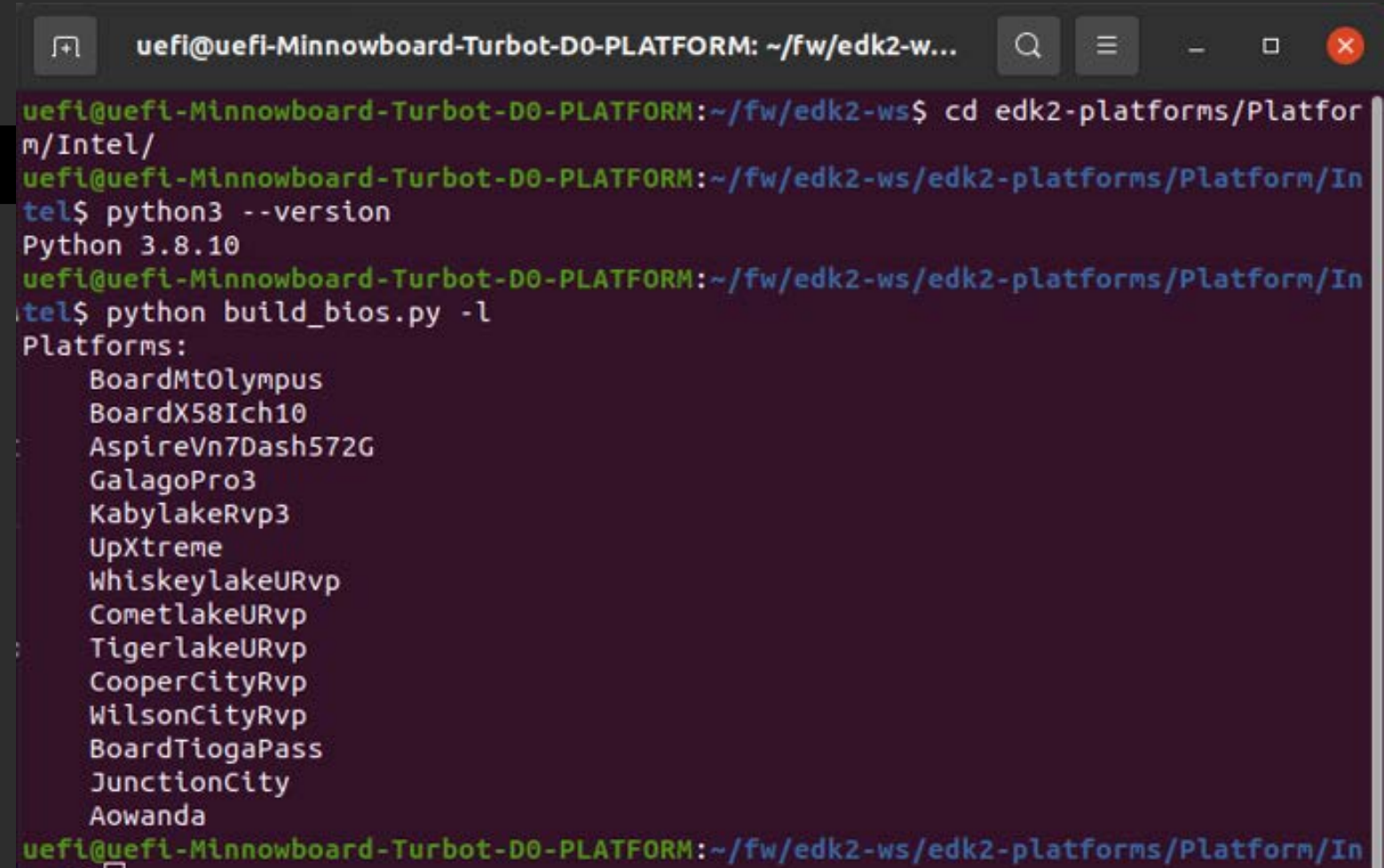
Build Environment

Check if Python is okay (may also need to set PYTHON_HOME)

```
$ python --version  
Python 3.8.10
```

Check for available MinPlatform Boards

```
$ python build_bios.py -l
```



```
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/fw/edk2-w...  
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws$ cd edk2-platforms/Platform/Intel/  
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws/edk2-platforms/Platform/Intel$ python3 --version  
Python 3.8.10  
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws/edk2-platforms/Platform/Intel$ python build_bios.py -l  
Platforms:  
BoardMtOlympus  
BoardX58Ich10  
AspireVn7Dash572G  
GalagoPro3  
KabyLakeRvp3  
UpXtreme  
WhiskeylakeURvp  
CometlakeURvp  
TigerlakeURvp  
CooperCityRvp  
WilsonCityRvp  
BoardTiogaPass  
JunctionCity  
Aowanda  
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws/edk2-platforms/Platform/Intel$
```


Invoke the Build

Invoke the Python Build script for Simics QSP

```
$ python build_bios.py -p BoardX58Ich10 -t GCC5
```



Takes
about 8
minutes

```
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/fw/edk2-w...
test_build_build WORKSPACE = /home/uefi/fw/edk2-ws
test_build_build PACKAGES_PATH = /home/uefi/fw/edk2-ws/edk2-platforms/Platform/Intel
test_sitecustomi /home/uefi/fw/edk2-ws/edk2-platforms/Platform/Intel: /home/uefi/fw/edk2-ws/edk2-platforms/Silicon/Intel: /home/uefi/fw/edk2-ws/edk2-non-osi/Silicon/Intel: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel
test_tests_Spliticon/Intel: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/SystemInformation: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/UserInterface: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Debugging: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/PowerManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/OutOfBandManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Network: /home/uefi/fw/edk2-ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
test32bitUnicode2-ws/edk2-platforms/Features/Intel: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Debugging: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/PowerManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/OutOfBandManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Network: /home/uefi/fw/edk2-ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
test32bitUnicodeplatforms/Features/Intel: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Debugging: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/PowerManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/OutOfBandManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Network: /home/uefi/fw/edk2-ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
testSupplementaures/Intel/Debugging: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/PowerManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/OutOfBandManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Network: /home/uefi/fw/edk2-ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
testSurrogatePaagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/PowerManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/OutOfBandManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Network: /home/uefi/fw/edk2-ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
testSurrogatePa: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/PowerManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/OutOfBandManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Network: /home/uefi/fw/edk2-ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
testSurrogatePa ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
testUtf16InUniFhome/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
testValidUtf8Fi EDK_TOOLS_PATH = /home/uefi/fw/edk2-ws/edk2/BaseTools
testValidUtf8Fi CONF_PATH = /home/uefi/fw/edk2-ws/Conf
PYTHON_COMMAND = /usr/bin/python3.8
-----
Processing meta-data .: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/SystemInformation: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/UserInterface: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Debugging: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/PowerManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/OutOfBandManagement: /home/uefi/fw/edk2-ws/edk2-platforms/Features/Intel/Network: /home/uefi/fw/edk2-ws/edk2-platforms/Drivers: /home/uefi/fw/edk2-ws/FSP: /home/uefi/fw/edk2-ws/edk2: /home/uefi/fw/edk2-ws: /home/uefi/fw/edk2-ws/edk2-non-osi/Platform/Intel
Architecture(s) = IA32
Build target = DEBUG
Toolchain = GCC5
Active Platform platform/Intel
SimicsOpenBoardPkg/BoardX58Ich10
EDK_TOOLS_PATH = /home/uefi/fw/edk2-ws/edk2/BaseTools
CONF_PATH = /home/uefi/fw/edk2-ws/Conf
PYTHON_COMMAND = /usr/bin/python3.8
```

