

# UEFI & EDK II Training

EDK II Debugging with Windows Lab – Simics® QSP

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

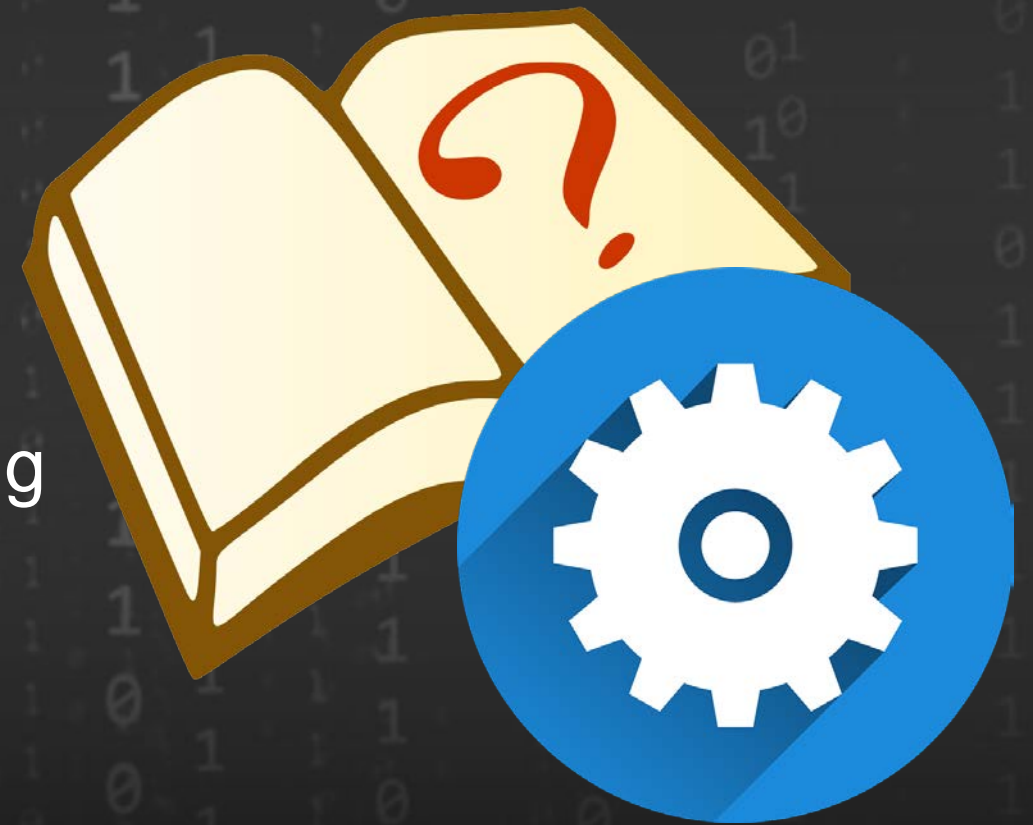
Copy and Paste [LabGuide.md](#)

# 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 0

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



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

Skip the Catch up Lab if Lab Writing UEFI App Lab completed ([UEFI App Lab Guide](#))

- **Perform** Lab Setup from previous Labs ([Lab Guide](#))
- **Copy** contents of C:../FW/LabSampleCode/SampleAppDebug/, directory “MyPkg”, to C:/FW/edk2-ws/edk2/
- **Open**  
edk2-platforms/Platform/Intel/SimicsOpenBoardPkg/BoardX58Ich10/OpenBoardPkg.dsc
- **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)

