

# UEFI & EDK II Training

EDK II Debugging with Linux Lab

[tianocore.org](https://tianocore.org)

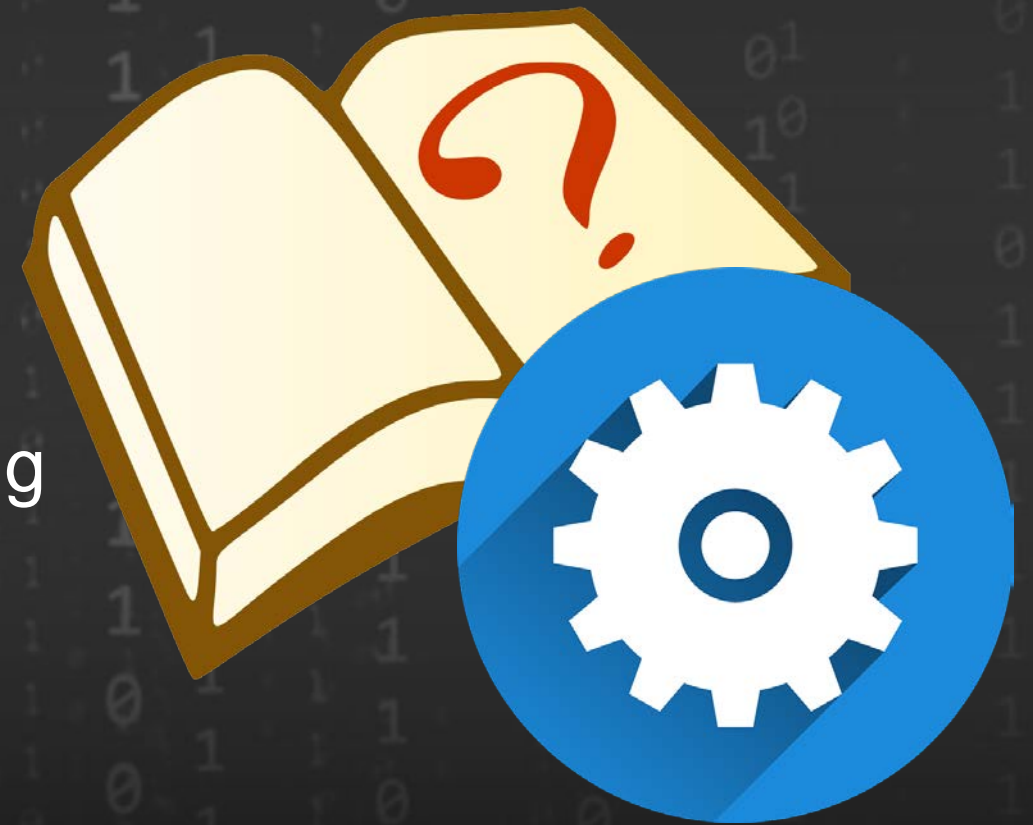
Copy and Paste [LabGuide.md](#)

# Lesson Objective

- ✿ Using PCDs to Configure DebugLib – LAB 1 & 2
- ✿ Change the DebugLib instance to modify the debug output – LAB 3 & 4
- ✿ Debug EDK II Boot Flow – LAB 5

## Catch up Lab

In this lab, you'll start where the previous Writing UEFI Applications left off.



# Lab 0: Catch up from previous lab (1)

**Skip** to next slide if Lab Writing UEFI App Lab completed ([UEFI App Lab Guide](#))

- **Perform** Lab Setup from previous Labs (Setup [Lab Guide](#))
- **Copy** contents of `../FW/LabSampleCode/SampleAppDebug`, directory “/MyPkg”, to `~/fw/edk2-ws/edk2/`
- **Open**  
`edk2-platforms/Platform/Intel/SimicsOpenBoardPkg/BoardX58Ich10/OpenBoardPkg.dsc`  
and add the following in the [Components . . .] section, Hint: add after comment:

```
# Add new modules here  
MyPkg/SampleApp/SampleApp.inf
```

