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UEFI & EDK II Training

EDK II Debugging with Windows Lab – Simics® QSP

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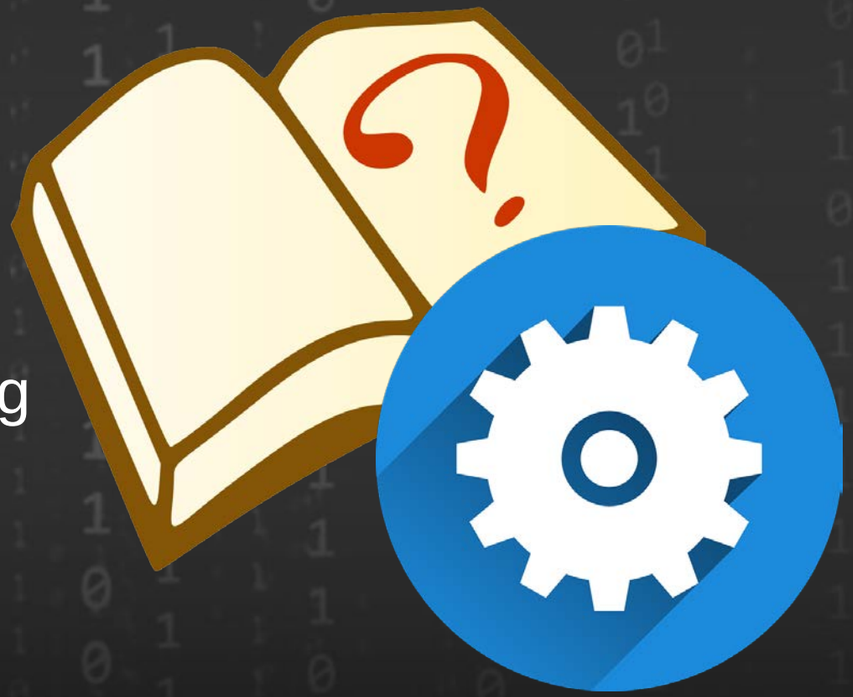
Lesson Objective

- 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`

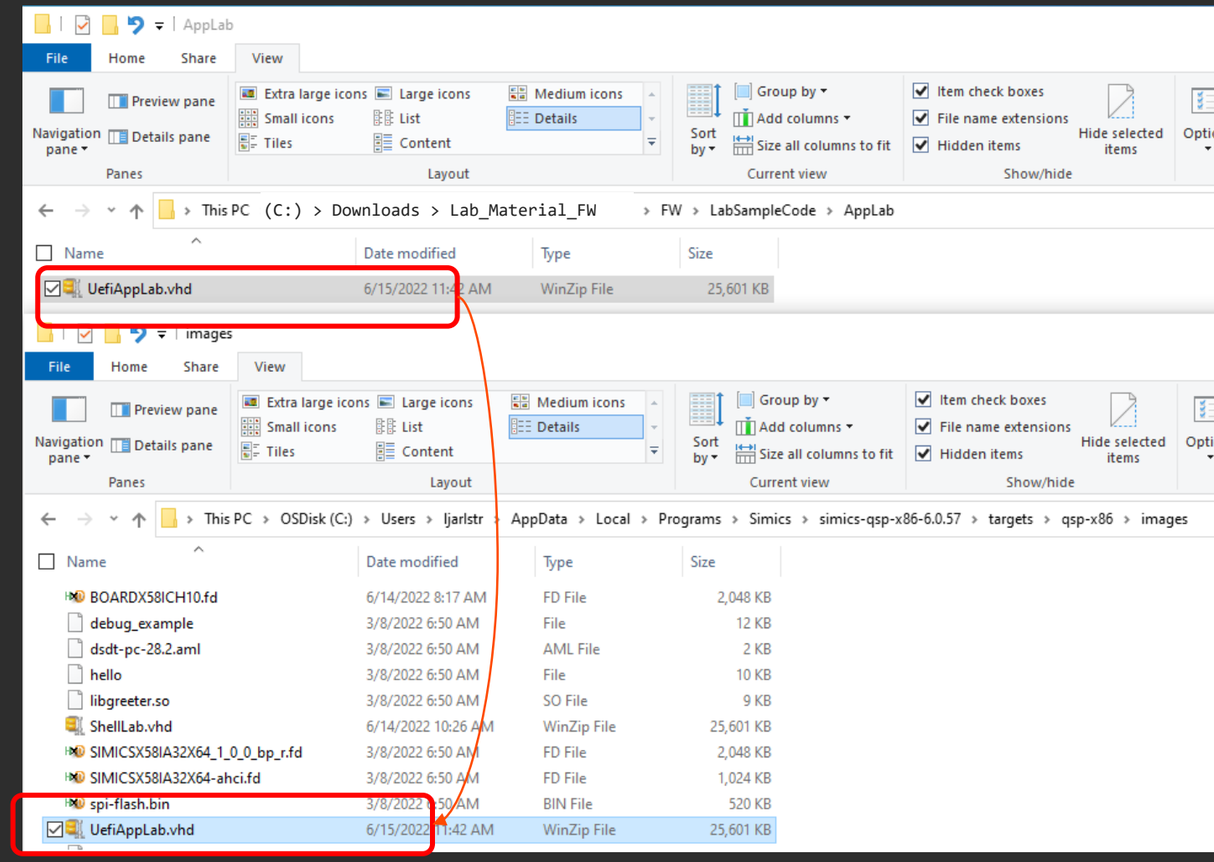
Lab 0: Catch up from previous lab (2)