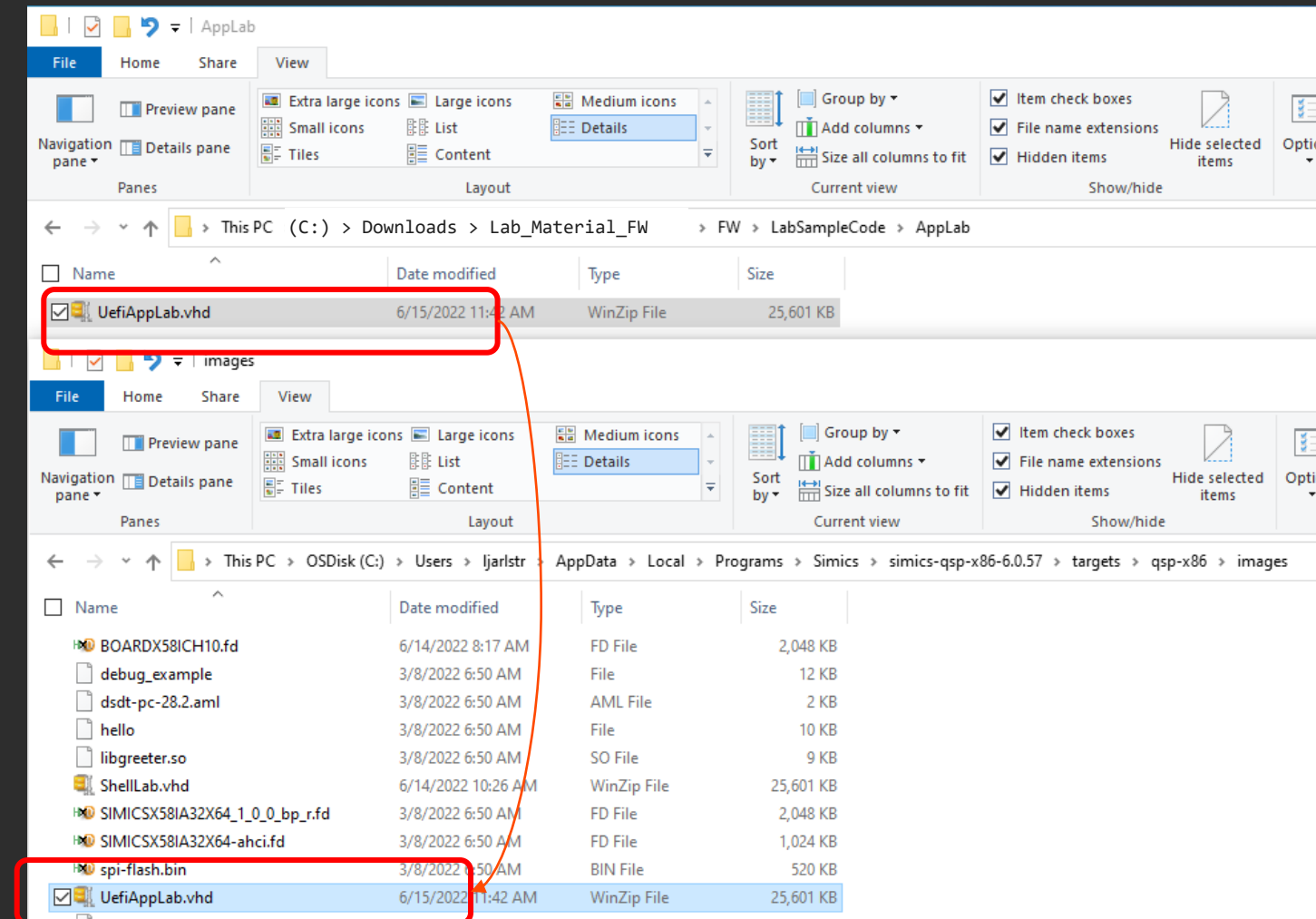
Copy the UefiAppLab.vhd

From:

