

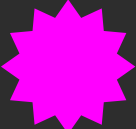


UEFI & EDK II Training

PLATFORM BUILD LAB WINDOWS EMULATOR

tianocore.org

See also [LabGuide.md](#) for Copy & Paste examples in labs

PLATFORM BUILD LABS

-  Pin Visual Studio Command Prompt to Windows Task Bar
-  Build a EDK II Platform using Emulator package
-  Run the Emulator in Windows

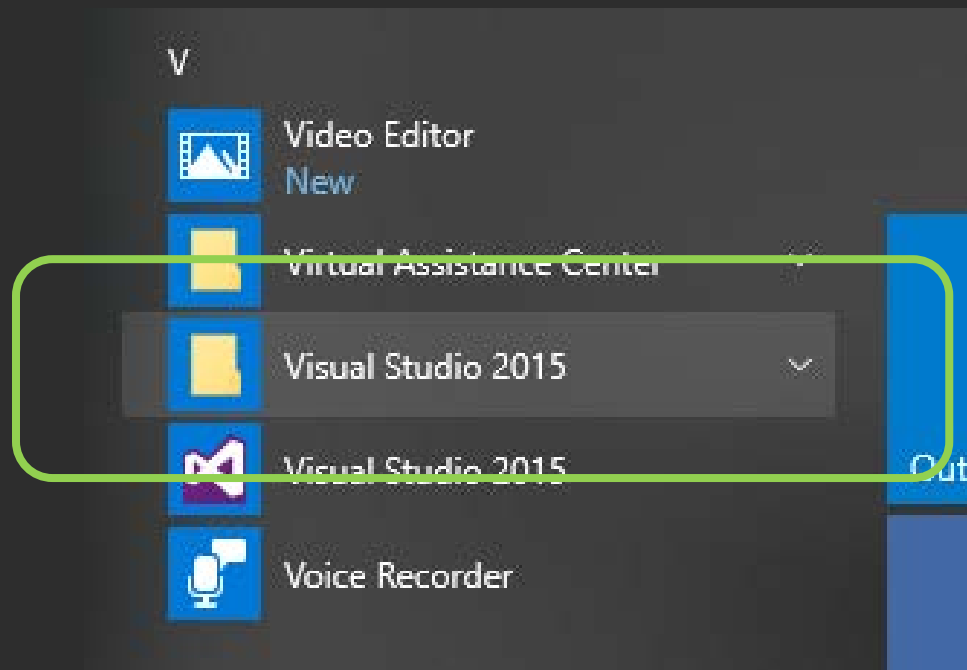
PIN VS COMMAND PROMPT

Pin the Visual Studio Command prompt to Windows Task Bar

Pin VS Command Prompt



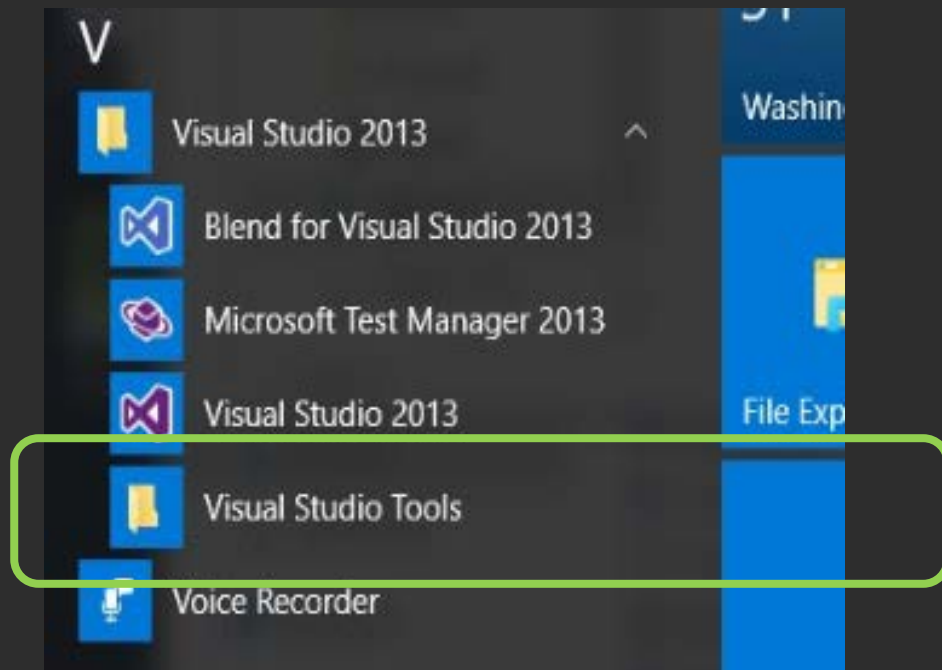
Windows 10



Steps to Pin Visual Studio Command Prompt to task bar for Windows 10

1. Using the Start menu in Windows 10, Left Click on “Windows Key” Lower Left 
2. Scroll down from the scroll bar on the right until “**Visual Studio 201ⁿ**”
3. Left Click “**Visual Studio 201ⁿ**”

Pin VS Command Prompt



VS 2013

4. Left Click “Visual Studio Tools”

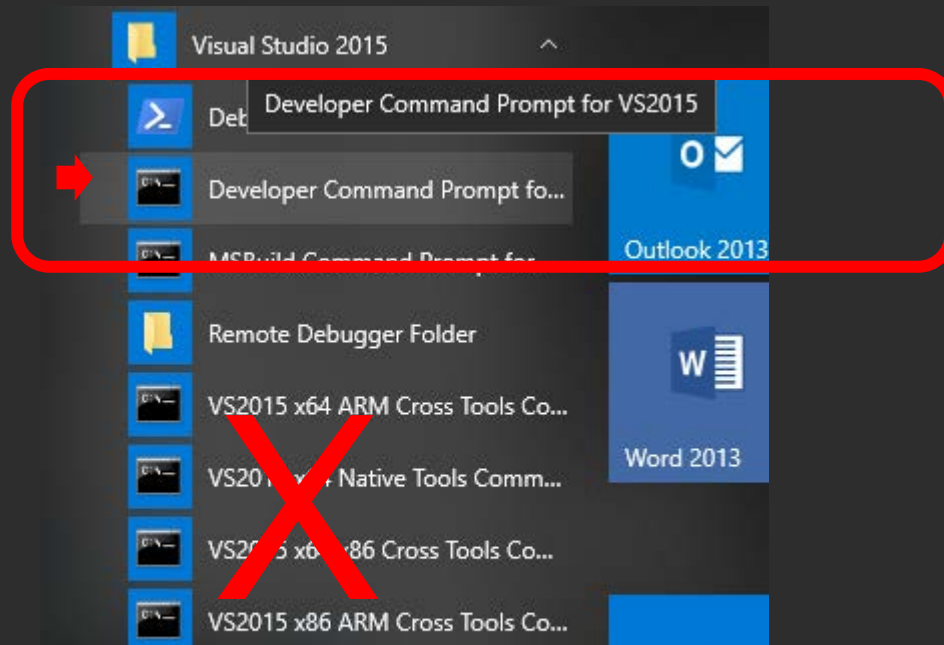
This will open another Windows file explorer window