Rebuild takes about 2 minutes

Examine Build Parameters

```
Python build_bios.py -p BoardX58Ich10 -t GCC5
```

...

```
Calling build -n 0 --log=Build.log --report-file=BuildReport.log  
and from \edk2-ws\conf\target.txt
```

TARGET	= DEBUG	Build Mode
TARGET_ARCH	= IA32 X64	CPU Architecture
TOOL_CHAIN_TAG	= GCC5	VS Tool Chain
ACTIVE_PLATFORM	= ... /SimicsOpenBoardPkg/ BoardX58Ich10/OpenBoardPkg.dsc	Platform DSC file
Report file created (via python script)	= BuildReport.log	PCDs, Libs, etc.

Build EDK II

-Inside Command Prompt

```
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/fw/edk2-ws/edk2-platforms/Platform/Intel

Region Name = FV

Generate Region at Offset 0x100000
  Region Size = 0xA00000
  Region Name = FV

GUID cross reference file can be found at /home/uefi/fw/edk2-ws/Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG_GCC5/FV/Guid.xref

FV Space Information
FVTEMPMEMORYSILICON [26%Full] 81920 (0x14000) total, 22104 (0x5658) used, 59816 (0xe9a8) free
FVPREMEMORY [31%Full] 917504 (0xe0000) total, 290672 (0x46f70) used, 626832 (0x99090) free
DXEFV [47%Full] 10485760 (0xa00000) total, 5005272 (0x4c5fd8) used, 5480488 (0x53a028) free
FVMAIN_COMPACT [96%Full] 1490944 (0x16c000) total, 1441728 (0x15ffc0) used, 49216 (0xc040) free
Build report can be found at /home/uefi/fw/edk2-ws/BuildReport.log

- Done -
Build end time: 14:07:38, Jun.13 2022
Build total time: 00:01:08

Running post_build to complete the build process.
Done
Fd file can be found at /home/uefi/fw/edk2-ws/Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG_GCC5/FV/BOARDX58ICH10.fd
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/fw/edk2-ws/edk2-platforms/Platform/Intel$
```

Finished build

Note the location of the final .fd file

Invoke QSP Simics with BOARDX58ICH10

Open Intel Simics Project Manager

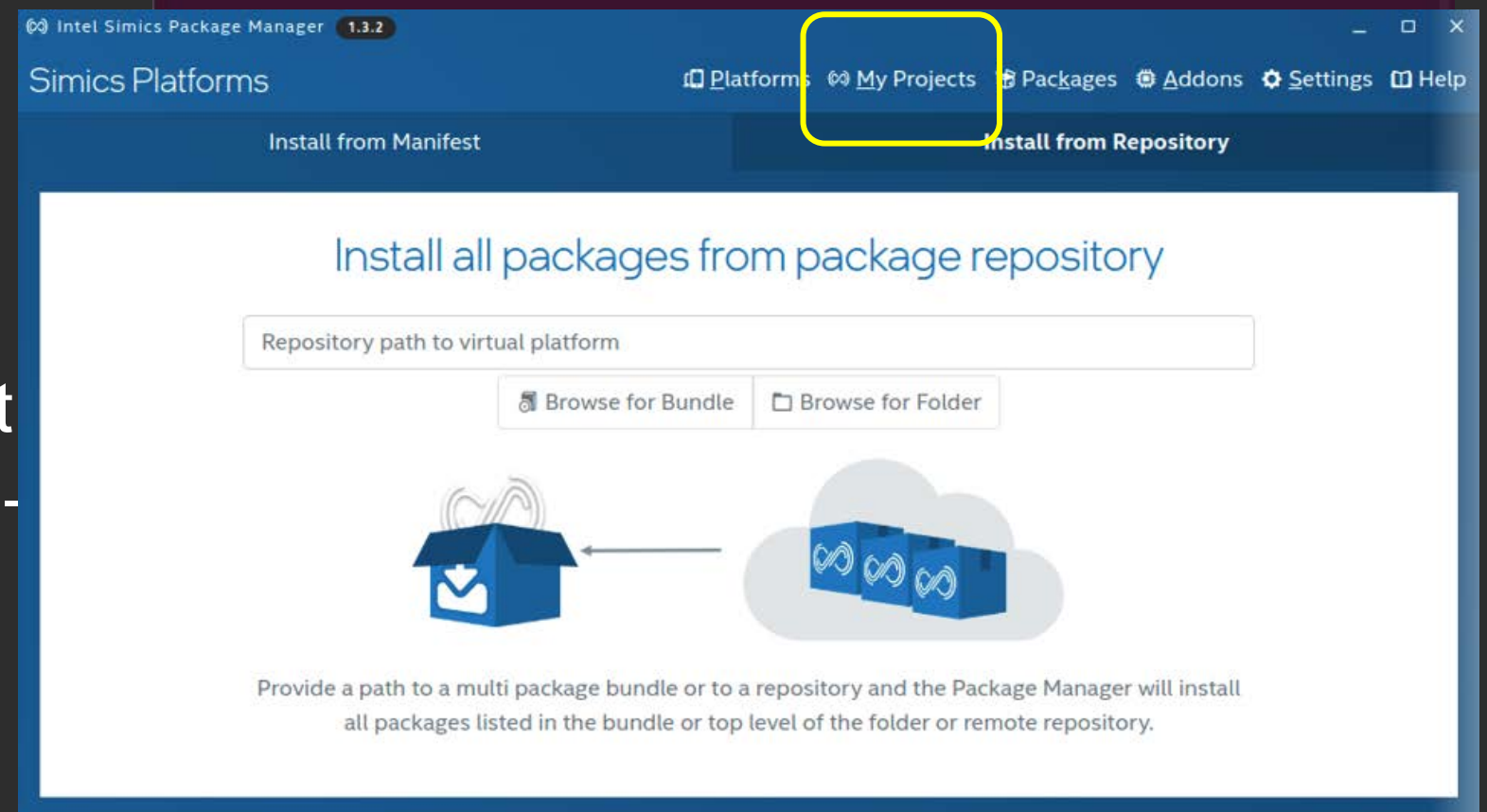
Open a terminal Prompt in the Un-tar directory of the Simics e.g., intel-simics-package-manager-1.2.3-linux64/

```
$ ./ispm-gui
```