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

to

**%USERPROFILE%**\AppData\Local\Pr  
ograms\Simics\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

**%USERPROFILE%\**

**\AppData\Local\Programs\Simics\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.

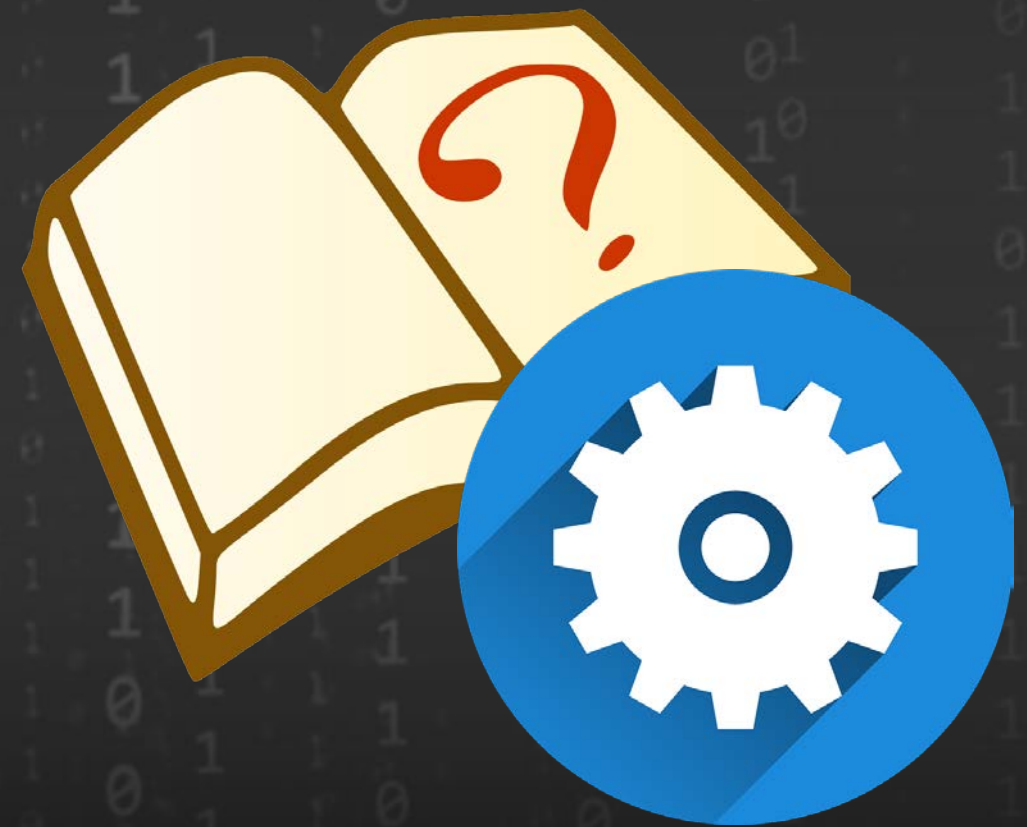
params from "%simics%/targets/qsp-x86/qsp-clear-linux.simics"
default cpu_comp_class = "x86QSP2"
default num_cores = 2
default num_threads = 2
}
$disk1_image="%simics%/targets/qsp-x86/images/UefiAppLab.vhd"

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

1. Mount the UefiAppLab.vhd using Disk Manager: [How to Mount VHD](#)
2. Open C:/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 QSP Board

At the VS Command Prompt, Build BoardX58Ich10

```
$> cd C:\FW\edk2-ws\edk2-platforms\Platform\Intel\
$> python build_bios.py -p BoardX58Ich10 -t VS20XX
```