Note: *VS 2013 example, other version of VS maybe different*

Pin VS Command Prompt

VS 2015

VS 2017 is similar

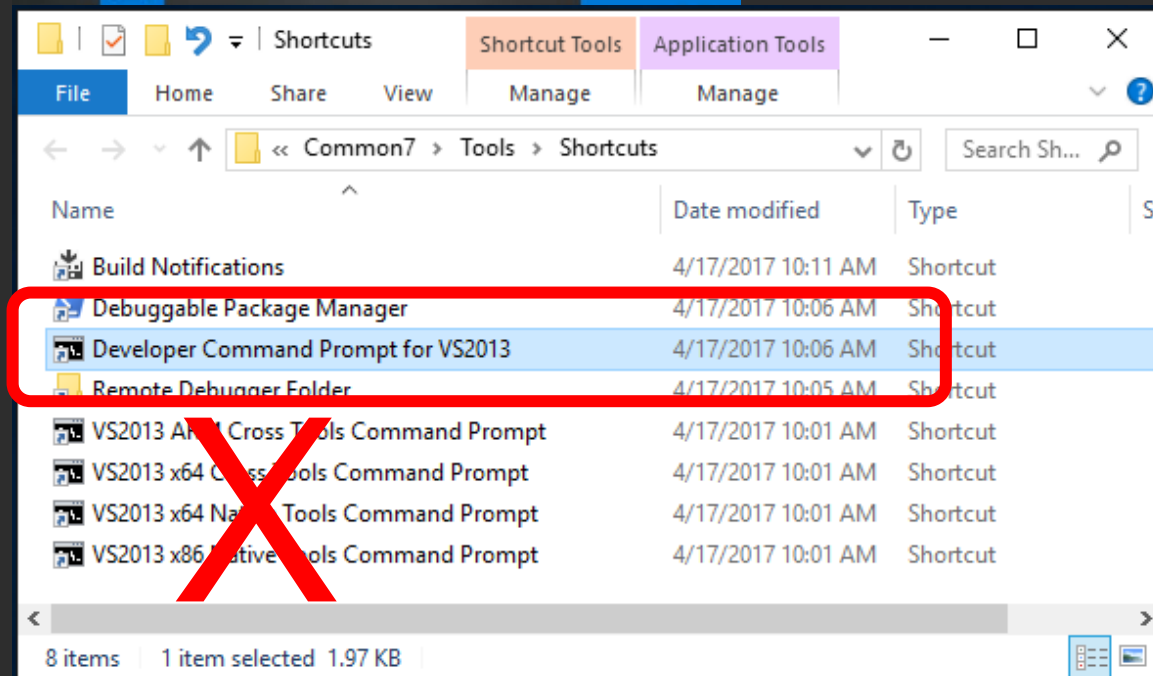


5. Select
“Developer Command Prompt for VS201n”

6. Right Click to open Windows dialog box

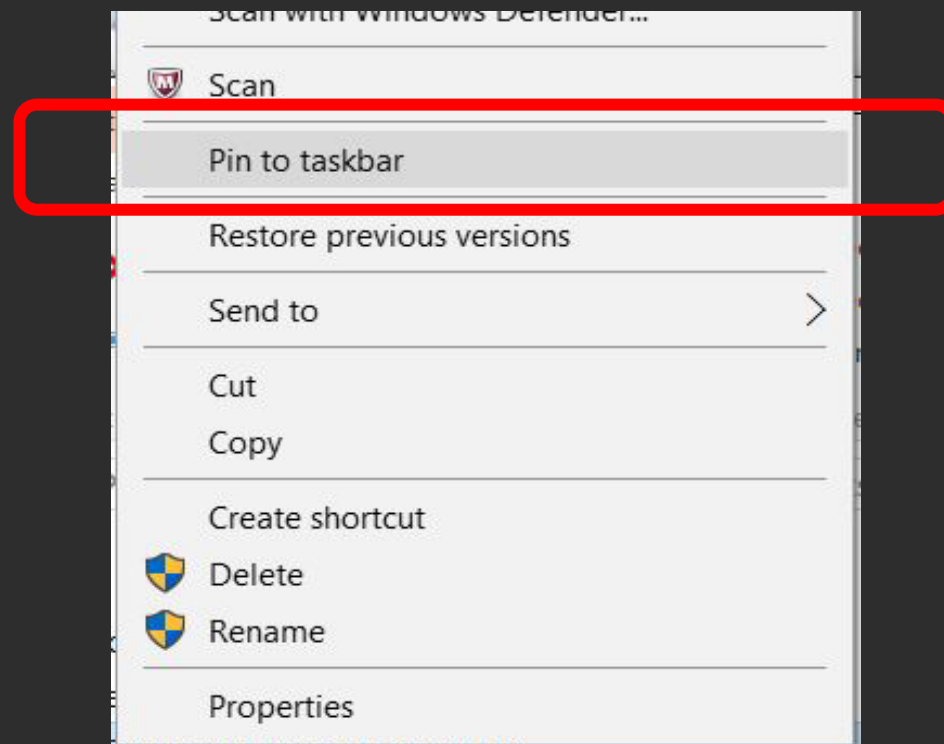
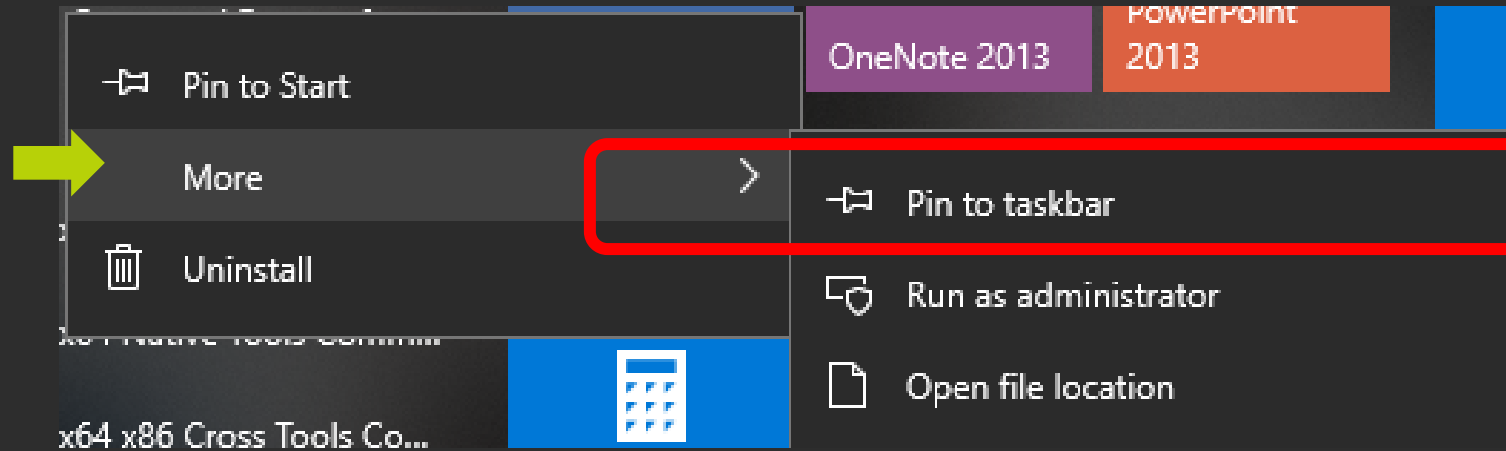
**Do not use any of the other
“.. Command Prompts”**