Copy the UefiAppLab.vhd

From:
.../Lab_Material_FW/FW/LabSampleCode/AppLab/UefiAppLab.vhd

to

%USERPROFILE%\AppData\Local\Programs\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

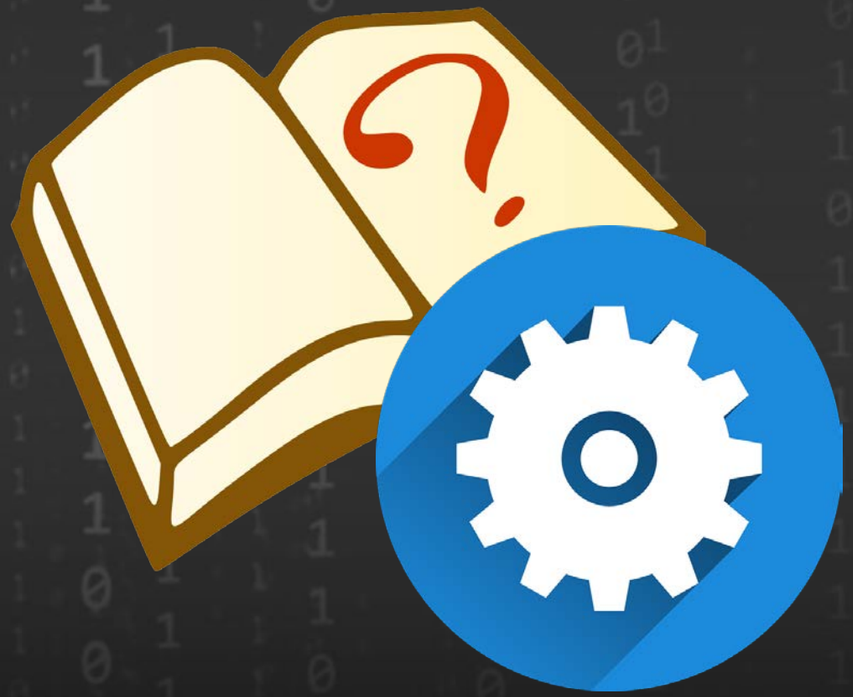
```
Decl{
decl {
! Script that runs the Quick Start Platform (QSP) with a modern
!   processor core.

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:

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```
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
```