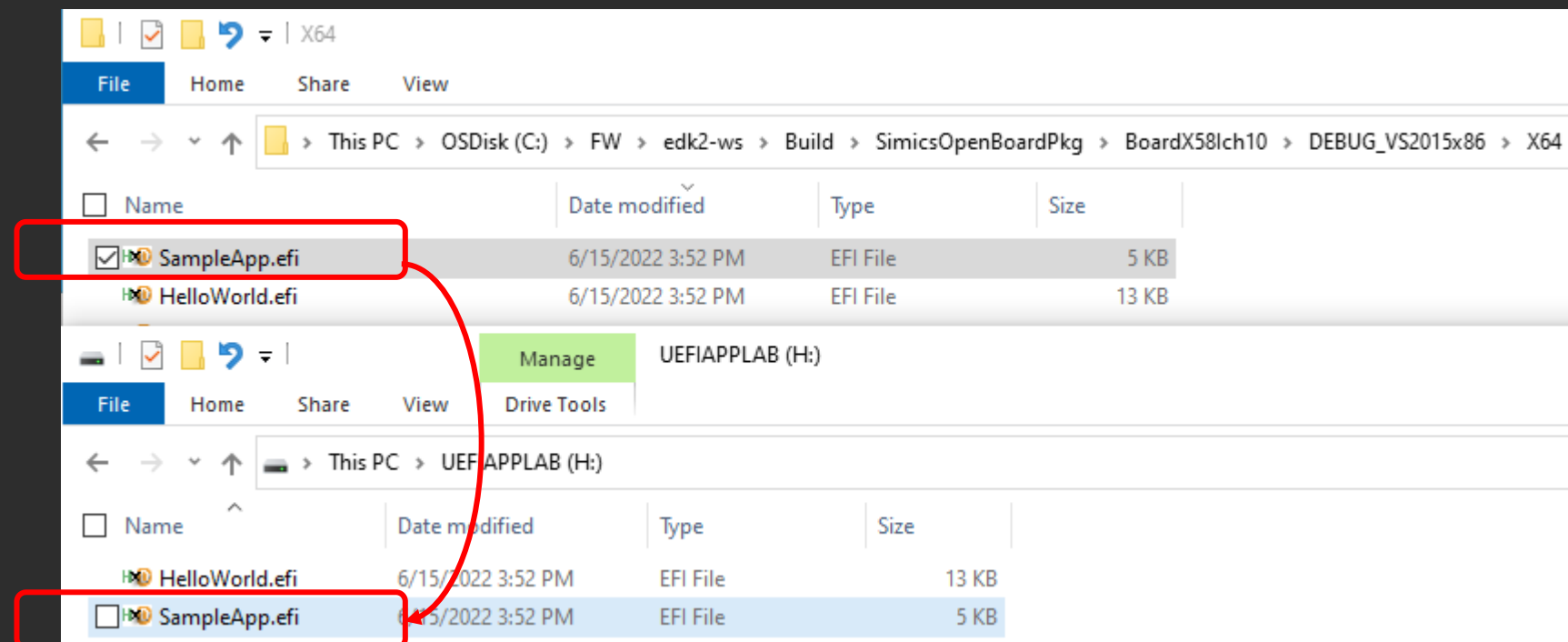
Copy

C:\FW\edk2-ws\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG\_VS2015x86\X64\SampleApp.efi

To

X:\UEFIAPPLAB\

(where X is the VHD Drive)



Build Directory

VHD Disk

# Lab 1: Build, Run and Test Result

**Open** another Windows 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”)

**Invoke** SampleApp at the Shell prompt

```
Shell> Fs1:  
FS1:\> SampleApp
```

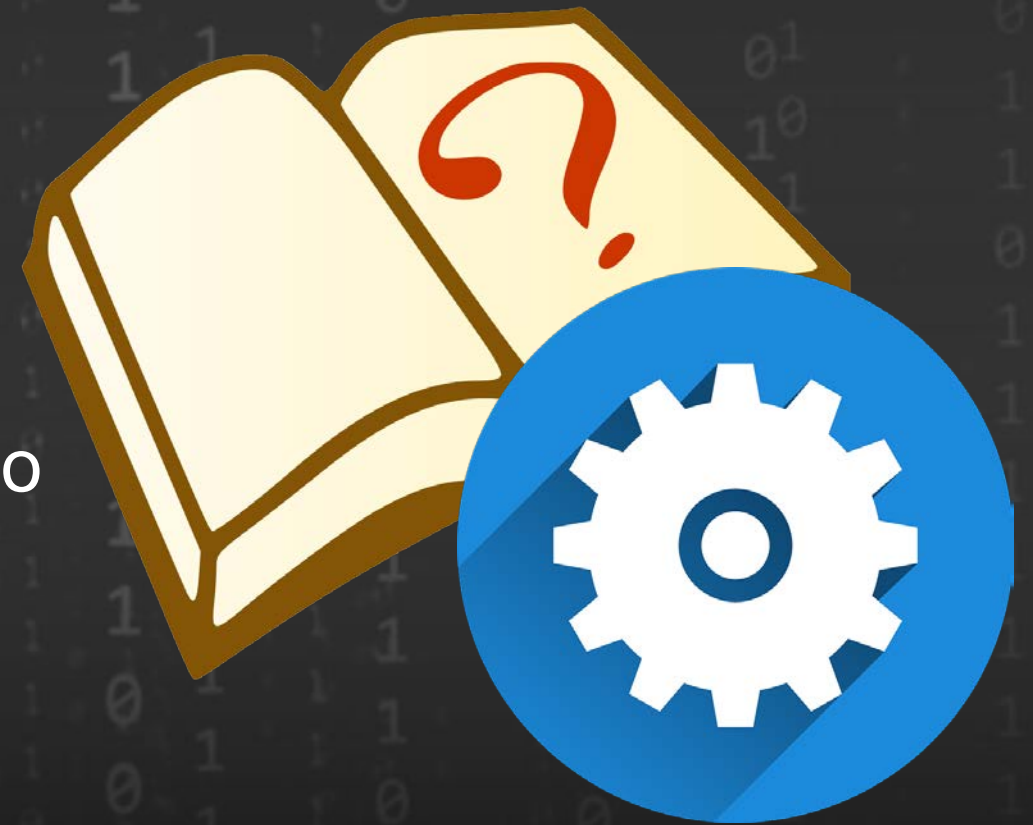
See that the output from the Debug statements goes to the Simics Serial Console

**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

C:/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 VS Command Prompt, Re-Build BoardX58Ich10

```
$> Cd C:\FW\edk2-ws\edk2-platforms\Platform\Intel\  
$> python build_bios.py -p BoardX58Ich10 -t VS20XX
```

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

Copy `..\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG_VS20XX\X64\SampleApp.efi` UefiAppLab Disk