In the GUI select My Projects

.Alternatively, Open a terminal prompt and cd to ~/simics-projects/my-simics-project-1

```
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/Simics/Int...
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM:~/Simics/intel-simics-package-manager-1.3.2-linux64/intel-simics-package-manager-1.3.2$ ./ispm-gui
[14734:0613/141927.859251:ERROR:sandbox_linux.cc(377)] InitializeSandbox() called with multiple threads in process gpu-process.
```

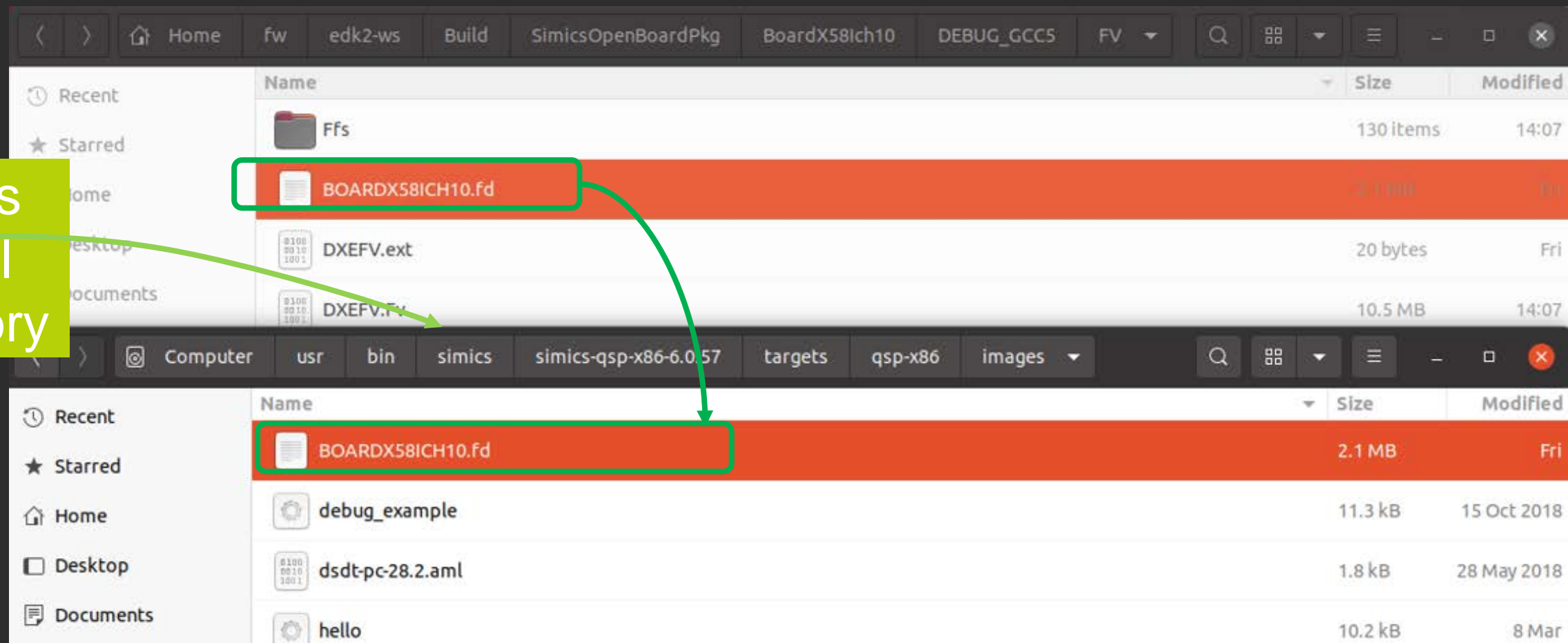


Copy BoardX85Ich10.fd to Simics

Copy `~/fw/edk2-ws/Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG_GCC5/FV/BOARDX58ICH10.fd`
To

`<SimicsInstallDir>/simics-qsp-x86-6.0.57/targets/qsp-x86/images`

Simics
Install
Directory



Update the Simics Script

Update the Simics Script to Use the BoardX85Ich10.fd image just built

Edit the file:

<SimicsInstallDir>/simics-qsp-x86-6.0.57/targets/qsp-x86/qsp-uefi.include

Where *SimicsInstallDir* is the directory selected to install Simics, e.g.,
Computer/usr/bin/simics

Replace

SIMICSX58IA32X64_1_0_0_bp_r.fd
With BOARDX58ICH10.fd

Save qsp-uefi.include

File: qsp-uefi.include

```
decl {  
  params from "qsp-images.include"  
  default bios_image =  
    "%simics%/targets/qsp-x86/images/BOARDX58ICH10.fd"  
  # "%simics%/targets/qsp-x86/images/SIMICSX58IA32X64_1_0_0_bp_r.fd"  
  default enable_efi = TRUE  
}
```

