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# UEFI & EDK II Training

## PLATFORM BUILD LAB - OVMF

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# PLATFORM BUILD LABS

- Build a EDK II Platform using OVMF package
- Run Ovmf using Qemu

# BUILD OVMFPKG

Setup OvmfPkg to build and run w/ QEMU

# Pre-requisites Ubuntu 16.04

Instructions from: tianocore wiki Ubuntu_1610
Example Ubuntu 16.04
The following need to be accessible for building Edk2, From the terminal prompt (Cnt-Alt-T):

```
bash$ sudo apt-get install build-essential uuid-dev iasl git gcc-5 nasm  python3-distutils
```

```
build-essential - Informational list of build-essential packages
uuid-dev - Universally Unique ID library (headers and static libraries)
iasl - Intel ASL compiler/decompiler (also provided by acpica-tools)
git - support for git revision control system
gcc-5 - GNU C compiler (v5.4.0 as of Ubuntu 16.04 LTS)
nasm - General-purpose x86 assembler
python3 - distutils - distutils module from the Python standard library
```

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

**Qemu – Emulation with Intel architecture with UEFI Shell**

ubuntu

# Pre-requisites Clear Linux* Project

Example Using Clear Linux* Project
The following need to be accessible for building Edk2, From the terminal prompt (Cnt-Alt-T):

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

`Devpkg-util-linux –` includes bundles for developer tools for writing "C" Applications included:
`gcc, nasm, uuid, etc.`

```
bash$  sudo swupd bundle-add kvm-host
```

**Qemu – Emulation with Intel architecture with UEFI Shell**

**Clear Linux* Project**

# Create QEMU Run Script

1. Create a run-ovmf directory under the home directory

```
bash$ cd ~
bash$ mkdir ~run-ovmf
bash$ cd run-ovmf
```

2. Create a directory to use as a hard disk image

```
bash$ mkdir hda-contents
```

3. Create a Linux shell script to run the QEMU from the run-ovmf directory

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

Open  RunQemu.sh ~/run-ovmf  Save  - + X

```
qemu-system-x86_64 -pflash bios.bin -hda fat:rw:hda-contents -net none
-debugcon file:debug.log -global isa-debugcon.iobase=0x402
```

4. Save and Exit

# DOWNLOAD the EDK II Source

**Open a terminal prompt and create a source working directory**

```
bash$ mkdir ~/src
bash$ cd ~/src
bash$ mkdir edk2-ws
```

**Internet Proxies – (company Firewall used for example)**

```
bash$ export http_proxy=http://proxy-us.company.com:911
bash$ export ftp_proxy=$http_proxy
```

**Download edk2 source tree using Git**

```
bash$ git clone -b Edk2Lab_22Q1 https://github.com/tianocore-training/edk2.git
Bash$ git clone https://github.com/tianocore/edk2-libc.git
```

**Download the Submodules and Checkout the Lab Branch**

```
bash$  cd edk2
bash$ submodule update –init
bash$  cd ..
```