- **Save** and close the file `OpenBoard.dsc`

# Lab 0: Catch up from previous lab (2)

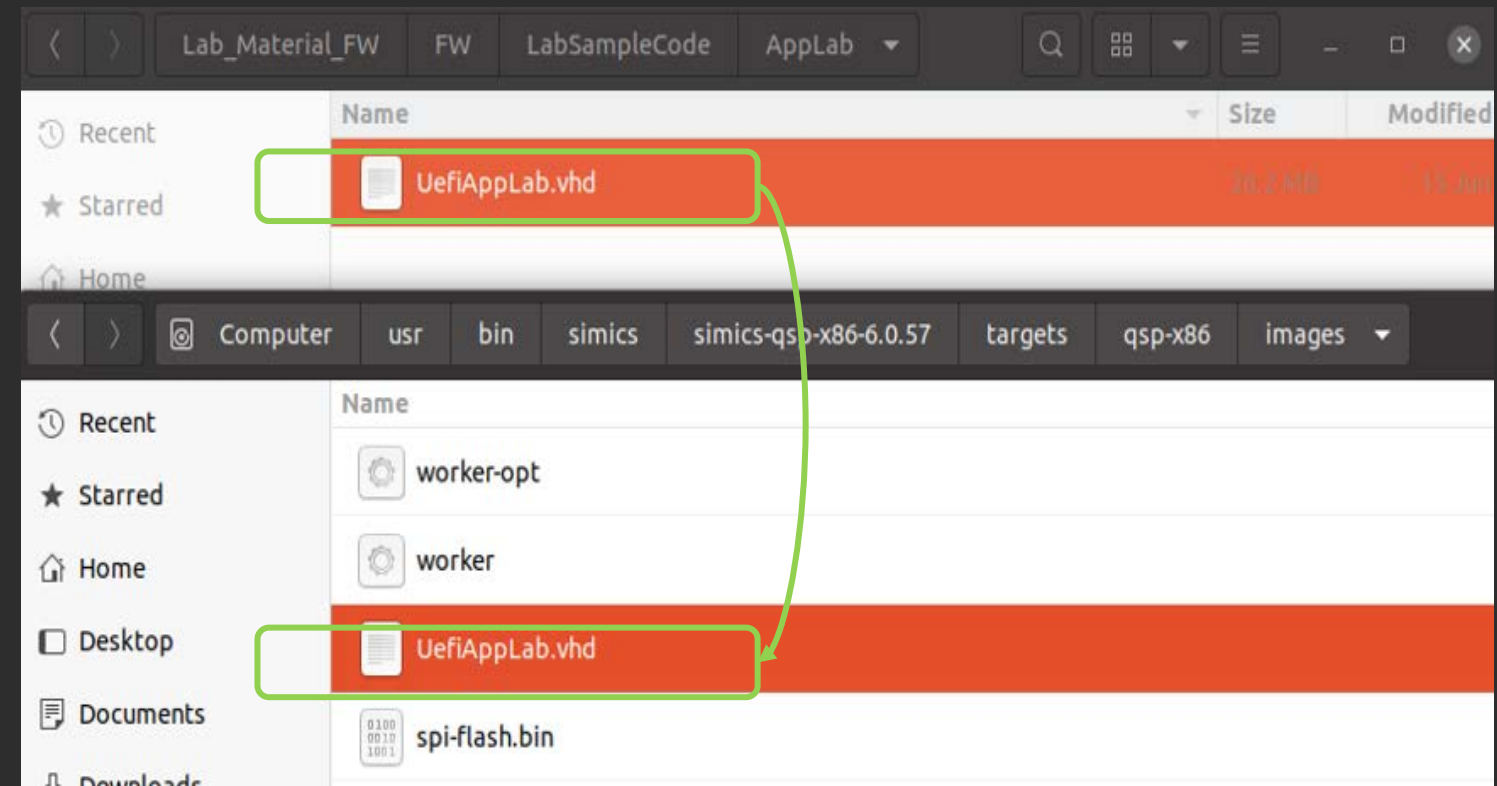
Copy the UefiAppLab.vhd

From:

.../Lab\_Material\_FW/FW/LabSampleCode/AppLab/UefiAppLab.vhd

To

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



# Lab 0: Catch up from previous lab (3)

**Update** the Simics Script to Use the UefiAppLab.vhd image as a file system

**Edit** the file: qsp-modern-core.simics from

<SimicsInstallDir>/simics-qsp-cpu-6.0.4/targets/qsp-x86/qsp-modern-core.simics

**Add** the following Line:

```
$disk1_image="%simics%/targets/qsp-x86/images/UefiAppLab.vhd"
```

Before the “run-command-file” line

**Save** qsp-modern-core.simics

File: qsp-modern-core.simics

```
Decl{
decl {
! Script that runs the Quick Start Platform (QSP) with a modern
!   processor core.

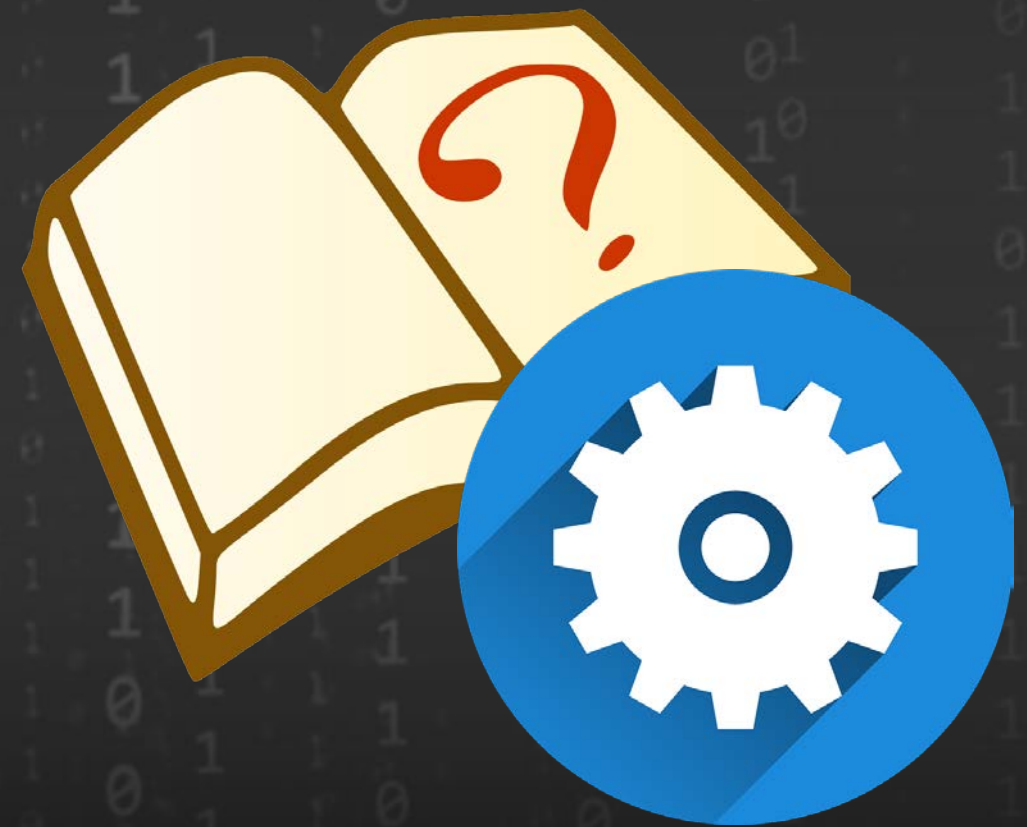
params from "%simics%/targets/qsp-x86/qsp-clear-linux.simics"
default cpu_comp_class = "x86QSP2"
default num_cores = 2
default num_threads = 2
}
$disk1_image="%simics%/targets/qsp-x86/images/UefiAppLab.vhd"

run-command-file "%simics%/targets/qsp-x86/qsp-clear-linux.simics"
```



# Lab 1 – Adding Debug Statements

In this lab, you'll add debug statements to the previous lab's SampleApp UEFI Shell application



# Lab 1: Add debug statements to SampleApp

Mount the UefiAppLab.vhd using GuestMount: [How to Mount VHD](#)

- Open `~/fw/edk2-ws/edk2/MyPkg/SampleApp/SampleApp.c`
- Add the following to the include statements at the top of the file after below the last “include” statement:

```
#include <Library/DebugLib.h>
```



# Lab 1: Add debug statements to SampleApp

Locate the UefiMain function. Then copy and paste the following code after the “EFI\_INPUT\_KEY KEY;” statement: and before the first Print() statement as shown in the screen shot below:

[LabGuide.md](#) for Copy and paste

```
DEBUG ((0xffffffff, "/n/nUEFI Base Training DEBUG DEMO/n") );
DEBUG ((0xffffffff, "0xffffffff USING DEBUG ALL Mask Bits Set/n") );

DEBUG ((DEBUG_INIT,      " 0x%08x USING DEBUG DEBUG_INIT/n" , (UINTN)(DEBUG_INIT)) );
DEBUG ((DEBUG_WARN,      " 0x%08x USING DEBUG DEBUG_WARN/n", (UINTN)(DEBUG_WARN)) );
DEBUG ((DEBUG_LOAD,      " 0x%08x USING DEBUG DEBUG_LOAD/n", (UINTN)(DEBUG_LOAD)) );
DEBUG ((DEBUG_FS,        " 0x%08x USING DEBUG DEBUG_FS/n", (UINTN)(DEBUG_FS)) );
DEBUG ((DEBUG_POOL,      " 0x%08x USING DEBUG DEBUG_POOL/n", (UINTN)(DEBUG_POOL)) );
DEBUG ((DEBUG_PAGE,      " 0x%08x USING DEBUG DEBUG_PAGE/n", (UINTN)(DEBUG_PAGE)) );
DEBUG ((DEBUG_INFO,      " 0x%08x USING DEBUG DEBUG_INFO/n", (UINTN)(DEBUG_INFO)) );
DEBUG ((DEBUG_DISPATCH,  " 0x%08x USING DEBUG DEBUG_DISPATCH/n", (UINTN)(DEBUG_DISPATCH)));
DEBUG ((DEBUG_VARIABLE,  " 0x%08x USING DEBUG DEBUG_VARIABLE/n", (UINTN)(DEBUG_VARIABLE)));
DEBUG ((DEBUG_BM,        " 0x%08x USING DEBUG DEBUG_BM/n", (UINTN)(DEBUG_BM)) );
DEBUG ((DEBUG_BLKIO,     " 0x%08x USING DEBUG DEBUG_BLKIO/n", (UINTN)(DEBUG_BLKIO)) );
DEBUG ((DEBUG_NET,       " 0x%08x USING DEBUG DEBUG_NET/n", (UINTN)(DEBUG_NET)) );
DEBUG ((DEBUG_UNDI,      " 0x%08x USING DEBUG DEBUG_UNDI/n", (UINTN)(DEBUG_UNDI)) );
DEBUG ((DEBUG_LOADFILE,  " 0x%08x USING DEBUG DEBUG_LOADFILE/n", (UINTN)(DEBUG_LOADFILE)));
DEBUG ((DEBUG_EVENT,     " 0x%08x USING DEBUG DEBUG_EVENT/n", (UINTN)(DEBUG_EVENT)) );
DEBUG ((DEBUG_GCD,       " 0x%08x USING DEBUG DEBUG_GCD/n", (UINTN)(DEBUG_EVENT)) );
DEBUG ((DEBUG_CACHE,     " 0x%08x USING DEBUG DEBUG_CACHE/n", (UINTN)(DEBUG_CACHE)) );
DEBUG ((DEBUG_VERBOSE,   " 0x%08x USING DEBUG DEBUG_VERBOSE/n", (UINTN)(DEBUG_VERBOSE)) );
DEBUG ((DEBUG_ERROR,     " 0x%08x USING DEBUG DEBUG_ERROR/n", (UINTN)(DEBUG_ERROR)) );
```

SAVE and CLOSE SampleApp.c

# Update UefiAppLab.vhd File

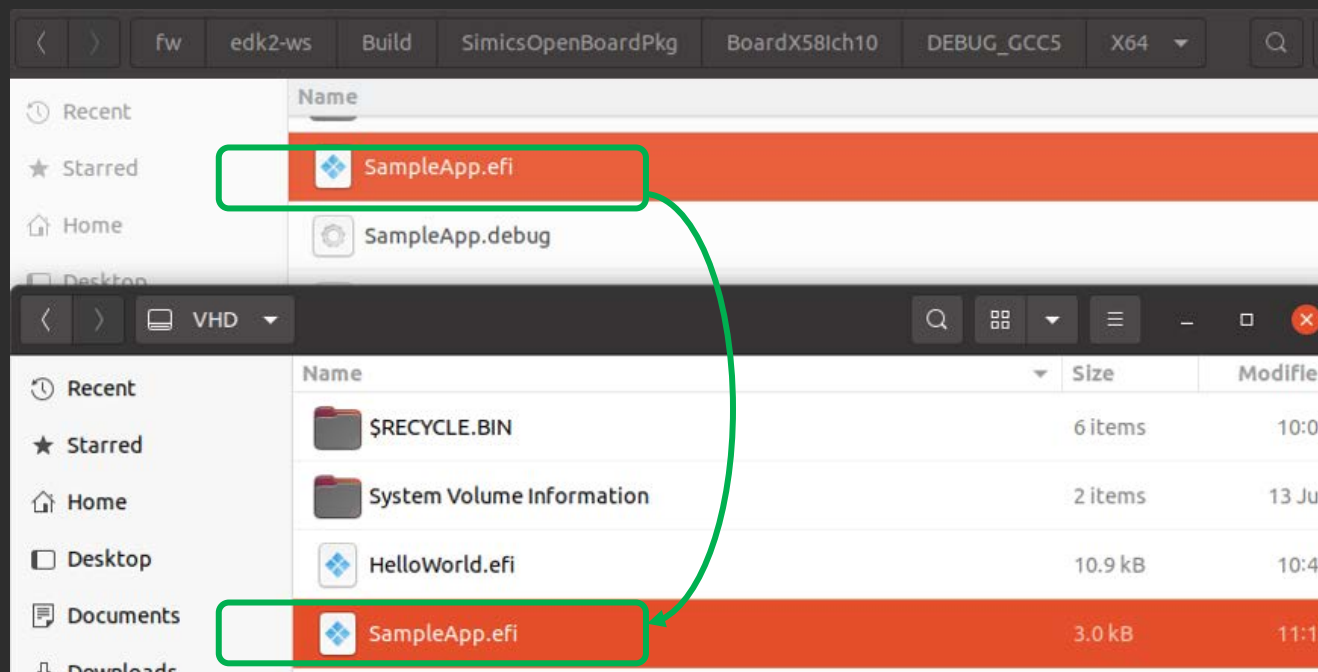
## Build the Simics Board

At the Another Terminal Prompt to Build BoardX58Ich10

```
$ cd ~/fw/edk2-ws/edk2
$ . edksetup.sh
$ cd ~/fw/edk2-ws/edk2-platforms/Platform/Intel/
$ python build_bios.py -p BoardX58Ich10 -t GCC5
```

## Copy **SampleApp.efi** from the build directory to the **VHD Disk**

```
$ cp ~/fw/edk2-ws/edk2/Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG_GCC5/X64/SampleApp.efi
~/VHD
```



Build Directory

VHD Disk

# Lab 1: Build, Run and Test Result

Open another Terminal Command Prompt

```
$ cd simics-projects/my-simics-project-1
```

Run the qsp-modern-core script :

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

```
simics> run
```

(Press “F2” at the logo, then Select “Boot Manger” followed by “EFI Internal Shell”)