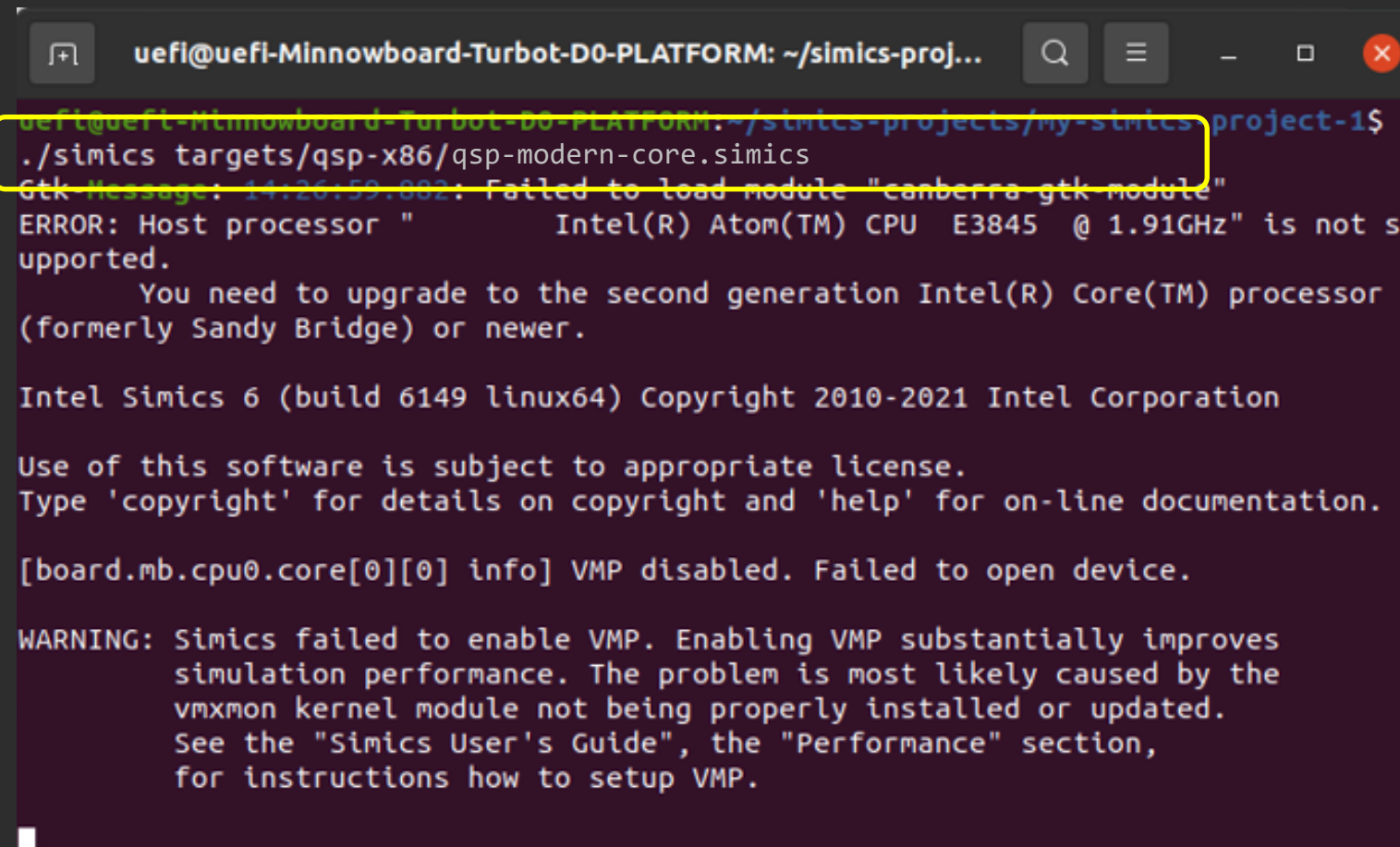
Invoke Simics QSP Script

Open A Simics Command Prompt: Double Click on



Invoke the qsp-modern-core script:

```
$> ./simics targets/qsp-x86/qsp-modern-core.simics
```



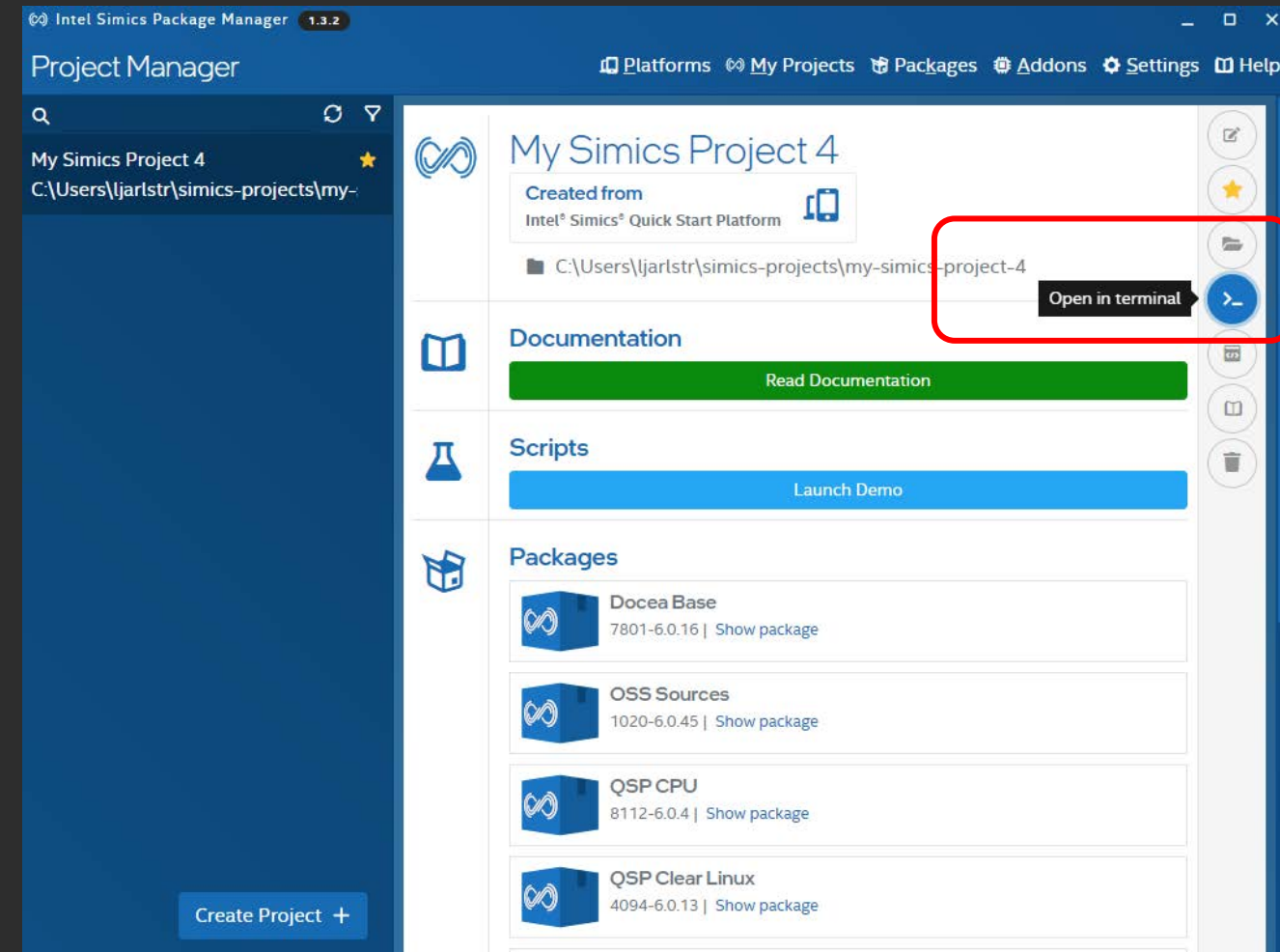
```
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/simics-proj...
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/simics-projects/my-simics-project-1$
./simics targets/qsp-x86/qsp-modern-core.simics
Gtk-Message: 14:26:59.082: Failed to load module "canberra-gtk-module"
ERROR: Host processor "Intel(R) Atom(TM) CPU E3845 @ 1.91GHz" is not supported.
You need to upgrade to the second generation Intel(R) Core(TM) processor (formerly Sandy Bridge) or newer.

Intel Simics 6 (build 6149 linux64) Copyright 2010-2021 Intel Corporation

Use of this software is subject to appropriate license.
Type 'copyright' for details on copyright and 'help' for on-line documentation.

[board.mb.cpu0.core[0][0] info] VMP disabled. Failed to open device.

WARNING: Simics failed to enable VMP. Enabling VMP substantially improves simulation performance. The problem is most likely caused by the vmxmon kernel module not being properly installed or updated. See the "Simics User's Guide", the "Performance" section, for instructions how to setup VMP.
```