VS 2013

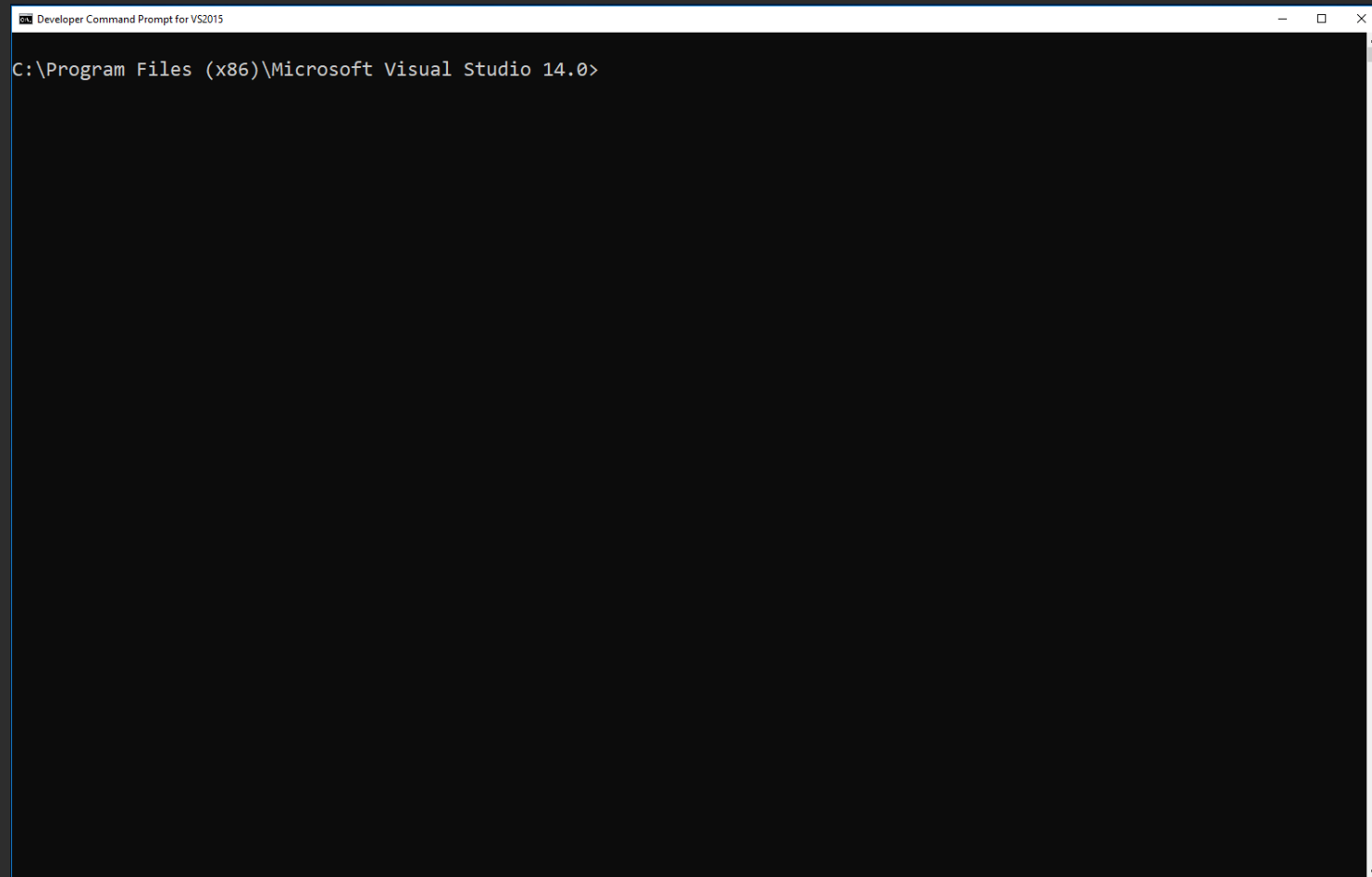


Pin VS Command Prompt

7. Left Click on
“Pin to taskbar”



Pin VS Command Prompt



8. Open VS Command Prompt”

All Windows Labs use this short-cut to Build Edk II platforms and projects using Windows Visual Studio :
2013 / 2015 /2017 or 2019





END OF PIN VS PROMPT

BUILD EMULATOR

Setup EmulatorPkg to build and run emulation with Windows

Prerequisites

– Done Before Class

- Windows 10: 
 - Continuous Integration (CI) - Stuart CI Build with Visual Studio VS2017 or VS2019 
 - Non-Stuart CI - Visual Studio VS2015, VS2017 or VS2019
 - Windows SDK (for rc)
 - Windows WDK (for Capsules)
- Python 3.7.x or greater and /Scripts directories on Path: [Link](#) to download  python™
- Git for Windows on Path : [Link](#) 
- NASM for Win64 : [Link](#)

Create Workspace Directory

Open Windows Command Prompt

Make new directory for Workspace:

```
$ cd /  
$ Mkdir FW  
$ cd FW  
$ Mkdir edk2-ws  
$ cd edk2-ws
```

Developer Command Prompt for VS2015

```
C:\Program Files (x86)\Microsoft Visual Studio 14.0>cd \  
C:\>cd fw\edk2-ws  
C:\FW\edk2-ws>
```

Download the EDK II Source Code

Download the open source EDK II from Github 

Note if behind a firewall, set PROXYS FIRST (example shows for Intel corporation)

```
$ git config --global https.proxy proxy-dmz.intel.com:912  
$ git config --global http.proxy proxy-dmz.intel.com:911
```


From the command prompt use “git clone” to download

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

Download the Submodules and Checkout the Lab Branch

```
C:\FW\edk2-WS> Cd edk2  
C:\FW\edk2-WS\edk2> git submodule update --init  
C:\FW\edk2-WS> Cd ..
```

Download Lab Material

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

Use git clone to download the Lab_Material_FW

```
C:\> git clone https://github.com/tianocore-training/Lab_Material_FW.git
```

Directory Lab_Material_FW will be created

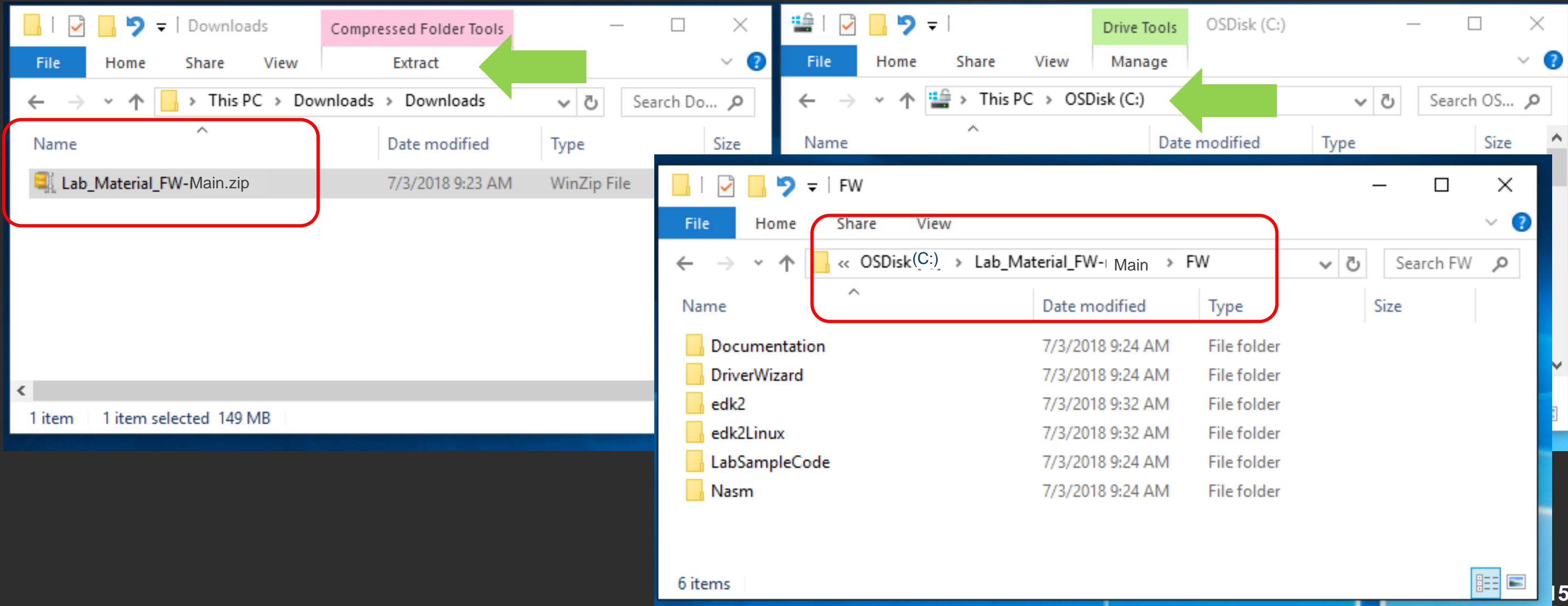
FW

- Documentation
- DriverWizard
- edk2-ws
- LabSampleCode
- Nasm

Build EDK II

-Extract the Source

Extract the Downloaded Lab_Material_FW-main.zip to C:\



The screenshot illustrates the process of extracting the downloaded Lab_Material_FW-main.zip file. It consists of two overlapping File Explorer windows.