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

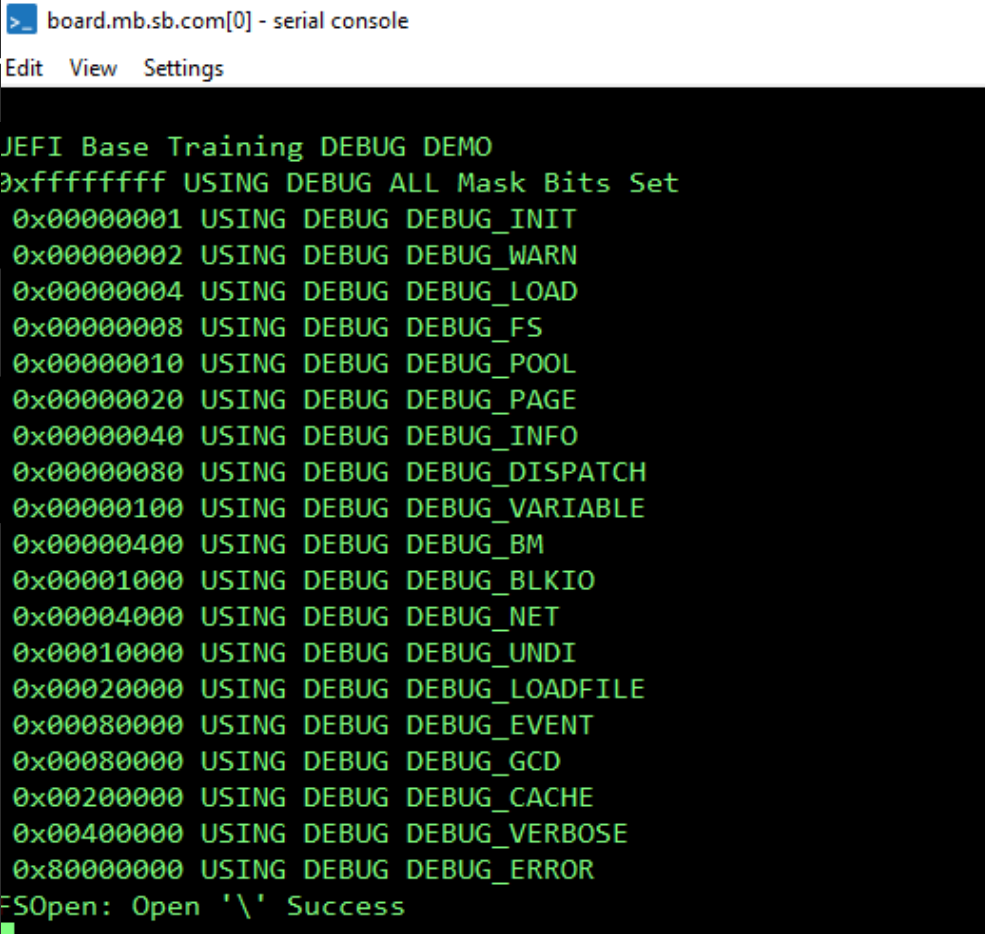
```
$> .\simics targets/qsp-x86/qsp-modern-core.simics  
simics> run
```

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  
JEFI 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

C:/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 VS Command Prompt, Re-Build BoardX58Ich10

```
$> Cd C:\FW\edk2-ws\edk2-platforms\Platform\Intel\
$> python build_bios.py -p BoardX58Ich10 -t VS20XX
```

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

Copy ..\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG\_VS20XX\X64\SampleApp.efi UefiAppLab Disk