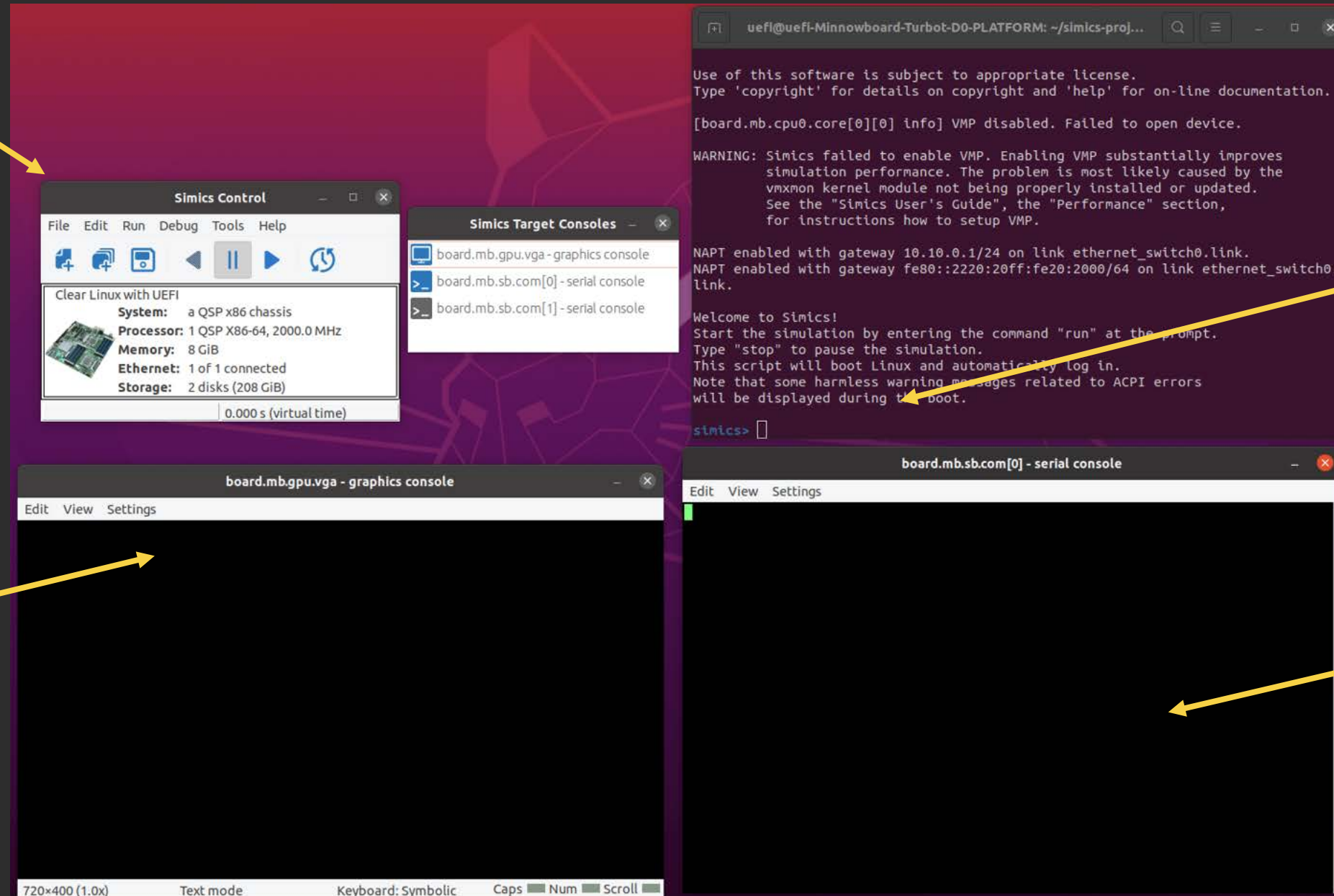
Simics Windows

After invoking the Simics QSP script, many Simics windows will have opened

Simics Control Console

Stop 

Run 



Target Graphics Console

Video from Target

Simics Command Prompt

Issue Simics Commands

Stop
Quit
Run
etc.