At the Shell prompt

```
Shell> Fs1:  
FS1:/> SampleApp
```

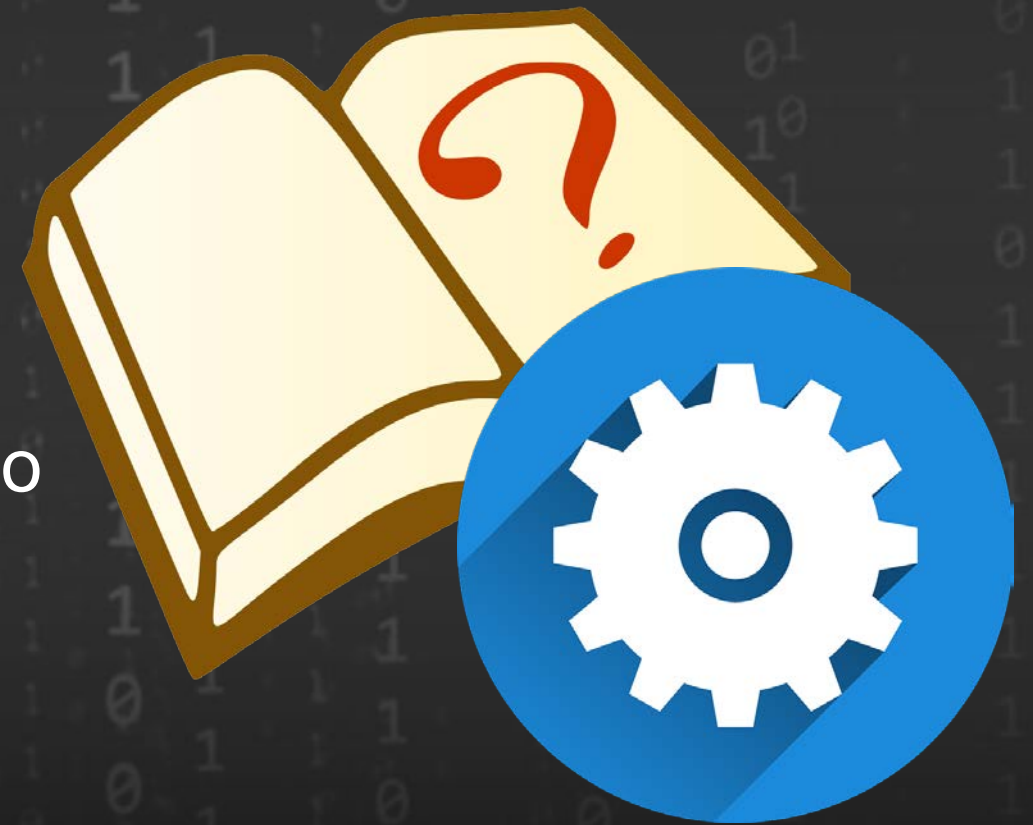
See that the output from the Debug statements goes to the Simics Serial Console

Exit Simics `simics> Stop` then `simics> quit`

```
-----  
Loading driver at 0x000DD279000 EntryPoint=0x000DD279344 SampleApp.efi  
InstallProtocolInterface: BC62157E-3E33-4FEC-9920-2D3B36D750DF DDF99818  
ProtectUefiImageCommon - 0xDDF901C0  
- 0x00000000DD279000 - 0x0000000000004020  
InstallProtocolInterface: 752F3136-4E16-4FDC-A22A-E5F46812F4CA DF303818  
  
>>>>[UefiMain] Entry point: 0xDD279560 <<<<<<  
  
UEFI Base Training DEBUG DEMO  
0xffffffff USING DEBUG ALL Mask Bits Set  
0x00000001 USING DEBUG DEBUG_INIT  
0x00000002 USING DEBUG DEBUG_WARN  
0x00000004 USING DEBUG DEBUG_LOAD  
0x00000008 USING DEBUG DEBUG_FS  
0x00000040 USING DEBUG DEBUG_INFO  
0x80000000 USING DEBUG DEBUG_ERROR  
FSOpen: Open '\\' Success  
█
```

## Lab 2 – Changing PCD Value

In this lab, you'll learn how to use PCD values to change debugging capabilities.



# Lab 2: Change PCDs for SampleApp

Open

`~/fw/edk2-ws/edk2-platforms/Platform/Intel/SimicsOpenBoardPkg/BoardX58Ich10/OpenBoardPkg.dsc`

Replace `MyPkg/SampleApp/SampleApp.inf` with the following:

```
MyPkg/SampleApp/SampleApp.inf {  
  <PcdsFixedAtBuild>  
    gEfiMdePkgTokenSpaceGuid.PcdDebugPropertyMask|0xff  
    gEfiMdePkgTokenSpaceGuid.PcdDebugPrintErrorLevel|0xffffffff  
}
```

**Save and close** `OpenBoardPkg.dsc`

[LabGuide.md](#) for Copy and paste



# Lab 2 : Build and Test SampleApp

## 1. At the Terminal Command Prompt, Re-Build BoardX58Ich10

```
$ cd ~/fw/edk2-ws/edk2-platforms/Platform/Intel/
$ python build_bios.py -p BoardX58Ich10 -t GCC5
```

## 2. Copy **SampleApp.efi** from the build directory to the **VHD Disk**

```
$ cp ../Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG_GCC5/X64/SampleApp.efi ~/VHD
```