# SETUP LAB MATERIAL

Lab_Material_FW.zip

# DOWNLOAD LAB MATERIAL

Download the Lab_Material_FW.zip from : github.com Lab_Matrial_FW.zip

OR

Use git clone to download the Lab_Material_FW

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

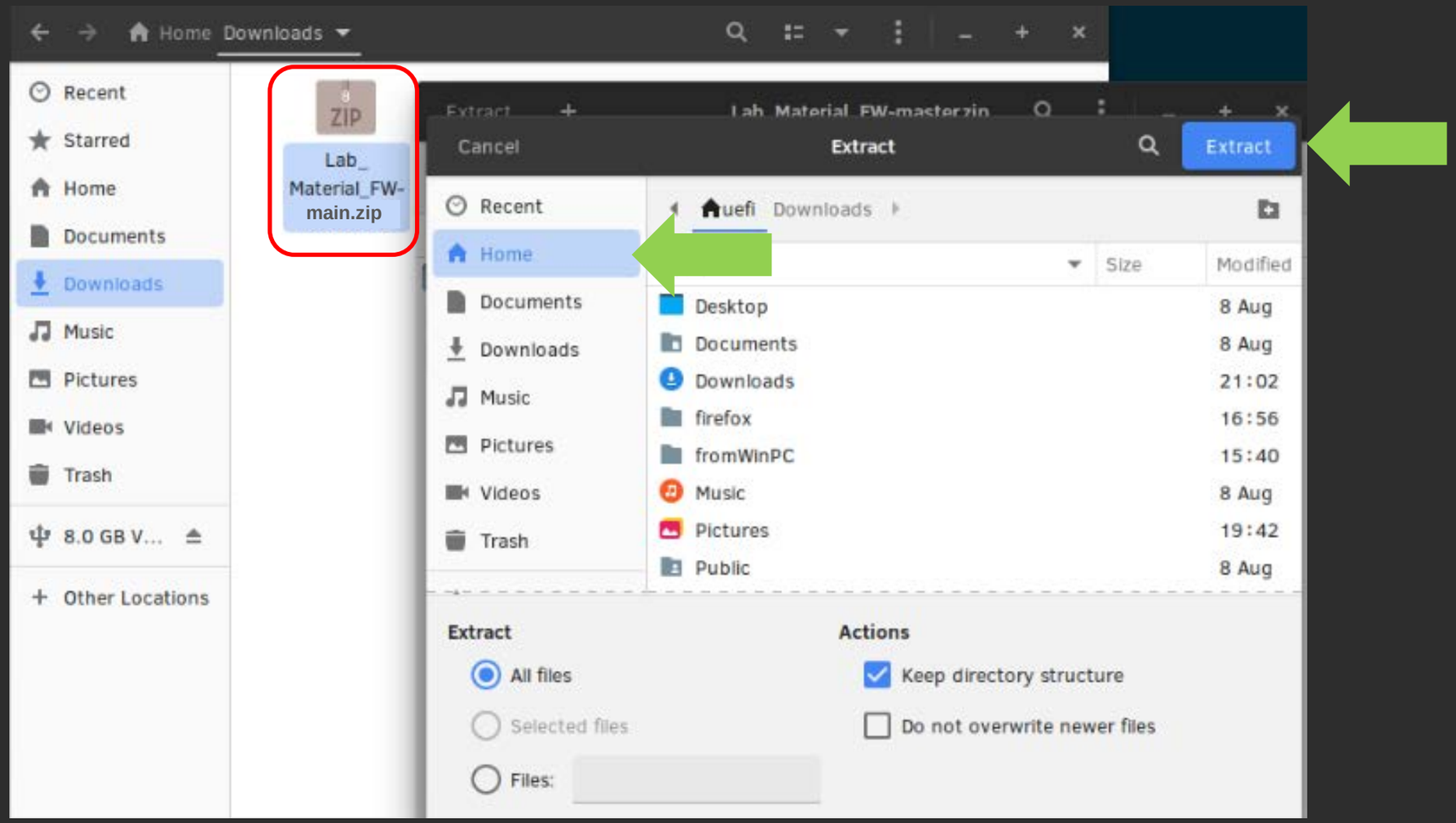
Directory Lab_Material_FW will be created

```
FW
 - Documentation
 - DriverWizard
 - edk2-ws
 - edk2Linux
 - LabSampleCode
```