Left Window (Downloads): The address bar shows 'This PC > Downloads > Downloads'. The file 'Lab_Material_FW-Main.zip' is selected in the list. A green arrow points to the 'Extract' button in the 'Compressed Folder Tools' ribbon.

Right Window (OSDisk (C:)): The address bar shows 'This PC > OSDisk (C:)'. A green arrow points to the 'Manage' button in the 'Drive Tools' ribbon. Below, the 'FW' folder is expanded, showing its contents.

Name	Date modified	Type	Size
Documentation	7/3/2018 9:24 AM	File folder	
DriverWizard	7/3/2018 9:24 AM	File folder	
edk2	7/3/2018 9:32 AM	File folder	
edk2Linux	7/3/2018 9:32 AM	File folder	
LabSampleCode	7/3/2018 9:24 AM	File folder	
Nasm	7/3/2018 9:24 AM	File folder	

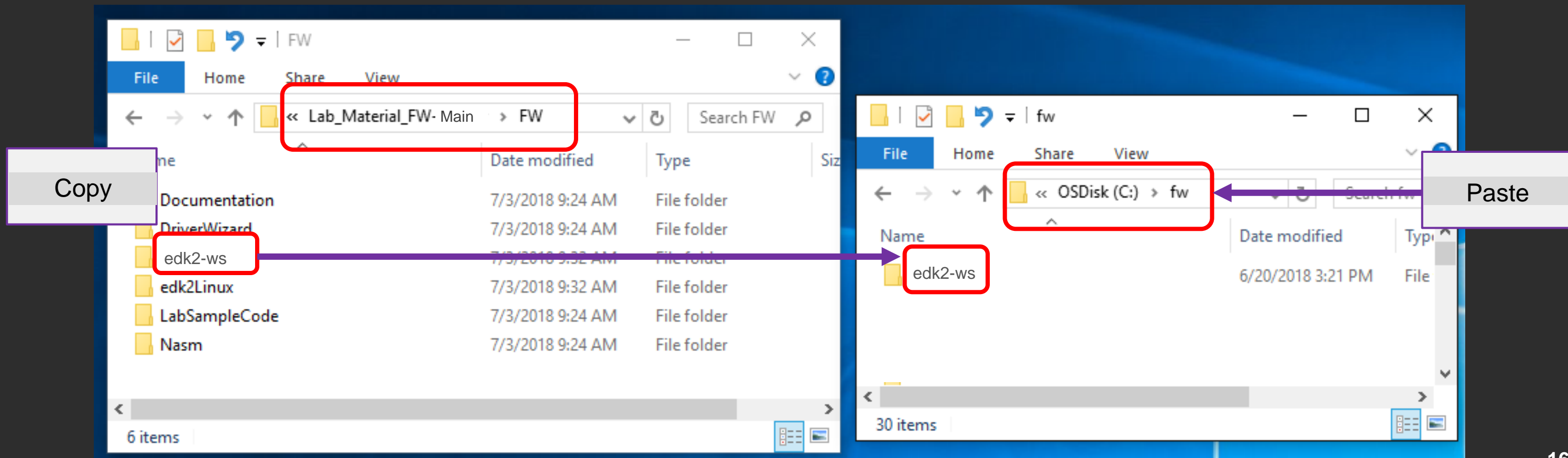
6 items

Build EDK II

- Copy edk2-ws

From the downloaded Lab_Material_FW folder, **copy** and **paste** folder “..\edk2-ws” to C:/FW