## 3. Run the qsp-modern-core script from Windows 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
```

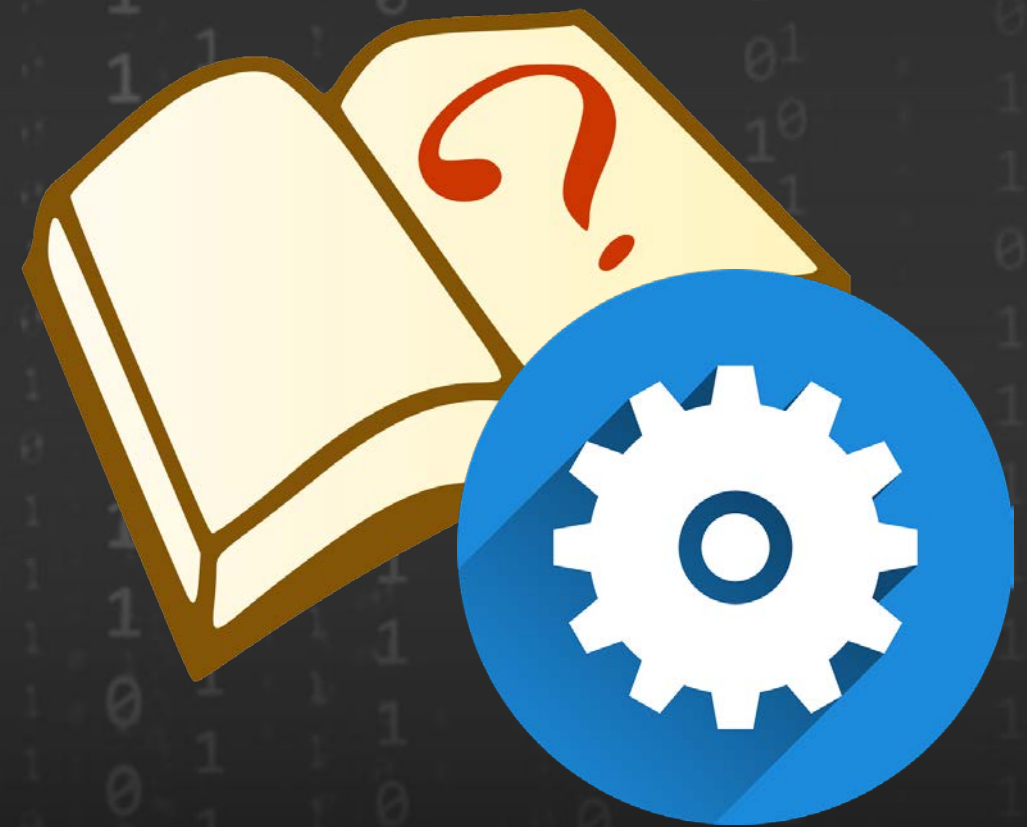
```
0x00000040 USING DEBUG DEBUG_INFO
```

```
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

C:/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 VS Command Prompt, Re-Build BoardX58Ich10

```
$> Cd C:\FW\edk2-ws\edk2-platforms\Platform\Intel\
$> python build_bios.py -p BoardX58Ich10 -t VS20XX
```

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

Copy ..\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG\_VS20XX\X64\SampleApp.efi UefiAppLab Disk

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

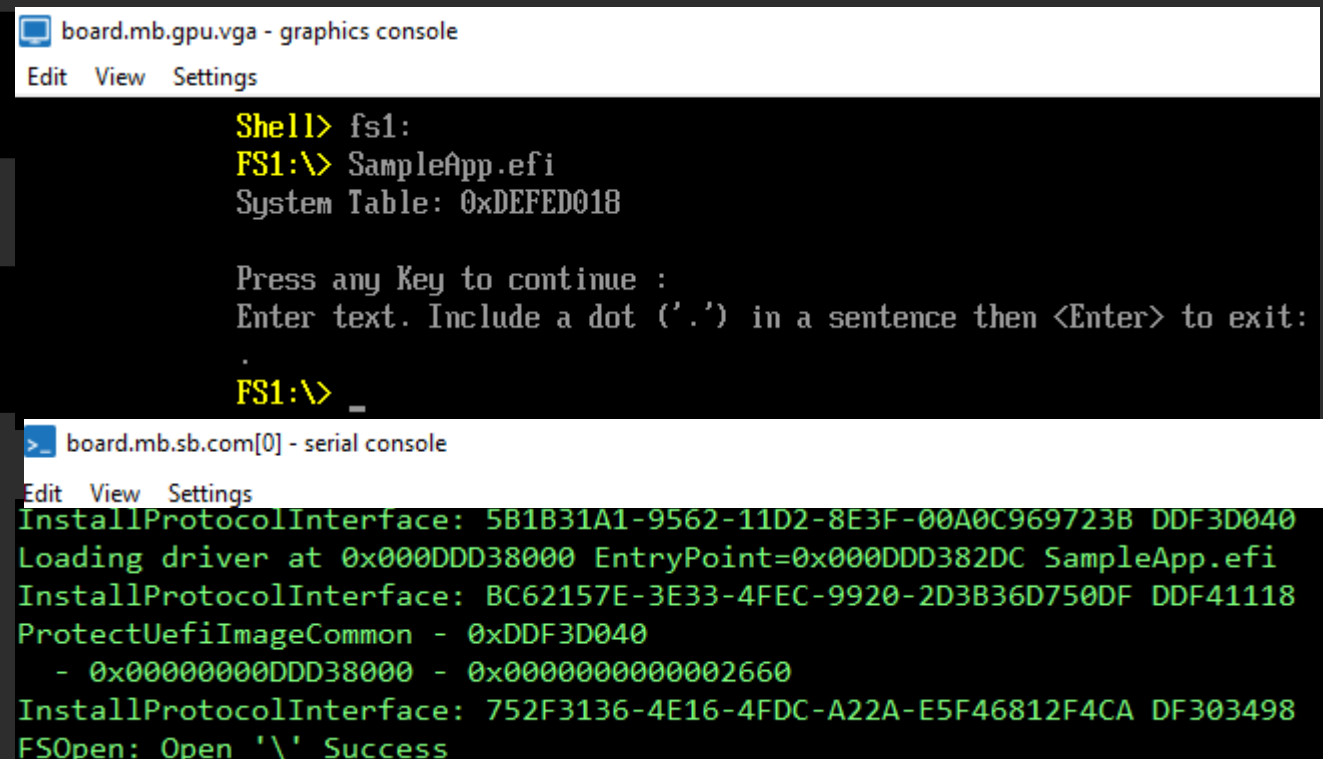
```
$> .\simics targets/qsp-x86/qsp-modern-core.simics
simics> run
```