# BUILD EDK II OVMF

## -Extract the Source

1. Extract the Downloaded **`Lab_Material_FW-main.zip`** to `Home` (this will create a directory `~/FW`)

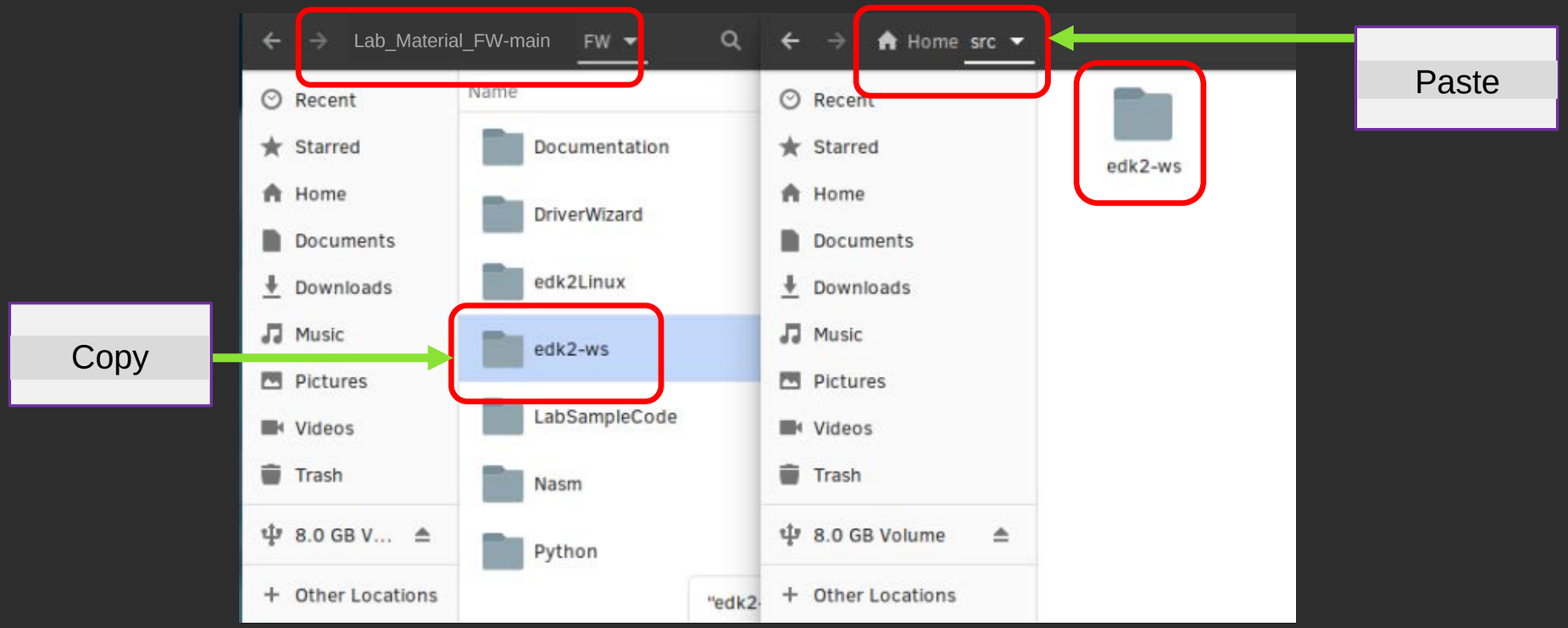


# BUILD EDK II OVMF
## - Copy the Source

2. Open a terminal prompt (Alt-Cnt-T)
3. Create a working space source directory under the home directory

```
bash$ cd ~src
```

4. From the FW folder, copy and paste folder “~…/FW/edk2-ws” to ~src



# BUILD EDK II OVMF

## - Building BaseTools

5. Export work space & platform path

```
bash$ cd ~src/edk2-ws
bash$ export WORKSPACE=$PWD
bash$ export PACKAGES_PATH=$WORKSPACE/edk2:$WORKSPACE/edk2-libc
```

6. Run Make

```
bash$ cd edk2
bash$ make -C BaseTools/
```

7. Make sure the tests pass OK

```
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 $
```

# BUILD OVMF PLATFORM

# BUILD EDK II OVMF

## -Update Target.txt

## What is OVMF?

### Open Virtual Machine Firmware - Build with edk2

```
bash$ cd ~/src/edk-ws/edk2
bash$ . 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

```
bash$ 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

```
bash$ build -D ADD_SHELL_STRING
```