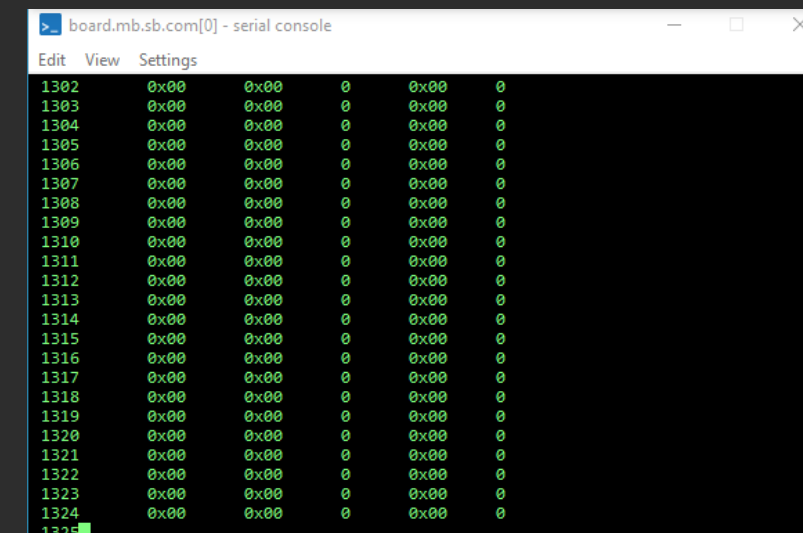
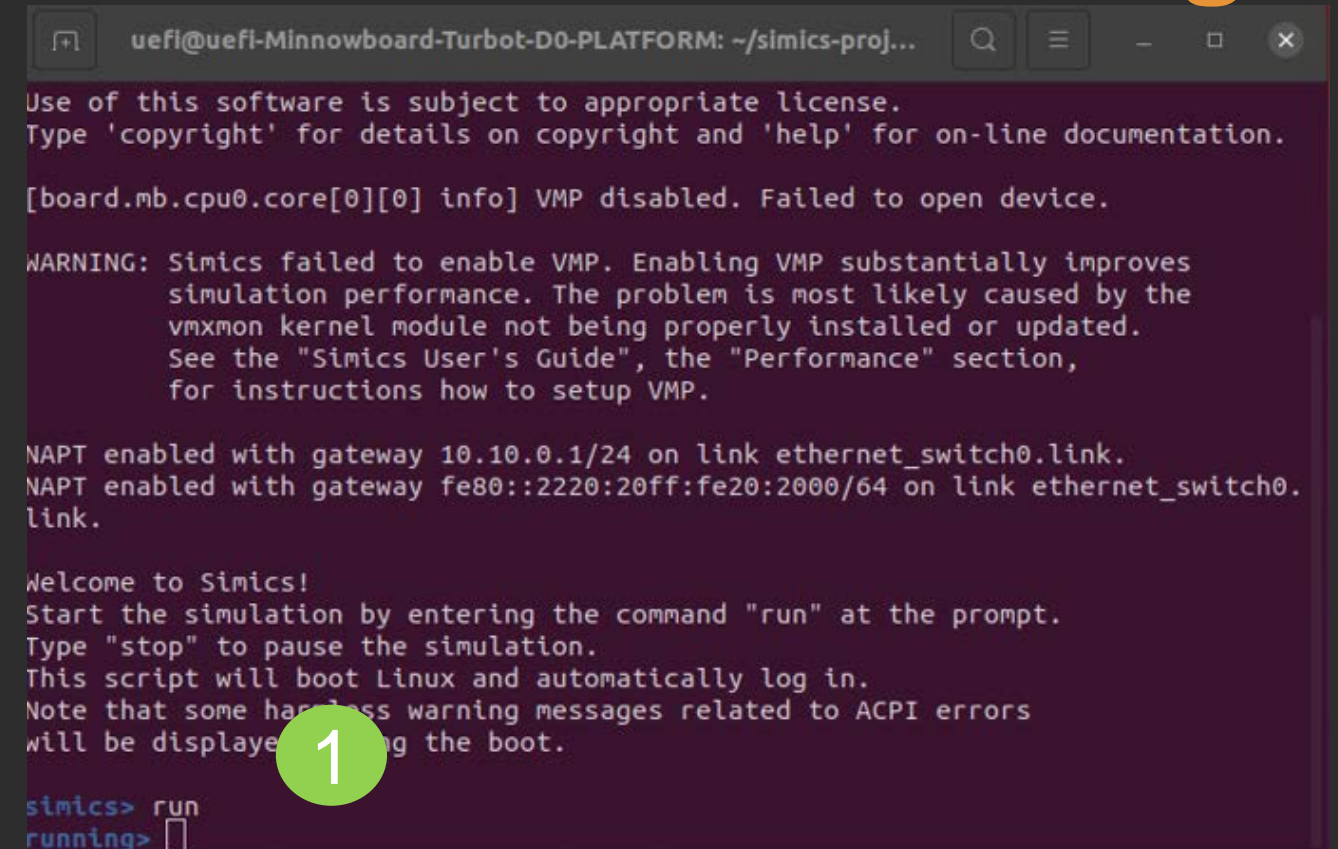
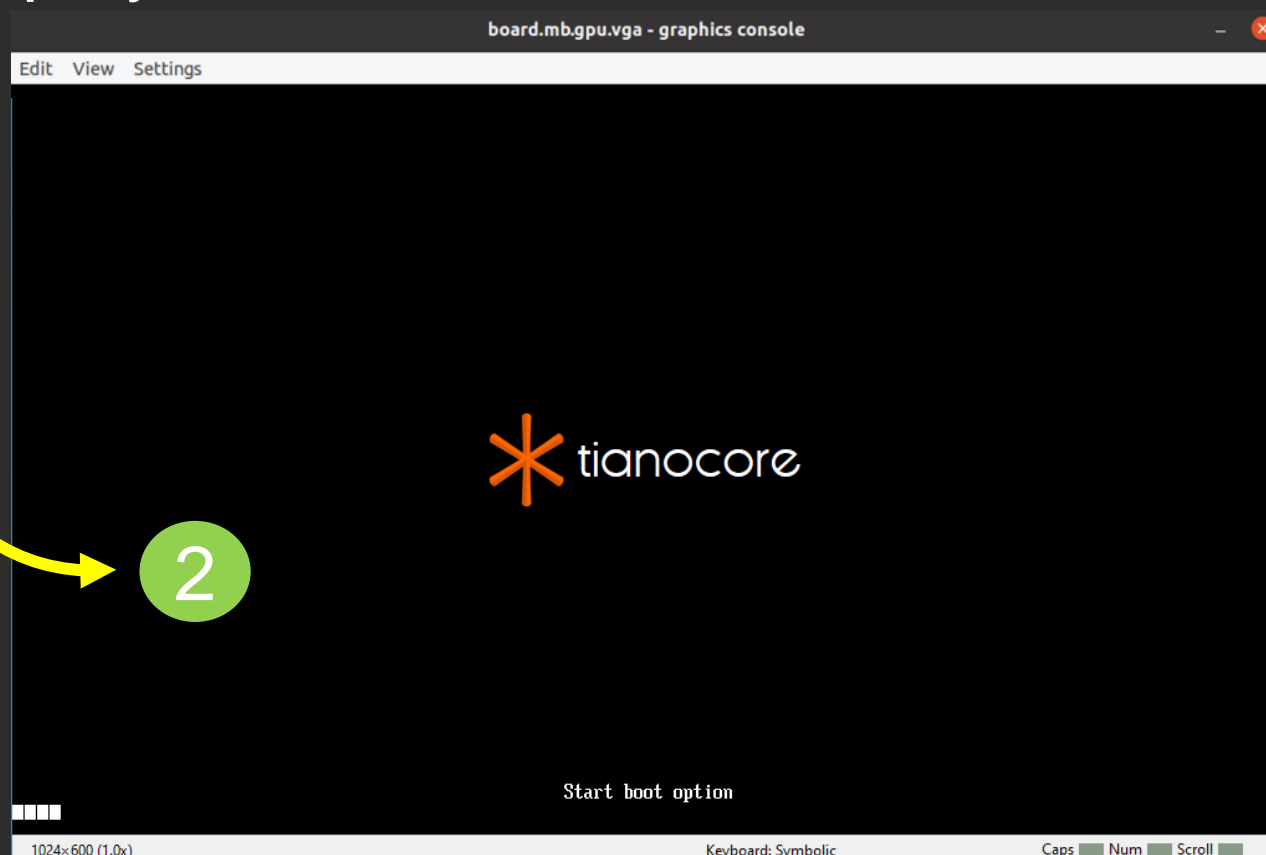
Target COM1 Console