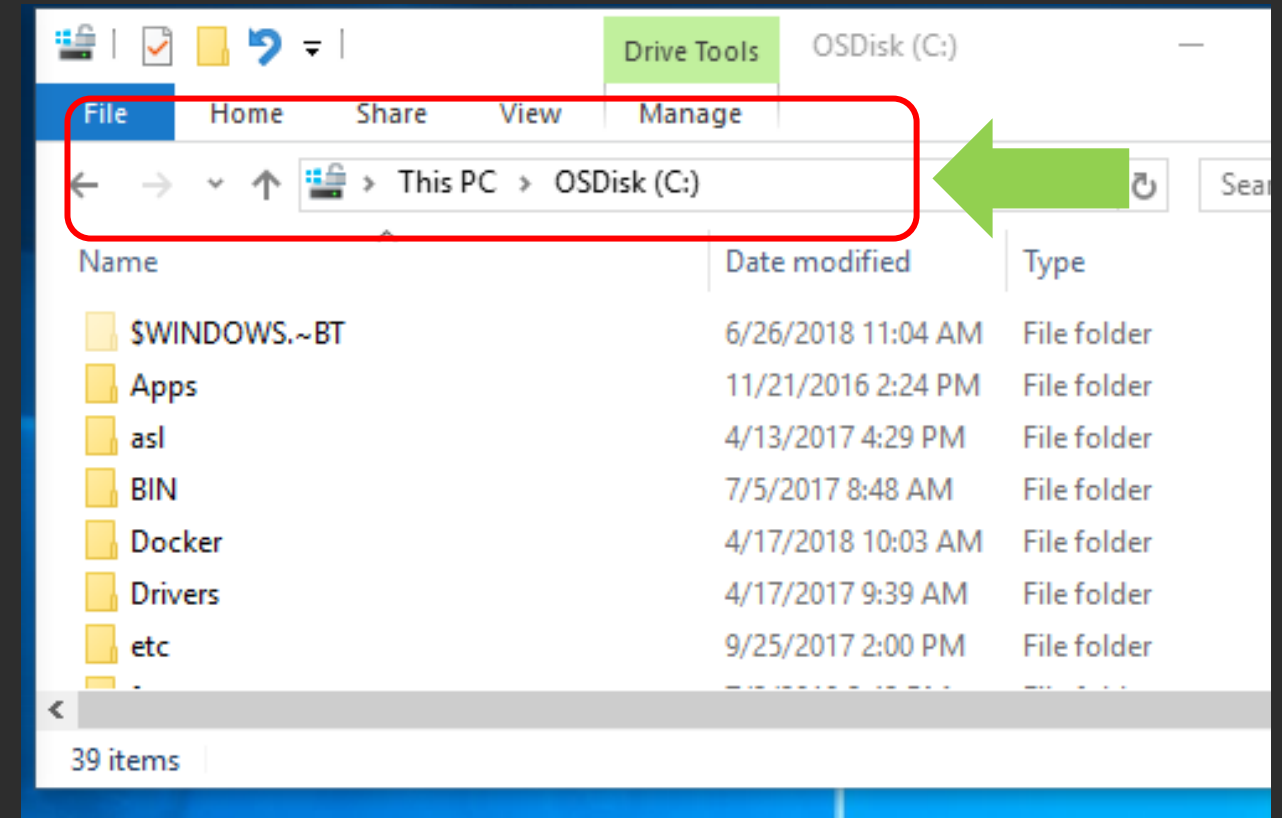
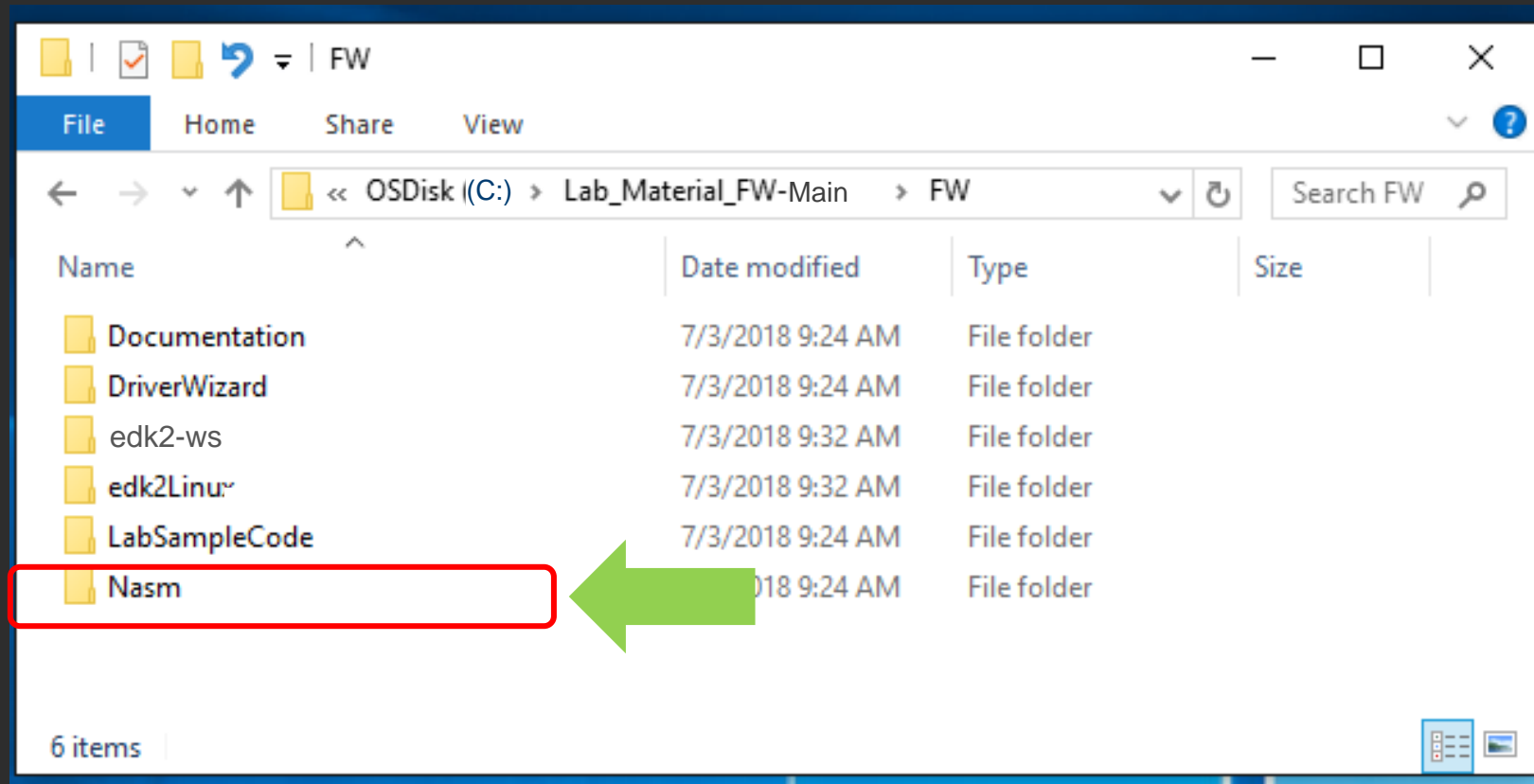
Note: Overwrite existing files and directories



Build EDK II

-Get Nasm

Copy Nasm directory to C:\
(creating C:\Nasm directory)



Stuart CI Build EmulatorPkg - Optional





1. CD to C:/FW/edk2-ws

```
$ setenv.bat  
$ cd C:\FW\edk2-ws\edk2
```

2. Install the pip requirements (Note, Proxy option needed behind a firewall)

```
$ pip install --upgrade -r pip-requirements.txt --proxy http://proxy-chain.intel.com:911
```

3. Get the code dependencies (done only when submodules change)

```
$ stuart_setup -c EmulatorPkg/PlatformCI/PlatformBuild.py TOOL_CHAIN_TAG=<Your TAG> -a X64
```

4. Update other dependencies (done on new VS Command Prompt)

```
$ stuart_update -c EmulatorPkg/PlatformCI/PlatformBuild.py TOOL_CHAIN_TAG=<Your TAG> -a X64
```

5. Build the BaseTools (done only when BaseTools change and first time)

```
$ python BaseTools\Edk2ToolsBuild.py -t <Your TAG>
```

6. Compile the EmulatorPkg

```
$ stuart_build -c EmulatorPkg/PlatformCI/PlatformBuild.py TOOL_CHAIN_TAG=<Your TAG> -a X64  
BLD_*_ADD_SHELL_STRING=1 BLD_*_WORKSPACE=%WORKSPACE%
```

Where “<Your TAG>” is either VS2017 or VS2019

Output from CI Stuart Build

```
Developer Command Prompt for VS 2017
INFO - Region Size = 0x2000
INFO - Region Name = DATA
INFO -
INFO - Generate Region at Offset 0x590000
INFO - Region Size = 0x10000
INFO - Region Name = None
INFO -
INFO - GUID cross reference file can be found at d:\lab\fw\edk2-ws\edk2\Build\EmulatorX64\DEBUG_VS2017\FV\Guid.xref
INFO -
INFO - FV Space Information
INFO - FVRECOVERY [48%Full] 5767168 total, 2769848 used, 2997320 free
INFO -
INFO - - Done -
INFO - Build end time: 13:17:07, Jul.27 2020
INFO - Build total time: 00:01:33
INFO -
INFO - -----
INFO - -----Cmd Output Finished-----
INFO - ----- Running Time (mm:ss): 01:33 -----
INFO - ----- Return Code: 0x00000000 -----
INFO - -----
PROGRESS - Running Post Build
DEBUG - Plugin Success: Windows RC Path Support
DEBUG - Plugin Success: Windows Visual Studio Tool Chain Support
INFO - Writing BuildToolsReports to D:\lab\FW\edk2-ws\edk2\Build\EmulatorX64\DEBUG_VS2017\BUILD_TOOLS_REPORT
DEBUG - Plugin Success: Build Tools Report Generator
PROGRESS - End time: 2020-07-27 13:17:07.515485 Total time Elapsed: 0:01:37
SECTION - Log file is located at: D:\lab\FW\edk2-ws\edk2\Build\BUILDLOG_EmulatorPkg.txt
SECTION - Summary
PROGRESS - Success
```

Finished build



NON-STUART CI BUILD EMULATORPKG

Skip if doing Stuart CI

Note: will need to update conf/target.txt for other labs

Non-Stuart CI Build EDK II

- build BaseTools

Open VS Command prompt & Cd to workspace directory

```
$> cd C:\FW\edk2-ws
```

Setup the local environment: (see batch file [setenv.bat](#))

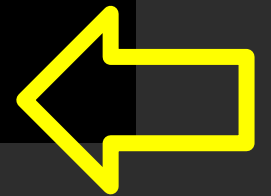
```
$> set WORKSPACE=%CD%
```

```
$> set PACKAGES_PATH=%WORKSPACE%\edk2;%WORKSPACE%\edk2-libc
```