## 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



board.mb.gpu.vga - graphics console

```

Edit View Settings

Shell> fs1:
FS1:\> SampleApp.efi
System Table: 0xDEDED018

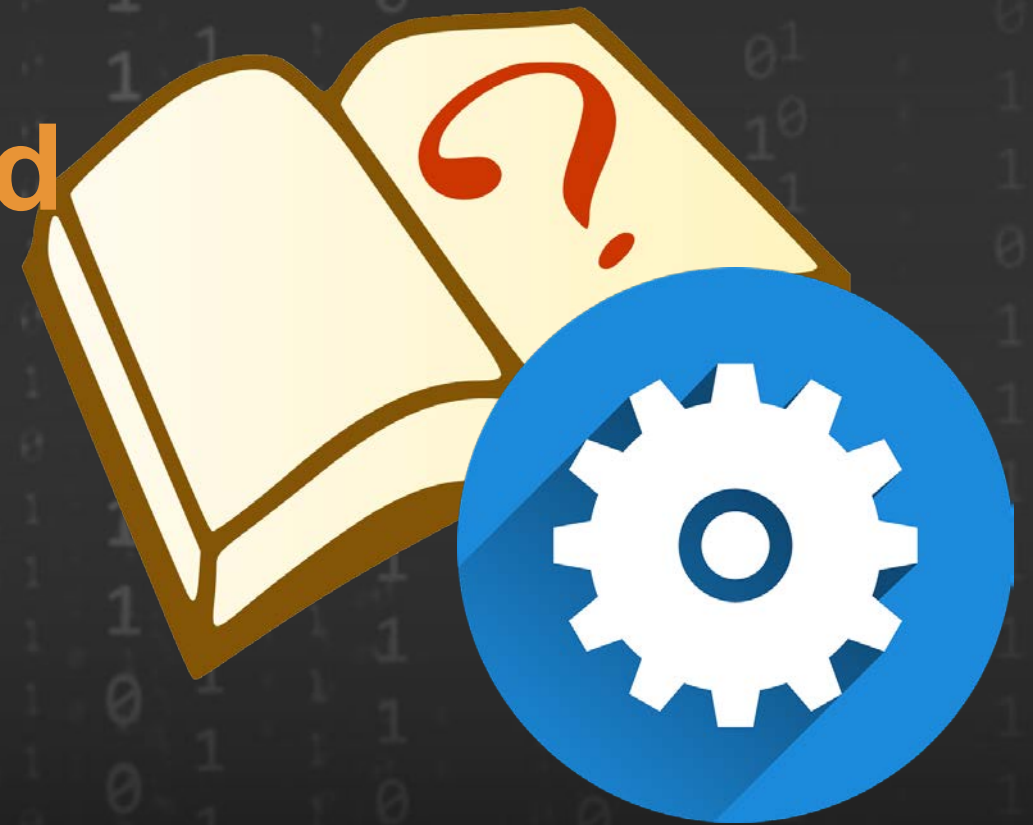
Press any Key to continue :
Enter text. Include a dot ('.') in a sentence then <Enter> to exit:
FS1:\> _

board.mb.sb.com[0] - serial console
Edit View Settings
InstallProtocolInterface: 5B1B31A1-9562-11D2-8E3F-00A0C969723B DDF3D040
Loading driver at 0x000DDD38000 EntryPoint=0x000DDD382DC SampleApp.efi
InstallProtocolInterface: BC62157E-3E33-4FEC-9920-2D3B36D750DF DDF41118
ProtectUefiImageCommon - 0xDDF3D040
- 0x00000000DDD38000 - 0x0000000000002660
InstallProtocolInterface: 752F3136-4E16-4FDC-A22A-E5F46812F4CA DF303498
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

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 the Boot Flow

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