More info: tianocore - wiki/OVMF

# BUILD EDK II OVMF

## -Inside Terminal

```
uefi@clr-0 :: ~/
uefi@clr-0~/src/edk2-ws/edk2 $ . edkse
Loading previous configuration from /h
WORKSPACE: /home/uefi/src/edk2-ws
EDK_TOOLS_PATH: /home/uefi/src/edk2-ws
CONF_PATH: /home/uefi/src/edk2-ws/edk2
uefi@clr-0~/src/edk2-ws/edk2 $ build
Build environment: Linux-5.2.7-816.nai
Build start time: 21:58:04, Aug.15 201

WORKSPACE        = /home/uefi/src/edk2
PACKAGES_PATH    = /home/uefi/src/edk2
EDK_TOOLS_PATH   = /home/uefi/src/edk2
CONF_PATH        = /home/uefi/src/edk2
PYTHON_COMMAND   = /usr/bin/python3.7


Architecture(s)  = X64
Build target     = DEBUG
Toolchain        = GCC5

Active Platform          = /home/uefi/src/edk2-ws/edk2/OvmfPkg/OvmfPkgX64.dsc
Flash Image Definition   = /home/uefi/src/edk2-ws/edk2/OvmfPkg/OvmfPkgX64.fdf

Processing meta-data ..
```

```
uefi@clr-0
k2-ws/Build/OvmfX64/DEBUG_GCC5/X64/
ib/OUTPUT/./XenHypercall.obj -I/hom
percallLib/X64 -I/home/uefi/src/edk
home/uefi/src/edk2-ws/Build/OvmfX64
ib/XenHypercallLib/DEBUG -I/home/ue
dk2-ws/edk2/MdePkg/Include -I/home/
ome/uefi/src/edk2-ws/edk2/OvmfPkg -
-I/home/uefi/src/edk2-ws/edk2/OvmfP
mfPkg/Library/XenHypercallLib/XenHy
"gcc" -g -fshort-wchar -fno-builtin
y-bounds -ffunction-sections -fdata
RING_ARRAY_NAME=BootManagerUiLibStr
tribute__((ms_abi))" -maccumulate-o
del=small -fpie -fno-asynchronous-u
Os -mno-mmx -mno-sse -D DISABLE_NEW
dk2-ws/Build/OvmfX64/DEBUG_GCC5/X64
nagerUiLib/OUTPUT/./BootManager.obj
ibrary/BootManagerUiLib -I/home/uef
eModulePkg/Library/BootManagerUiLib
-ws/edk2/MdePkg -I/home/uefi/src/ed
k2-ws/edk2/MdePkg/Include/X64 -I/ho
/uefi/src/edk2-ws/edk2/MdeModulePkg
ePkg/Library/BootManagerUiLib/BootM
```

```
uefi@clr-0 :: ~/src/edk2-ws/edk2
  Region Name = None

Generate Region at Offset 0x20000
  Region Size = 0xE0000
  Region Name = FV

Generate Region at Offset 0x100000
  Region Size = 0xB00000
  Region Name = FV

GUID cross reference file can be found at /home/uefi/src/edk2-ws/Build/OvmfX64/D
EBUG_GCC5/FV/Guid.xref

FV Space Information
SECFV [10%Full] 212992 total, 21808 used, 191184 free
PEIFV [19%Full] 917504 total, 183016 used, 734488 free
DXEFV [35%Full] 11534336 total, 4069440 used, 7464896 free
FVMAIN_COMPACT [34%Full] 3440640 total, 1191176 used, 2249464 free

- Done -
Build end time: 22:03:31, Aug.15 2019
Build total time: 00:05:27

uefi@clr-0~/src/edk2-ws/edk2 $
```