Invoke Edksetup.bat from directory C:/FW/edk2-ws/edk2 to Build BaseTools

```
$> cd edk2
```

```
$> edksetup.bat Rebuild
```



Building BaseTools only needs to be done once but setting up local environment and edksetup.bat needs to be done each new VS prompt session

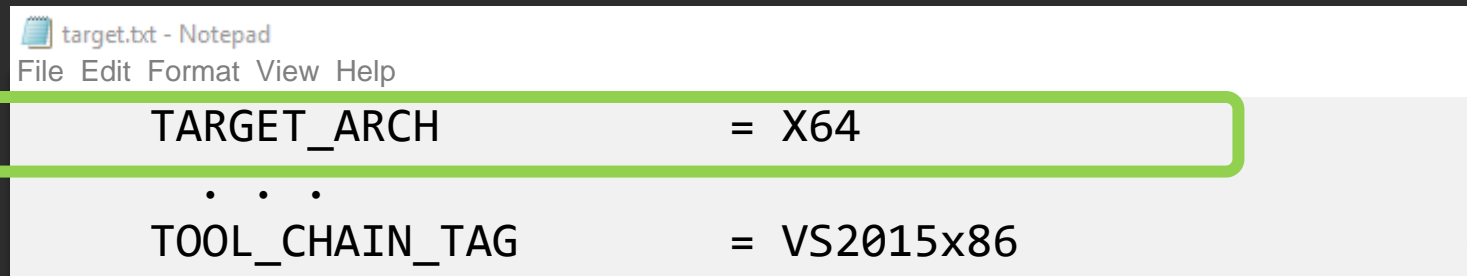
Non Stuart CI Build EDK II

EmulatorPkg – Non Stuart CI Build with edk2 -Update Target.txt

Invoke Edksetup.bat

```
$> cd C:\FW\edk2-ws\edk2
$> edksetup.bat
```

Edit the file Conf/target.txt (*change* TOOL_CHAIN_TAG)
notepad Conf/target.txt



VS version	TOOL_CHAIN_TAG
2015	VS2015x86
2017	VS2017
2019	VS2019

Save and Exit

Build EmulatorPkg

```
$> build -D ADD_SHELL_STRING -a X64
```

Possible Build Errors

1. If you get a BUILD Error: Error “C:/Program “ not found
 - First check that you have opened Visual Studio and installed the “C++”
 - Open Visual Studio and create a “C++” project
 - (This will take some time to install)
2. If you get a BUILD Error: Check if RC.Exe compiler not found is the error -[here](#)
3. If you get a BUILD Error: fatal error C1041: cannot open program database ... Check [here](#)

Build EDK II -Inside VS Prompt

```

C:\FW\edk2>build -D WIN_SEC_BUILD -a X64

# Install to C:\FW\edk2-ws\edk2
#####
execute command "nmake all" in

!!! WARNING !!! NASM_PREFIX env
Found nasm.exe, setting the e

!!! WARNING !!! No CYGWIN_HOME

C:\FW\edk2-ws\edk2>build -D WIN
Build environment: Windows-10-1
Build start time: 11:13:20, Aug

Workspace
=====
WORKSPACE      = c:\fw\edk2-ws
PACKAGES_PATH  = c:\fw\edk2-ws
EDK_TOOLS_PATH = c:\fw\edk2-ws
EDK_TOOLS_BIN  = c:\fw\edk2-ws
CONF_PATH      = c:\fw\edk2-ws
PYTHON_COMMAND = py -3

Processing meta-data
.Architecture(s) = X64
Build target     = DEBUG
Toolchain        = VS2015x86

Active Platform  = c:\fw\
...

d\Emulator\X64\DEBUG_VS2015x86\FV\Guid.xref
FV Space Information
FVRECOVERY [47%Full] 5767168 total, 2726792 used, 3040376 free
#####
##### Done -
##### Build end time: 11:17:31, Aug.12 2019
##### Build total time: 00:04:11
#####
C:\FW\edk2-ws\edk2>