## 3. Run the qsp-modern-core script from Terminal Command Prompt

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

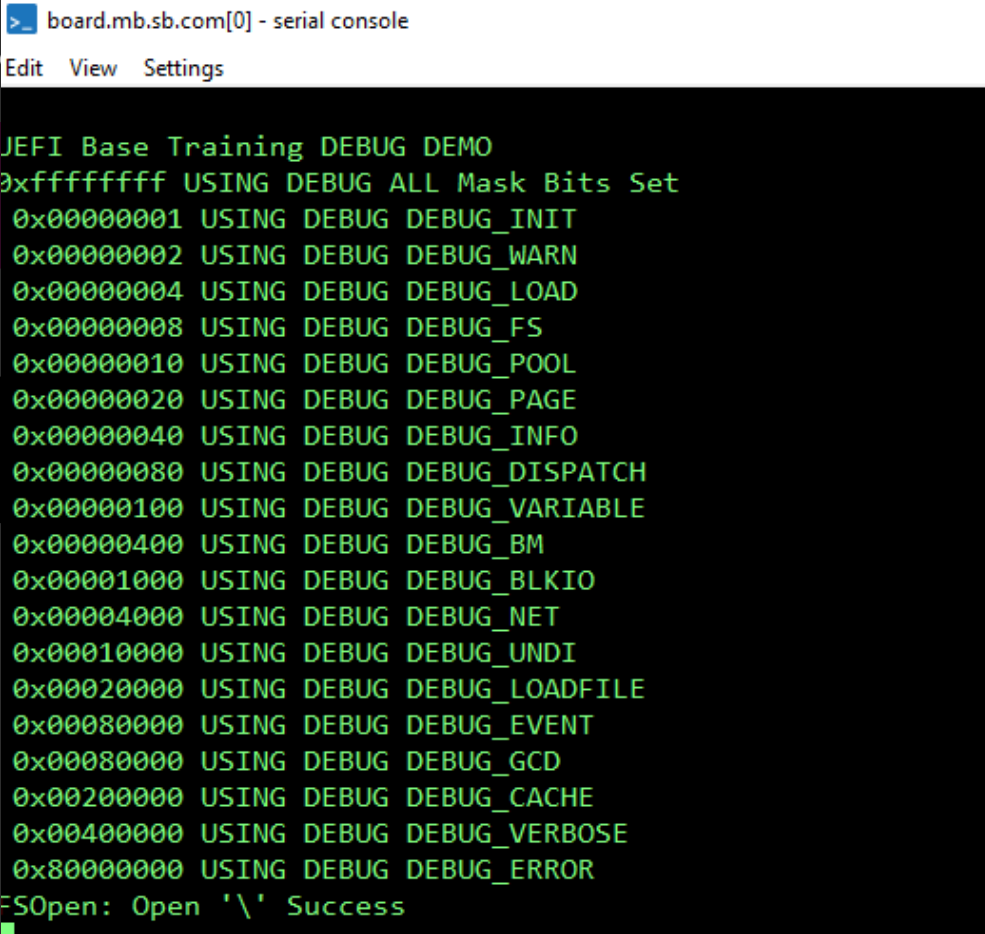
## 4. At the UEFI Shell prompt

```
Shell> Fs1:
FS1:/> SampleApp.efi
```

See that the output from ALL the Debug statements goes to the Simics Serial Console

## 5. Exit Simics

```
simics> stop, simics> quit
```



```
board.mb.sb.com[0] - serial console
Edit View Settings
UEFI Base Training DEBUG DEMO
0xffffffff USING DEBUG ALL Mask Bits Set
0x00000001 USING DEBUG DEBUG_INIT
0x00000002 USING DEBUG DEBUG_WARN
0x00000004 USING DEBUG DEBUG_LOAD
0x00000008 USING DEBUG DEBUG_FS
0x00000010 USING DEBUG DEBUG_POOL
0x00000020 USING DEBUG DEBUG_PAGE
0x00000040 USING DEBUG DEBUG_INFO
0x00000080 USING DEBUG DEBUG_DISPATCH
0x00000100 USING DEBUG DEBUG_VARIABLE
0x00000400 USING DEBUG DEBUG_BM
0x00001000 USING DEBUG DEBUG_BLKIO
0x00004000 USING DEBUG DEBUG_NET
0x00010000 USING DEBUG DEBUG_UNDI
0x00020000 USING DEBUG DEBUG_LOADFILE
0x00080000 USING DEBUG DEBUG_EVENT
0x00080000 USING DEBUG DEBUG_GCD
0x00200000 USING DEBUG DEBUG_CACHE
0x00400000 USING DEBUG DEBUG_VERBOSE
0x80000000 USING DEBUG DEBUG_ERROR
FSOpen: Open '\\' Success
```



## Lab 3 – Library Instances for Debugging

In this lab, you'll learn how to add specific debug library instances.



# Lab 3: Using Library Instances for Debugging

Open

`~/fw/edk2-platforms/Platform/Intel/SimicsOpenBoardPkg/BoardX58Ich10/OpenBoardPkg.dsc`

Replace `MyPkg/SampleApp/SampleApp.inf { . . . }` with the following:

```
MyPkg/SampleApp/SampleApp.inf {  
  <LibraryClasses>  
    DebugLib|MdePkg/Library/UefiDebugLibConOut/UefiDebugLibConOut.inf  
}
```

**Save and close** `OpenBoardPkg.dsc`

# Lab 3 : Build and Test SampleApp

## 1. At the Terminal Command Prompt, Re-Build BoardX58Ich10

```
$ cd ~/fw/edk2-ws/edk2-platforms/Platform/Intel/
$ python build_bios.py -p BoardX58Ich10 -t GCC5
```

## 2. Copy **SampleApp.efi** from the build directory to the **VHD Disk**

Copy ../Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG\_GCC5/X64/SampleApp.efi UefiAppLab Disk

## 3. Run the qsp-modern-core script from Terminal Command Prompt:

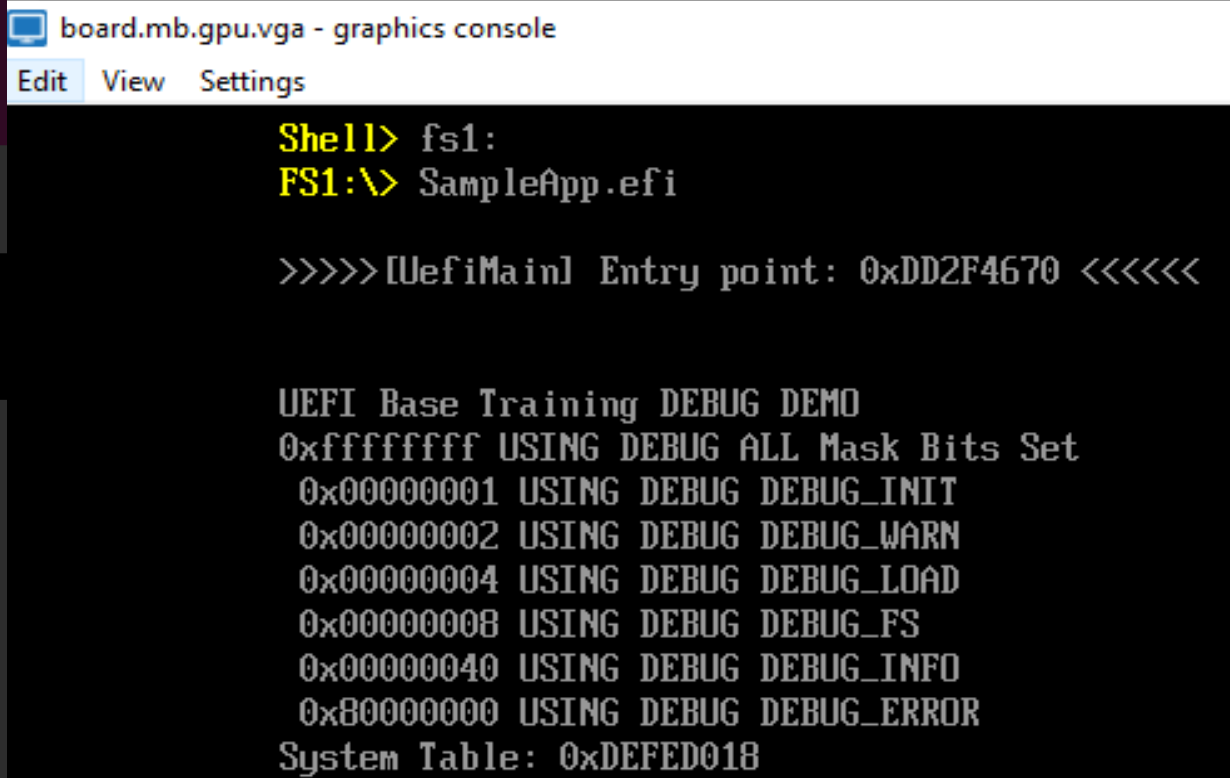
```
$ ./simics targets/qsp-x86/qsp-modern-core.simics
simics> run
```