Finished build

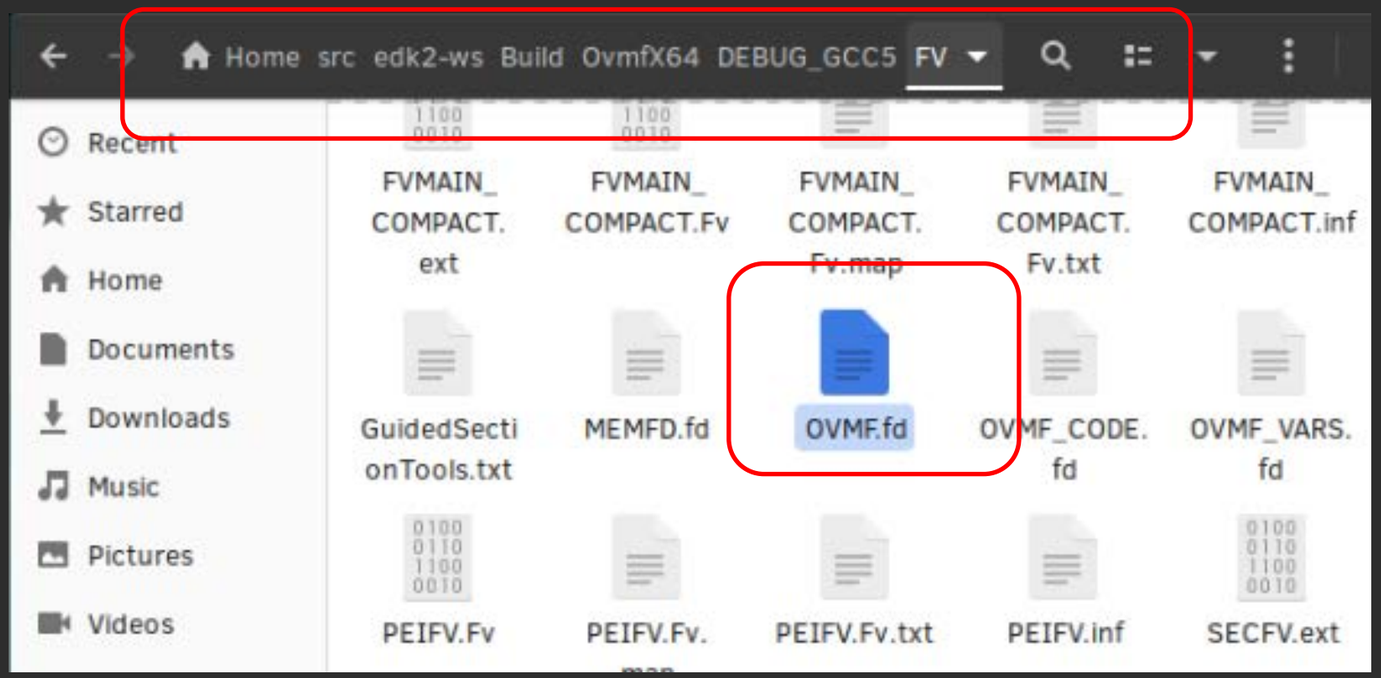
# BUILD EDK II OVMF

## -Verify Build Succeeded

OVMF.fd should be in the Build directory

- For GCC5 with X64, it should be located at

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



# INVOKE QEMU

Change to run-ovmf directory under the home directory

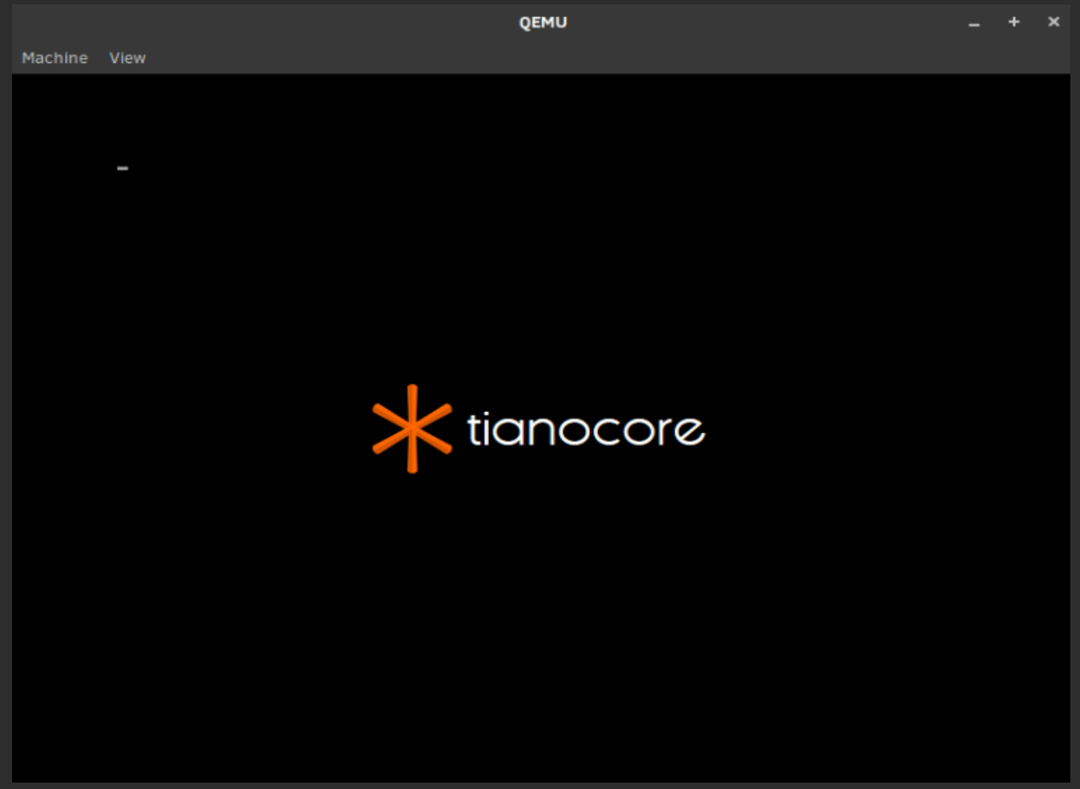
```
bash$ cd $HOME/run-ovmf
```

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

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

Run the RunQemu.sh Linux shell script

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



# Show the UEFI Boot Variables

At the Shell Prompt:

```
Shell> FS0:

FS0:> BCFG Boot Dump
```

```
  Desc    - UEFI BootManagerMenuApp
  DevPath - Fv(6D99E806-3D38-42C2-A095-5F4300BFD7DC)/FvFile(EEC25BDC-67F2-4D95-B
1D5-F81B2039D11D)
  Optional- N
Option: 02. Variable: Boot0002
  Desc    - UEFI Misc Device
  DevPath - VenHw(5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,00000000)/VenHw(6888A4AE-
AFCE-E84B-9102-F7B9DAE6A030,00000000)
  Optional- Y
Option: 03. Variable: Boot0003
  Desc    - UEFI Non-Block Boot Device
  DevPath - VenHw(5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,00000000)/VenHw(964E5B22-
6459-11D2-8E39-00A0C969723B,00000000)
  Optional- Y
Option: 04. Variable: Boot0004
  Desc    - UEFI BootManagerMenuApp
  DevPath - Fv(6D99E806-3D38-42C2-A095-5F4300BFD7DC)/FvFile(EEC25BDC-67F2-4D95-B
1D5-F81B2039D11D)/BootManagerMenuApp
  Optional- Y
Option: 05. Variable: Boot0000
  Desc    - UEFI Enter Setup
  DevPath - Fv(6D99E806-3D38-42C2-A095-5F4300BFD7DC)/FvFile(462CAA21-7614-4503-8
36E-8AB6F4662331)/Enter Setup
  Optional- N
FS0:\> _
```