```



Approx.
6 Min

Finished build

RUN THE EMULATOR

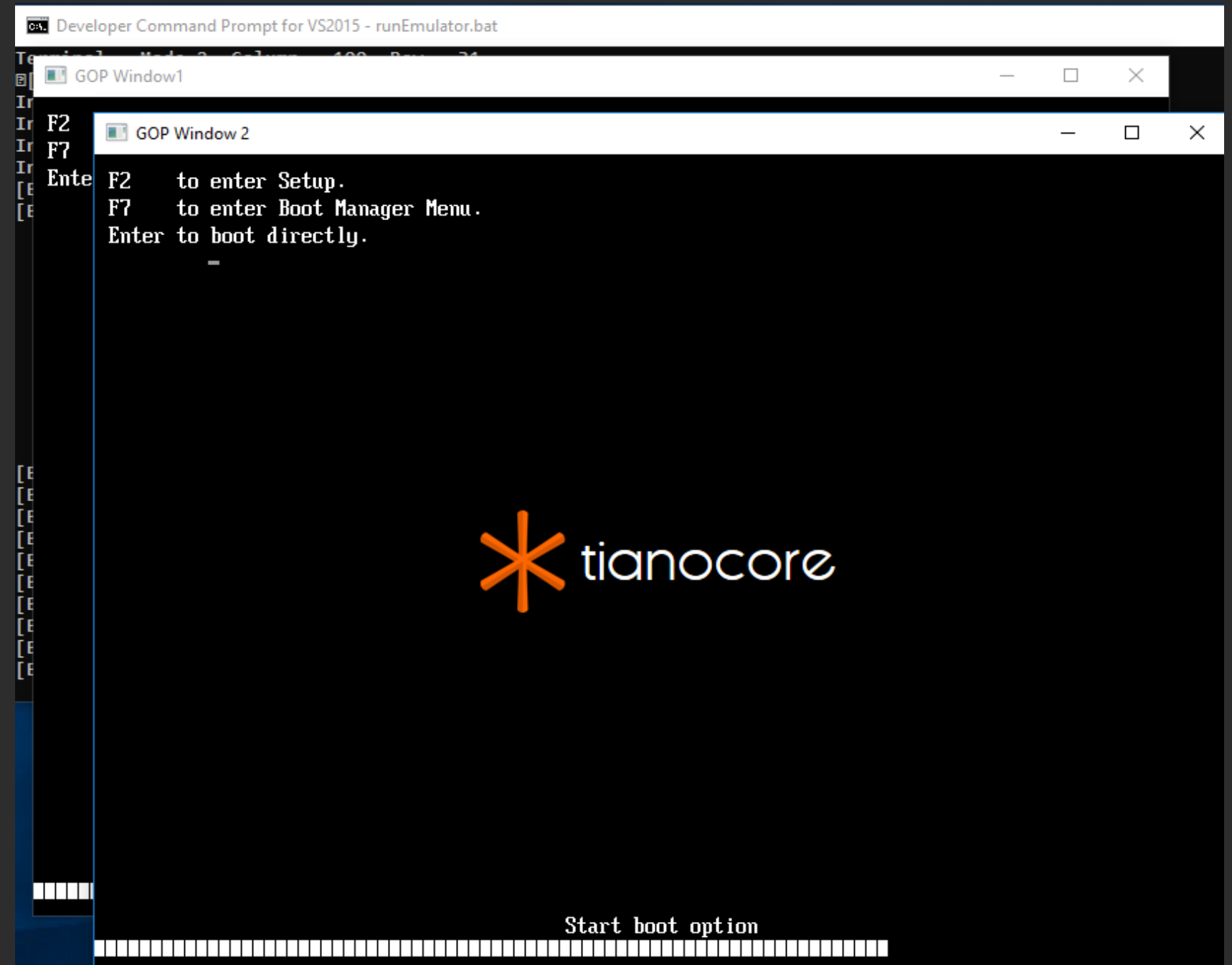
Invoke Emulation

From the command prompt

```
$> RunEmulator.bat
```

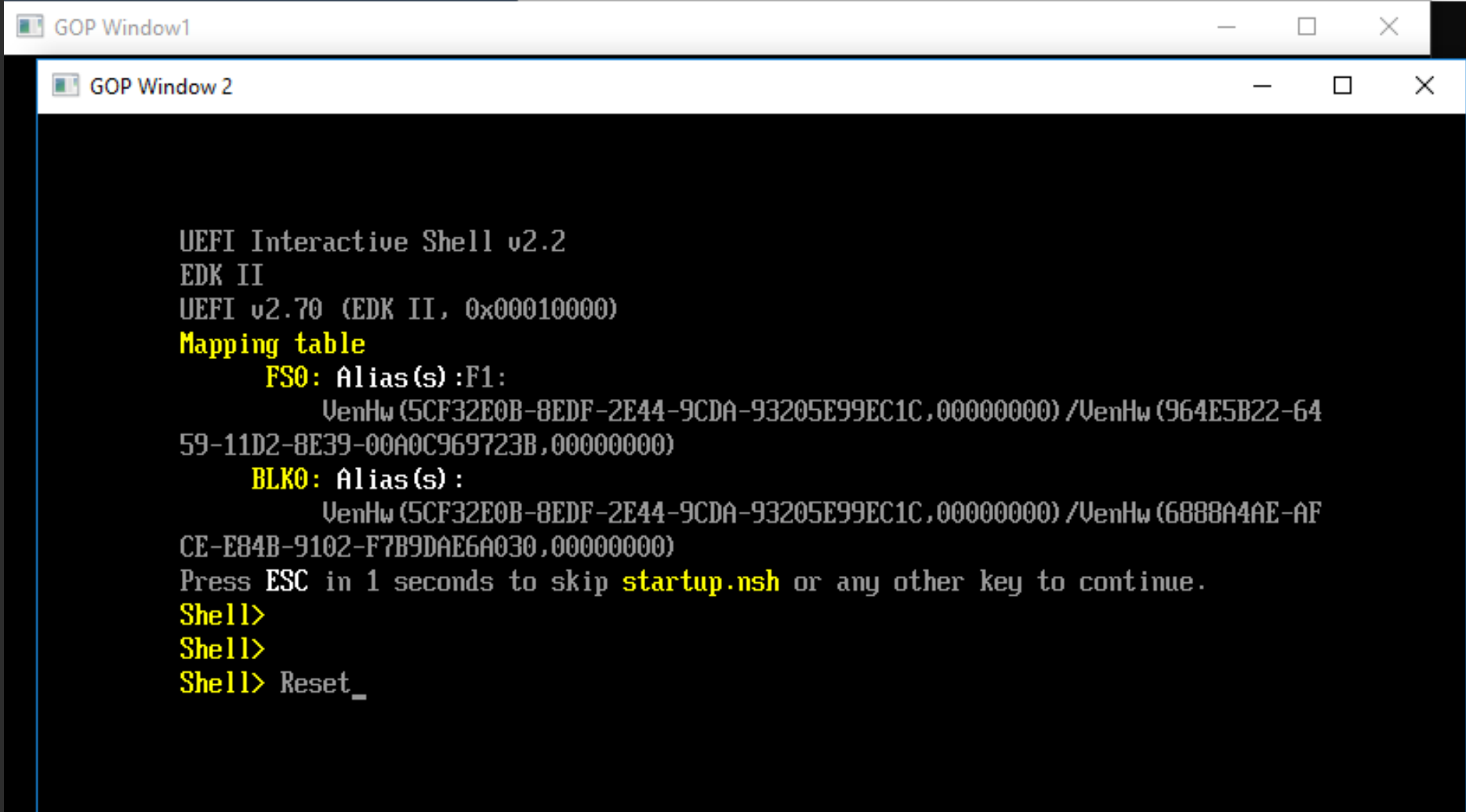
Or
run **WinHost.exe** from:
Build/ . . ./X64 directory

Notice 2 “GOP Window n” opened



Emulator at Shell Prompt

The Emulator will be running on top of Windows with the UEFI Shell prompt available.



The screenshot shows a window titled 'GOP Window 2' containing the UEFI Interactive Shell v2.2. The text displayed is as follows:

```
UEFI Interactive Shell v2.2
EDK II
UEFI v2.70 (EDK II, 0x00010000)
Mapping table
  FS0: Alias(s) :F1:
        VenHw (5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,000000000) /VenHw (964E5B22-64
59-11D2-8E39-00A0C969723B,000000000)
  BLK0: Alias(s) :
        VenHw (5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,000000000) /VenHw (6888A4AE-AF
CE-E84B-9102-F7B9DAE6A030,000000000)
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.
Shell>
Shell>
Shell> Reset_
```

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) /FuFile (EEC25BDC-67F2-4D95-B
1D5-F81B2039D11D)
Optional- N
Option: 02. Variable: Boot0002
Desc      - UEFI Misc Device
DevPath   - VenHw (5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,000000000) /VenHw (6888A4AE-
AFCE-E84B-9102-F7B9DAE6A030,000000000)
Optional- Y
Option: 03. Variable: Boot0003
Desc      - UEFI Non-Block Boot Device
DevPath   - VenHw (5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,000000000) /VenHw (964E5B22-
6459-11D2-8E39-00A0C969723B,000000000)
Optional- Y
Option: 04. Variable: Boot0004
Desc      - UEFI BootManagerMenuApp
DevPath   - Fv (6D99E806-3D38-42C2-A095-5F4300BFD7DC) /FuFile (EEC25BDC-67F2-4D95-B
1D5-F81B2039D11D) /BootManagerMenuApp
Optional- Y
Option: 05. Variable: Boot0000
Desc      - UEFI Enter Setup
DevPath   - Fv (6D99E806-3D38-42C2-A095-5F4300BFD7DC) /FuFile (462CAA21-7614-4503-B
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 NU+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 NU+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

From Windows File explorer, Copy the file from the

%WORKSPACE%\edk2\ShellPkg\OldShell\Shell_FullX64.efi to the directory
%WORKSPACE%\Build\ . . .\X64