## 4. At the UEFI Shell prompt

```
Shell> Fs1:
FS1:/> SampleApp.efi
```

See that the output from the Debug statements now goes to the Simics VGA console

## 5. Exit Simics `simics> stop, simics> quit`



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

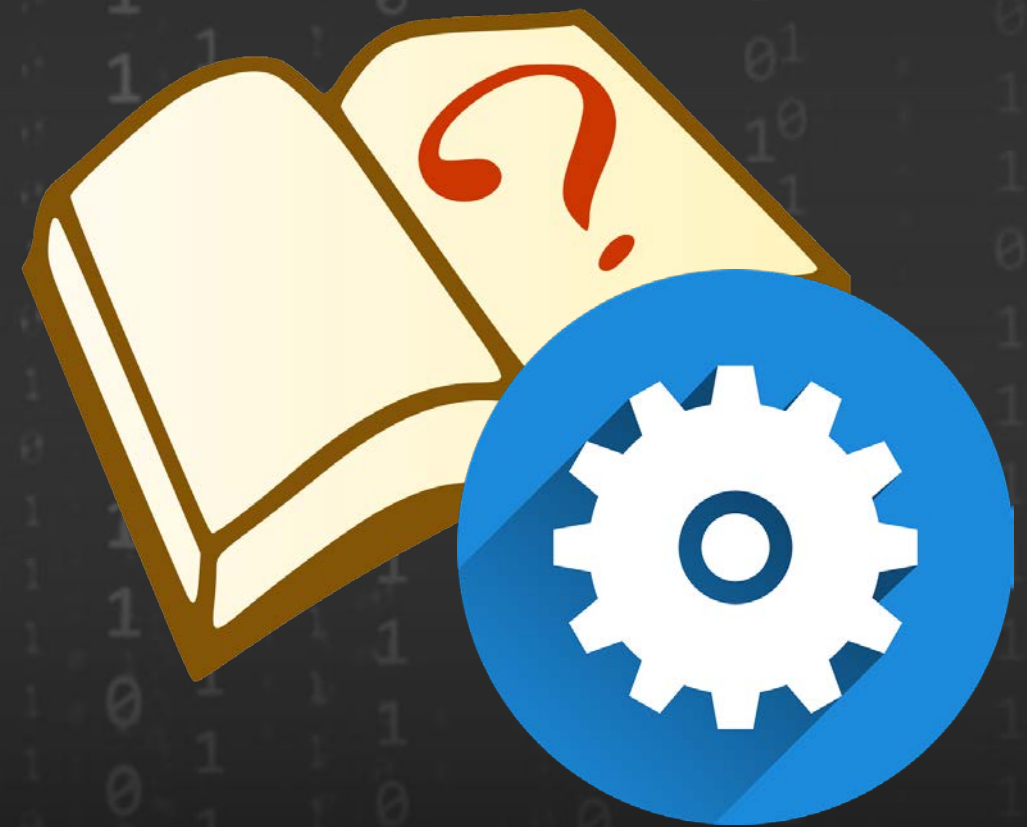
Shell> fs1:
FS1:\> SampleApp.efi

>>>>>[UefiMain] Entry point: 0xDD2F4670 <<<<<<

UEFI Base Training DEBUG DEMO
0xffffffff USING DEBUG ALL Mask Bits Set
0x00000001 USING DEBUG DEBUG_INIT
0x00000002 USING DEBUG DEBUG_WARN
0x00000004 USING DEBUG DEBUG_LOAD
0x00000008 USING DEBUG DEBUG_FS
0x00000040 USING DEBUG DEBUG_INFO
0x80000000 USING DEBUG DEBUG_ERROR
System Table: 0xDEDED018
```

## Lab 4: Null Instance of DebugLib

In this lab, you'll change the DebugLib to the Null instance.



# Lab 4: Using Null Library Instances

Open

`~/fw/edk2-platforms/Platform/Intel/SimicsOpenBoardPkg/BoardX58Ich10/OpenBoardPkg.dsc`

Replace `MyPkg/SampleApp/SampleApp.inf` { . . . } with the following:

```
MyPkg/SampleApp/SampleApp.inf {  
  <LibraryClasses>  
  DebugLib|MdePkg/Library/BaseDebugLibNull/BaseDebugLibNull.inf  
}
```

**Save and close** `OpenBoardPkg.dsc`

# Lab 4 : Build and Test SampleApp

## 1. At the Terminal Command Prompt, Re-Build BoardX58Ich10