# Use the Dmpstore to Show the Boot Order

At the Shell Prompt:

```
FS0:> Dmpstore BootOrder
```

```
FS0:\> dmpstore bootorder
Variable NV+RT+BS 'EFIGlobalVariable:BootOrder' DataSize = 0x0C
  00000000: 05 00 01 00 02 00 03 00-04 00 00 00            *............*
FS0:\> _
```

# Use the BCFG to Move a boot item

Use BCFG to Move the 5th boot item too 1st location.

Then verify using the “dmpstore”

(Hint: use BCFG -? –b for help menu)

The dmpstore output should look like the screen shot

Result

```
FS0:\> dmpstore bootorder
Variable NV+RT+BS 'EFIGlobalVariable:BootOrder' DataSize = 0x0C
  00000000: 00 00 05 00 01 00 02 00-03 00 04 00              *.....
```

# Use the BCFG to Add a boot item

Copy the old EFI Shell from
`~/src/edk2-ws/edk2/ShellPkg/OldShell/Shell_FullX64.efi`
`to the run-ovmf directory  ~/run-ovmf/hda-contents`

Use BCFG to Add  a 06 entry for a new boot option with `Shell_FullX64.efi`

Then verify using the "`BCFG Boot Dump`"

Hint: make sure `Shell_FullX64.efi` is in the FS0: directory by doing:

```
FS0:\> dir shell*.efi
Directory of: FS0:\

08/26/2021  15:33            771,136  Shell_FullX64.efi
```

```
FS0:\> Dir
```

After the `bcfg` add, The output should look like

Result

```
  Optional- Y
Option: 06. Variable: Boot0006
  Desc    - Olde EFI Shell 1.0
  DevPath - VenHw(5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,00000000)/VenHw
6459-11D2-8E39-00A0C969723B,00000000)/\Shell_FullX64.efi
  Optional- N
FS0:\> _
```

Exit QEMU

# SUMMARY

- Build a EDK II Platform using OVMF package
- Run Ovmf using Qemu

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# Questions?

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# ACKNOWLEDGEMENTS