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

After the bcfg add, The output should look like



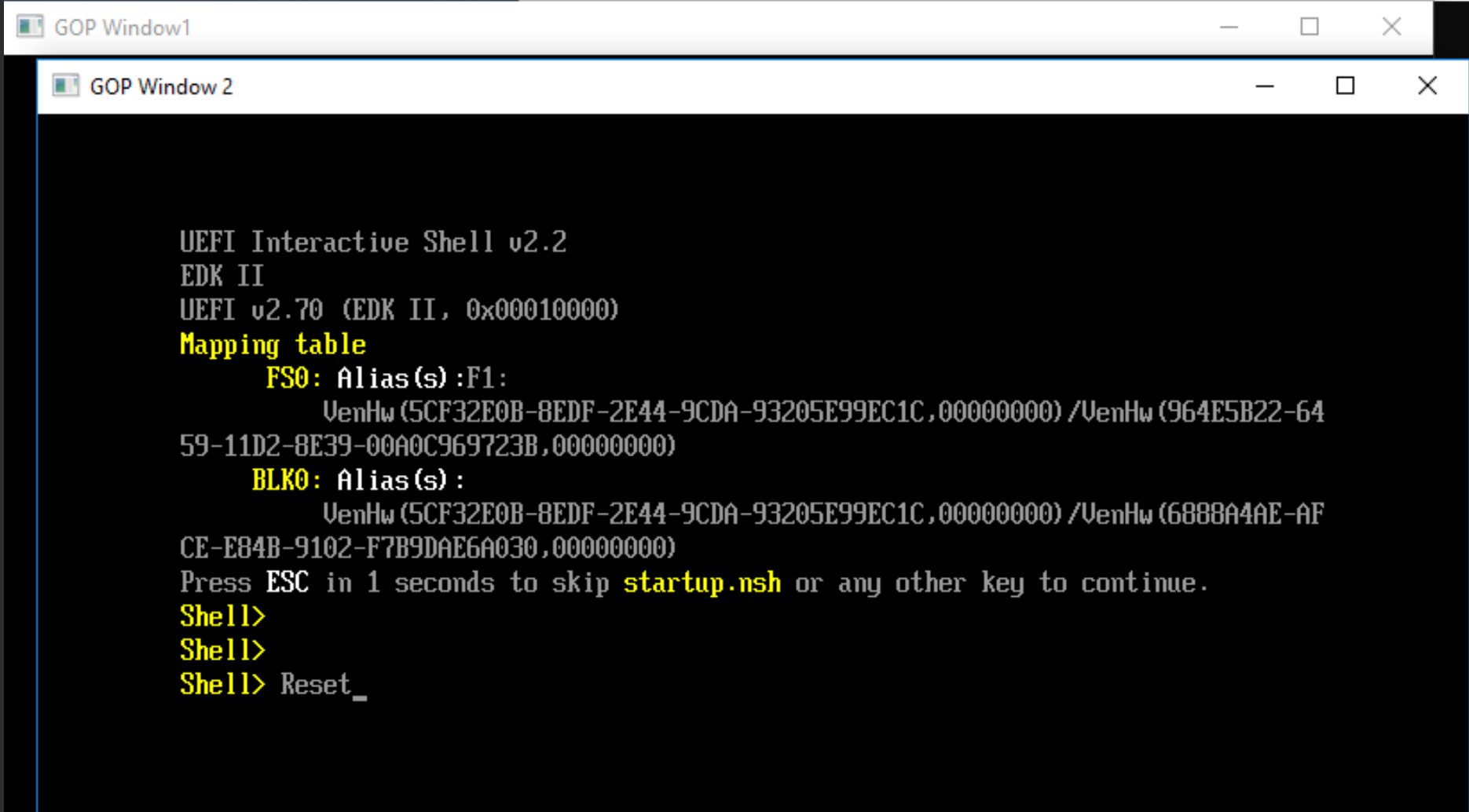
```
FS0:\> dir shell*.efi
Directory of: FS0:\
09/28/2021  12:32                1,425,408  Shell.efi
08/26/2021  15:33                771,136  Shell_FullX64.efi
```

Optional- Y	Result
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:\> _	



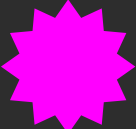


Emulator at Shell Prompt

Type : “Reset” to exit



```
UEFI Interactive Shell v2.2
EDK II
UEFI v2.70 (EDK II, 0x00010000)
Mapping table
  FS0: Alias(s) :F1:
        VenHw (5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,000000000) /VenHw (964E5B22-64
59-11D2-8E39-00A0C969723B,000000000)
  BLK0: Alias(s) :
        VenHw (5CF32E0B-8EDF-2E44-9CDA-93205E99EC1C,000000000) /VenHw (6888A4AE-AF
CE-E84B-9102-F7B9DAE6A030,000000000)
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.
Shell>
Shell>
Shell> Reset_
```

SUMMARY

-  Pin Visual Studio Command Prompt to Windows Task Bar
-  Build a EDK II Platform using Emulator package
-  Run the Emulator in Windows

Questions?



Return to Main Training Page



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BACK UP

Build Errors

Build Error- RC.exe

Error message:



```

Developer Command Prompt for VS2015
DEBUG_VS2015x86\X64\ShellPkg\DynamicCommand\TftpDynamicCommand\TftpDynamicCommand\OUTPUT\tftpDynamicCommandhii.rc
'c:\Program' is not recognized as an internal or external command,
operable program or batch file.
"C:\Program Files (x86)\Microsoft Visual Studio 14.0\VC\bin\x86_amd64\link.exe" /OUT:c:\fw\edk2-ws\Build\EmulatorX64
\DEBUG_VS2015x86\X64\MdeModulePkg\Universal\Disk\PartitionDxe\PartitionDxe\DEBUG\PartitionDxe.dll /NOLOGO /NODEFAULTLIB /IGN
ORE:4001 /OPT:REF /OPT:ICF=10 /MAP /ALIGN:32 /SECTION:.xdata,D /SECTION:.pdata,D /Machine:X64 /LTCG /DLL /ENTRY:_ModuleEntry
Point /SUBSYSTEM:EFI_BOOT_SERVICE_DRIVER /SAFESEH:NO /BASE:0 /DRIVER /DEBUG /ALIGN:4096 /FILEALIGN:4096 /SUBSYSTEM:CONSOLE /
EXPORT:InitializeDriver=_ModuleEntryPoint /BASE:0x10000 @c:\fw\edk2-ws\Build\EmulatorX64\DEBUG_VS2015x86\X64\MdeModulePkg\
Universal\Disk\PartitionDxe\PartitionDxe\OUTPUT\static_library_files.lst
NMAKE : fatal error U1077: '"c:\Program Files (x86)\Windows Kits\8.1\bin\x64\rc.exe' : return code '0x1'
Stop.
'c:\Program' is not recognized as an internal or external command,
operable program or batch file.
NMAKE : fatal error U1077: '"c:\Program Files (x86)\Windows Kits\8.1\bin\x64\rc.exe' : return code '0x1'

```

Find where the RC.EXE is located on your VS Installation:

Example (VS 2015): The RC.exe is located on this machine:

C:\Program Files (x86)\Windows Kits\8.1\bin\x64

Edit Conf\tools_def.txt

Build Error- RC.exe Cont.

Edit `Conf\tools_def.txt`

Search for your installation of Visual Studio (2013, 2015, 2017) “RC.EXE”

Probably in path `C:\Program Files (x86)\Windows Kits\`

Update according to the path for where the RC.EXE is found

```
# Microsoft Visual Studio 2013 Professional Edition
DEFINE WINSDK8_BIN      = c:\Program Files\Windows Kits\8.1\bin\x86\
DEFINE WINSDK8x86_BIN   = c:\Program Files (x86)\Windows Kits\8.1\bin\x64

# Microsoft Visual Studio 2015 Professional Edition
DEFINE WINSDK81_BIN     = c:\Program Files\Windows Kits\8.1\bin\x86\
DEFINE WINSDK81x86_BIN  = c:\Program Files (x86)\Windows Kits\8.1\bin\x64

# Microsoft Visual Studio 2017 Professional Edition
DEFINE WINSDK10_BIN     = C:\Program Files (x86)\Windows Kits\10\bin\x86
```

Paths on your
machine



Copy and Paste RC error: [Link](#)

Build Error: fatal error C1041:

Build Error from fatal error C1041: cannot open program database

This Error is usually because the location you are building is being shared by another application in Windows. Example: Syncplicity may cause this

Error Message:

```
k:\fw\edk2\MdePkg\Library\BaseLib\LinkedList.c : fatal error C1041: cannot open program
database
'k:\fw\edk2\build\nt32ia32\debug_vs2013x86\ia32\mdepkg\library\baselib\baselib\vc120.pdb'; if
multiple CL.EXE write to the same .PDB file, please use /FS
NMAKE : fatal error U1077: '"C:\Program Files (x86)\Microsoft Visual Studio
12.0\Vc\bin\cl.exe"' : return code '0x2'
Stop.
```

Solution: Try using a Workspace that is not shared