Debug Output from Target

Simics Getting Started: <https://www.intel.com/content/www/us/en/developer/articles/guide/simics-simulator-get-started.html>

Run Simics to Boot Target

1. "Next type 'run' in the Simics command line
2. Be ready to press 'F2' in the Target Graphics console when logo is displayed

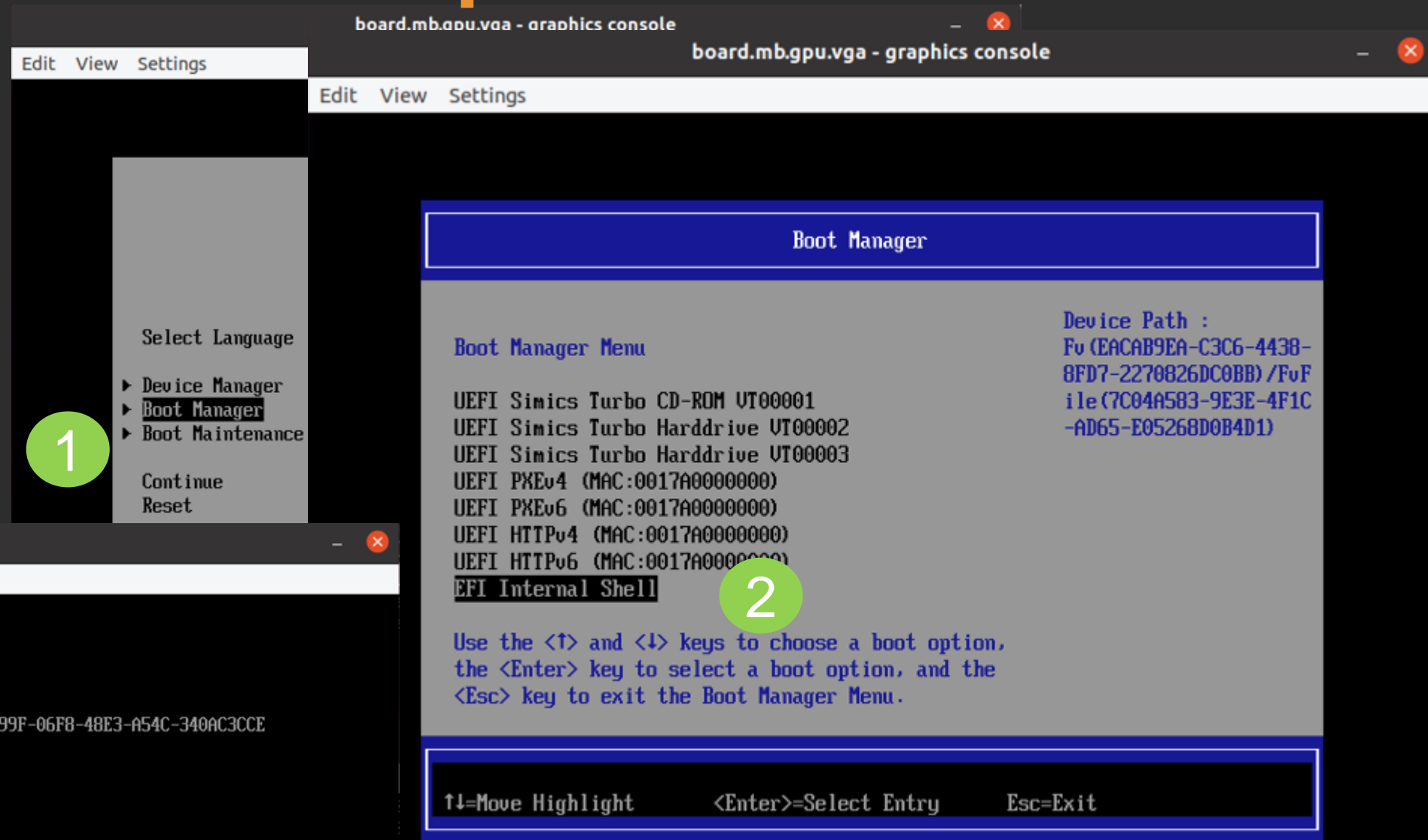


QSP Setup –Boot to UEFI Shell

From QSP Setup

1. Click on “Boot Manager”
2. Click on “EFI Internal Shell”

Boots to UEFI Shell



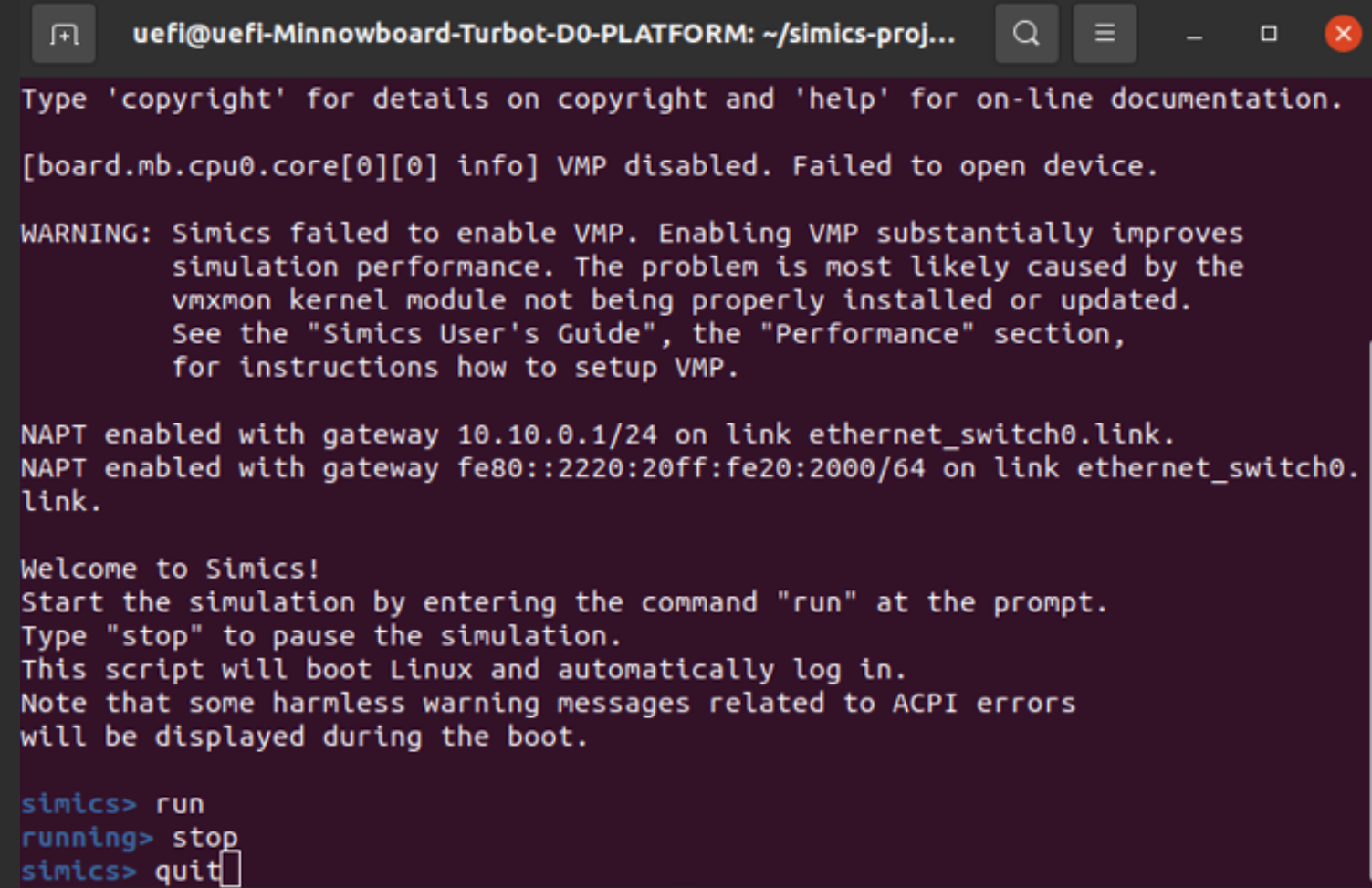
```
board.mb.gpu.vga - graphics console
Edit View Settings

UEFI Interactive Shell v2.2
EDK II
UEFI v2.70 (EDK II, 0x00010000)
Mapping table
FS0: Alias(s) :HD0a65535a1::BLK1:
PciRoot (0x0) /Pci (0x1F,0x2) /Sata (0x0,0xFFFF,0x0) /HD (1,GPT,529E199F-06F8-48E3-A54C-340AC3CCE
109,0x800,0x47000)
BLK0: Alias(s) :
PciRoot (0x0) /Pci (0x1F,0x2) /Sata (0x0,0xFFFF,0x0)
BLK5: Alias(s) :
PciRoot (0x0) /Pci (0x1F,0x2) /Sata (0x2,0xFFFF,0x0)
BLK4: Alias(s) :
PciRoot (0x0) /Pci (0x1F,0x2) /Sata (0x1,0xFFFF,0x0)
BLK2: Alias(s) :
PciRoot (0x0) /Pci (0x1F,0x2) /Sata (0x0,0xFFFF,0x0) /HD (2,GPT,33E3EDBE-D767-4E48-9946-599A266E5
282,0x47800,0x7A000)
BLK3: Alias(s) :
PciRoot (0x0) /Pci (0x1F,0x2) /Sata (0x0,0xFFFF,0x0) /HD (3,GPT,86128076-E126-4778-B8B9-098C78878
233,0xC1800,0x17CB6C01)
Press ESC in 3 seconds to skip startup.nsh or any other key to continue.
Shell> _
```


Exit QSP UEFI Shell & Simics

- To Stop the QSP Simulation, from the Simics Command Line Prompt Window, Type: “**stop**”