```
$> Cd C:\FW\edk2-ws\edk2-platforms\Platform\Intel\  
$> python build_bios.py -p BoardX58Ich10 -t VS20XX
```

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

C:\fw\edk2-ws\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG\_VS20XX\FV\BOARDX58ICH10.fd To  
%USERPROFILE%\AppData\Local\Programs\Simics\simics-qsp-x86-6.0.57\targets\qsp-x86\images

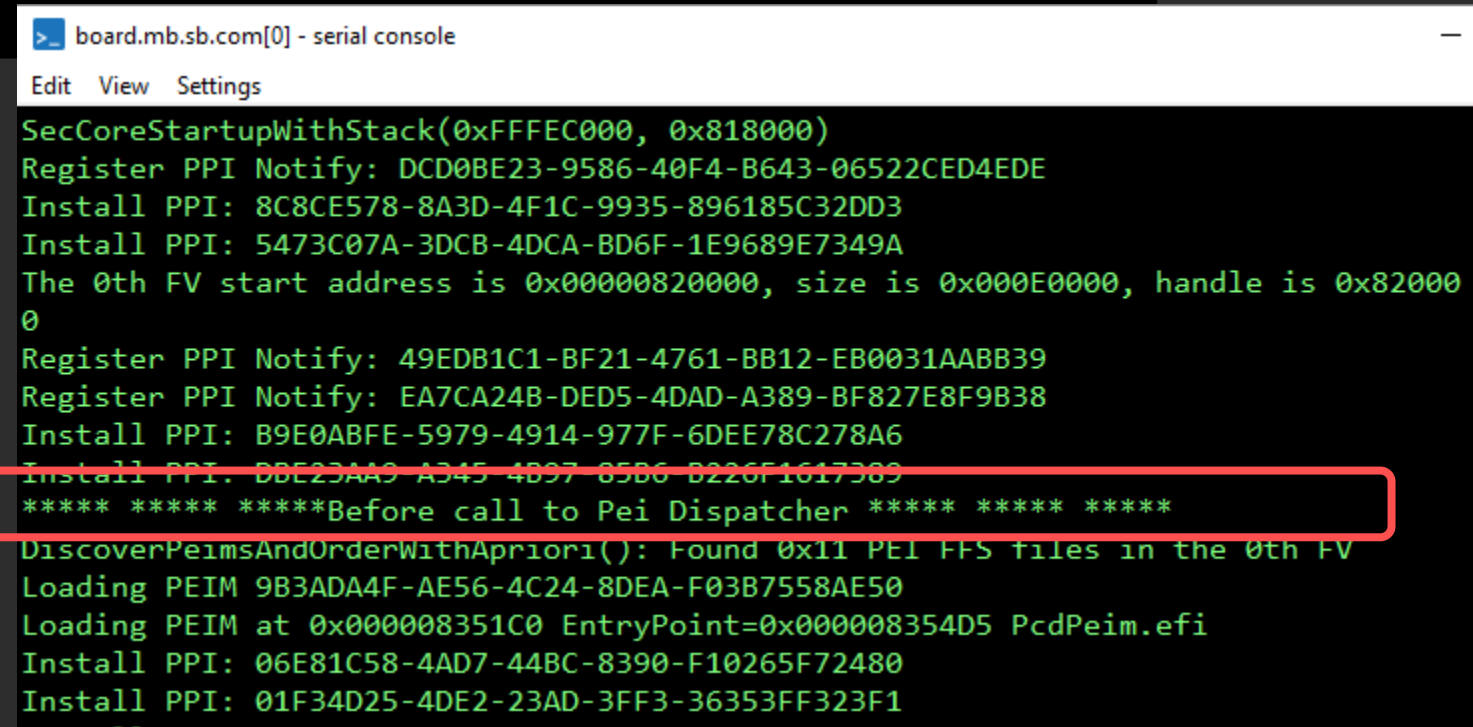
## 3. Run the qsp-modern-core script from Windows Command Prompt :

```
$> .\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 with a Debugger and add a "CpuDeadLoop" or "CpuBreakPoint"

## 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: DBE23AA9-A345-4B97-85B6-B226F1617389  
***** Before call to Pei Dispatcher *****  
DiscoverPeimsAndOrderWithApriori(): Found 0x11 PEI FFS 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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