```
$ cd ~/fw/edk2-ws/edk2-platforms/Platform/Intel/
$ python build_bios.py -p BoardX58Ich10 -t GCC5
```

## 2. Copy **SampleApp.efi** from the build directory to the **VHD Disk**

Copy ../Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG\_GCC5/X64/SampleApp.efi UefiAppLab Disk

## 3. Run the qsp-modern-core script from Terminal Command Prompt:

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

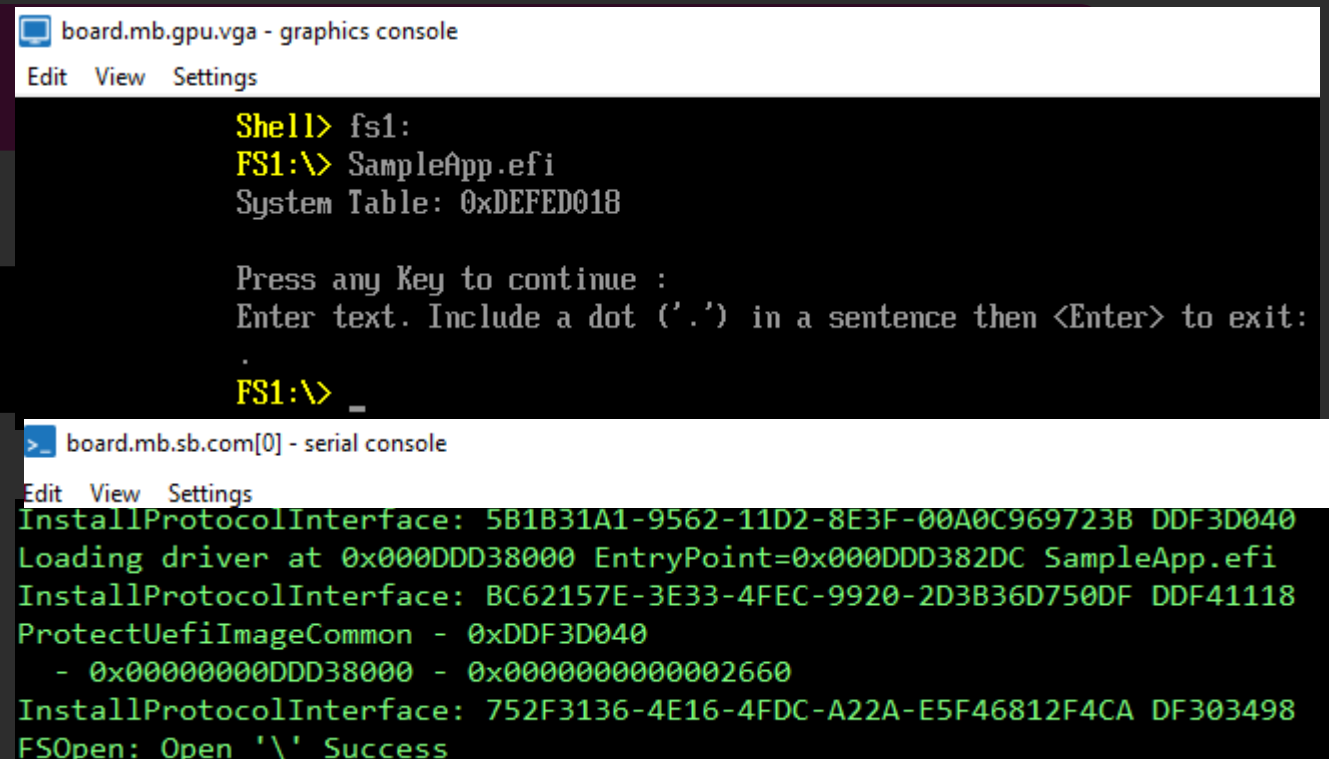
## 4. At the UEFI Shell prompt

```
Shell> Fs1:
FS1:/> SampleApp.efi
```

See that there is **NO** Debug output

## 5. Exit Simics

```
simics> stop, simics> quit
```

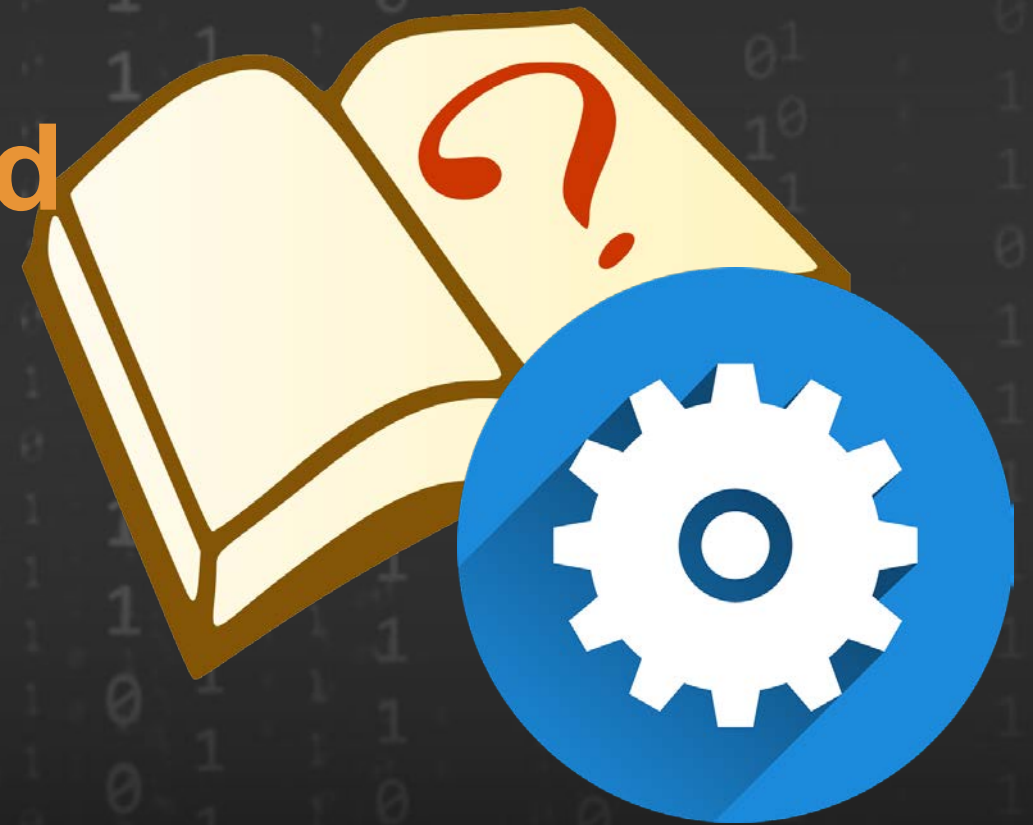


The first screenshot shows the UEFI Shell interface for 'board.mb.gpu.vga - graphics console'. It displays the command 'fs1:' followed by 'SampleApp.efi' and 'System Table: 0xDEFED018'. It prompts the user to 'Press any Key to continue' and 'Enter text. Include a dot ('.') in a sentence then <Enter> to exit:'. The second screenshot shows the serial console output for 'board.mb.sb.com[0] - serial console'. It displays the command 'InstallProtocolInterface: 5B1B31A1-9562-11D2-8E3F-00A0C969723B DDF3D040' followed by 'Loading driver at 0x000DDD38000 EntryPoint=0x000DDD382DC SampleApp.efi'. It then displays the command 'InstallProtocolInterface: BC62157E-3E33-4FEC-9920-2D3B36D750DF DDF41118' followed by 'ProtectUefiImageCommon - 0xDDF3D040' and '0x00000000DDD38000 - 0x0000000000002660'. Finally, it displays the command 'InstallProtocolInterface: 752F3136-4E16-4FDC-A22A-E5F46812F4CA DF303498' followed by 'FSOpen: Open \'\' Success'.



## Lab 5: Debugging EDK II add Debug to Boot Flow

In this lab, you'll learn how to add Debug statements to the EDK II Boot flow and check the debug log output



# Lab 5: Debug Boot Flow

Edit the MdeModulePkg/Core/Pei/PeiMain/PeiMain.c and add a “DEBUG” print ~line 489 before the call to the PeiDispatcher:

```
DEBUG((DEBUG_INFO, "***** ***** *****Before call to Pei Dispatcher ***** ***** *****/n"));
```

Save PeiMain.c

```
487 // Call PEIM dispatcher
488 //
489 DEBUG((DEBUG_INFO, "***** ***** *****Before call to Pei Dispatcher ***** ***** *****\n"));
490 PeiDispatcher (SecCoreData, &PrivateData);
491
```

# Lab 5 : Build and Test SampleApp

## 1. At the Terminal Command Prompt, Re-Build BoardX58Ich10

```
$ cd ~/fw/edk2-ws/edk2-platforms/Platform/Intel/
$ python build_bios.py -p BoardX58Ich10 -t GCC5
```

## 2. Copy the Simics QSP Board .FD file

~/fw/edk2-ws/Build/SimicsOpenBoardPkg/BoardX58Ich10/DEBUG\_GCC5/FV/BOARDX58ICH10.fd To  
<SimicsInstallDir>/simics-qsp-x86-6.0.57/targets/qsp-x86/images

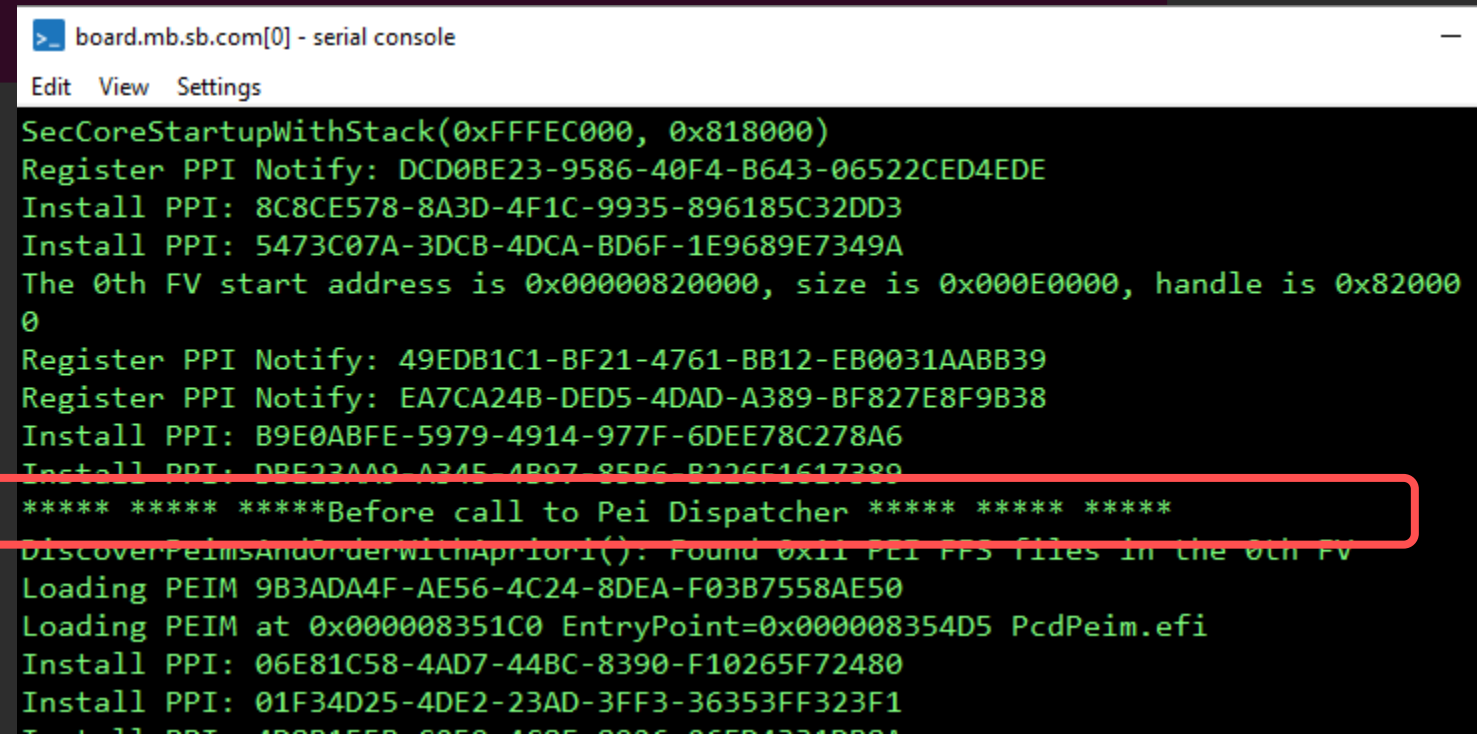
## 3. Run the qsp-modern-core script from Terminal Command Prompt:

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

## 4. Scroll back in the Simics Serial Console to find the Debug statement before the PEI Dispatcher. This would be a place to debug a PEIM

## 5. Exit Simics

```
simics> stop, simics> quit
```



```
board.mb.sb.com[0] - serial console
Edit View Settings
SecCoreStartupWithStack(0xFFFFEC000, 0x818000)
Register PPI Notify: DCD0BE23-9586-40F4-B643-06522CED4EDE
Install PPI: 8C8CE578-8A3D-4F1C-9935-896185C32DD3
Install PPI: 5473C07A-3DCB-4DCA-BD6F-1E9689E7349A
The 0th FV start address is 0x00000820000, size is 0x000E0000, handle is 0x82000
0
Register PPI Notify: 49EDB1C1-BF21-4761-BB12-EB0031AABB39
Register PPI Notify: EA7CA24B-DED5-4DAD-A389-BF827E8F9B38
Install PPI: B9E0ABFE-5979-4914-977F-6DEE78C278A6
Install PPI: DBE22AA0-A345-4B07-85B6-B226F1617380
*****Before call to Pei Dispatcher*****
DiscoverPeimsAndOrderWithApriori(): Found 0x11 PEI PFS files in the 0th FV
Loading PEIM 9B3ADA4F-AE56-4C24-8DEA-F03B7558AE50
Loading PEIM at 0x000008351C0 EntryPoint=0x000008354D5 PcdPeim.efi
Install PPI: 06E81C58-4AD7-44BC-8390-F10265F72480
Install PPI: 01F34D25-4DE2-23AD-3FF3-36353FF323F1
```

# Summary

- ✿ Using PCDs to Configure DebugLib – LAB 1 & 2
- ✿ Change the DebugLib instance to modify the debug output – LAB 3 & 4
- ✿ Debug EDK II Boot flow- LAB 5

# Questions?





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