 - This will stop the Simics simulation of the QSP board
 - To continue, type: “run”
- To Exit this Simulation, type: “**quit**”
 - This will remove all other Simics windows
- To Restart, reissue the command:

```
$ ./simics targets/qsp-x86/qsp-modern-core.simics
```



```
uefi@uefi-Minnowboard-Turbot-D0-PLATFORM: ~/simics-proj...
Type 'copyright' for details on copyright and 'help' for on-line documentation.
[board.mb.cpu0.core[0][0] info] VMP disabled. Failed to open device.

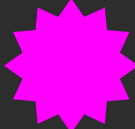



WARNING: Simics failed to enable VMP. Enabling VMP substantially improves
simulation performance. The problem is most likely caused by the
vmxmon kernel module not being properly installed or updated.
See the "Simics User's Guide", the "Performance" section,
for instructions how to setup VMP.

NAPT enabled with gateway 10.10.0.1/24 on link ethernet_switch0.link.
NAPT enabled with gateway fe80::2220:20ff:fe20:2000/64 on link ethernet_switch0.
link.

Welcome to Simics!
Start the simulation by entering the command "run" at the prompt.
Type "stop" to pause the simulation.
This script will boot Linux and automatically log in.
Note that some harmless warning messages related to ACPI errors
will be displayed during the boot.

simics> run
running> stop
simics> quit
```

SUMMARY

-  Build a EDK II Platform using OVMF package
-  Run Ovmf using Qemu
-  Build a EDK II Platform using Simics Open Source QSP Board
-  Run Simics with the QSP Board

Questions?



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