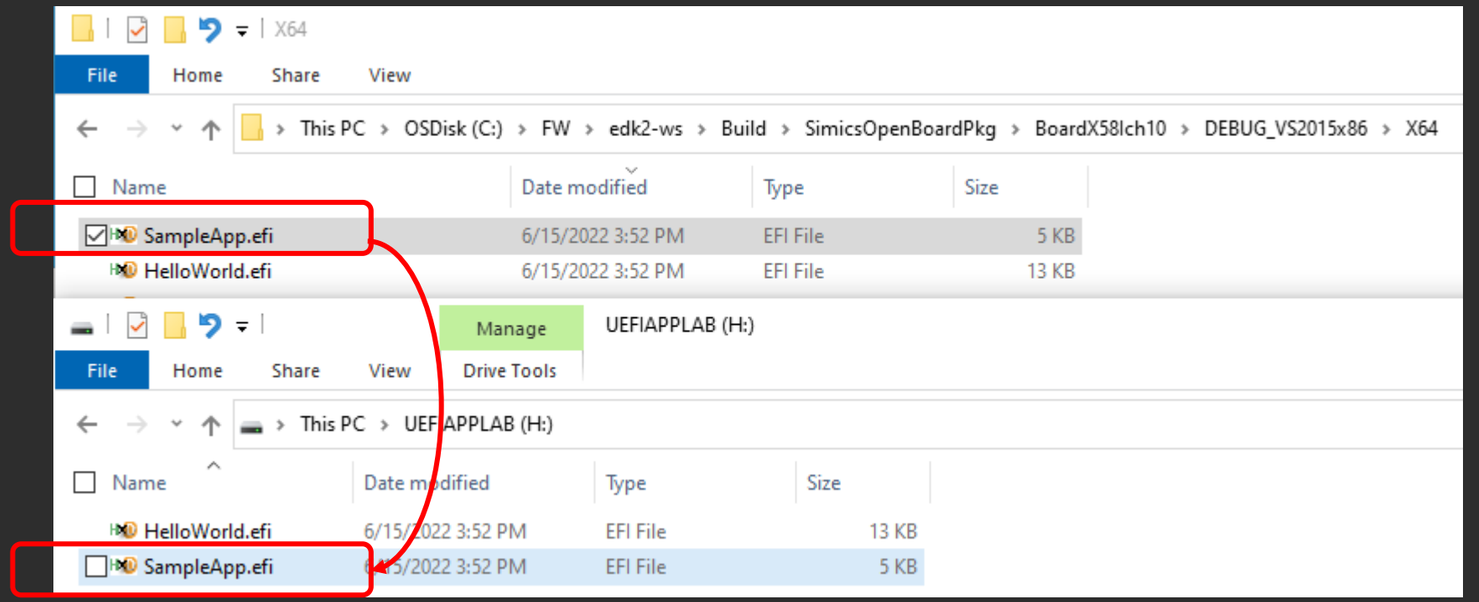
Copy

`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
```

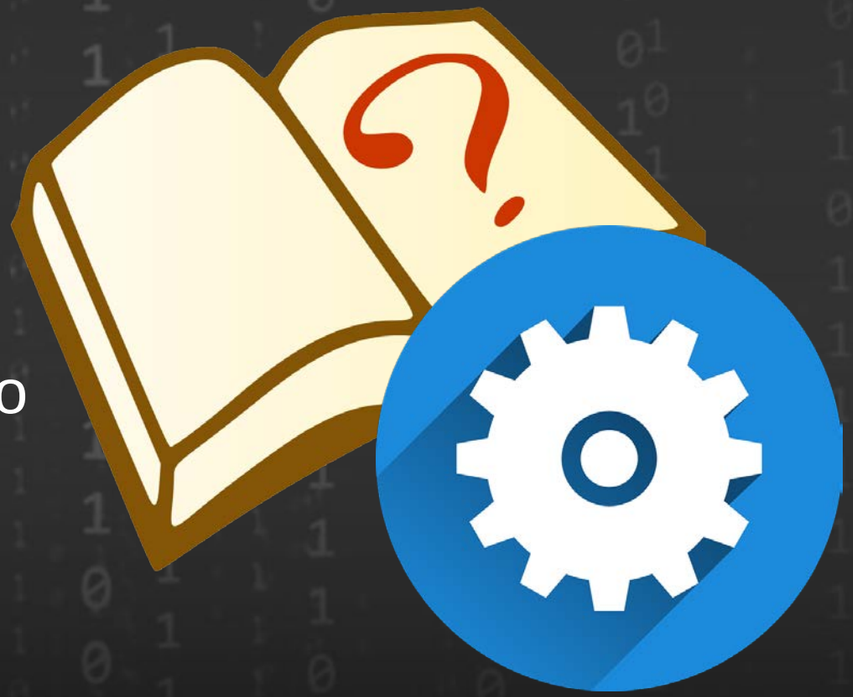
```
Loading driver at 0x000DD279000 EntryPoint=0x000DD279344 SampleApp.efi
InstallProtocolInterface: BC62157E-3E33-4FEC-9920-2D3B36D750DF DDF99818
ProtectUefiImageCommon - 0xDDF901C0
  - 0x00000000DD279000 - 0x0000000000004020
InstallProtocolInterface: 752F3136-4E16-4FDC-A22A-E5F46812F4CA DF303818

>>>>>[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
```

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

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

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`

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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

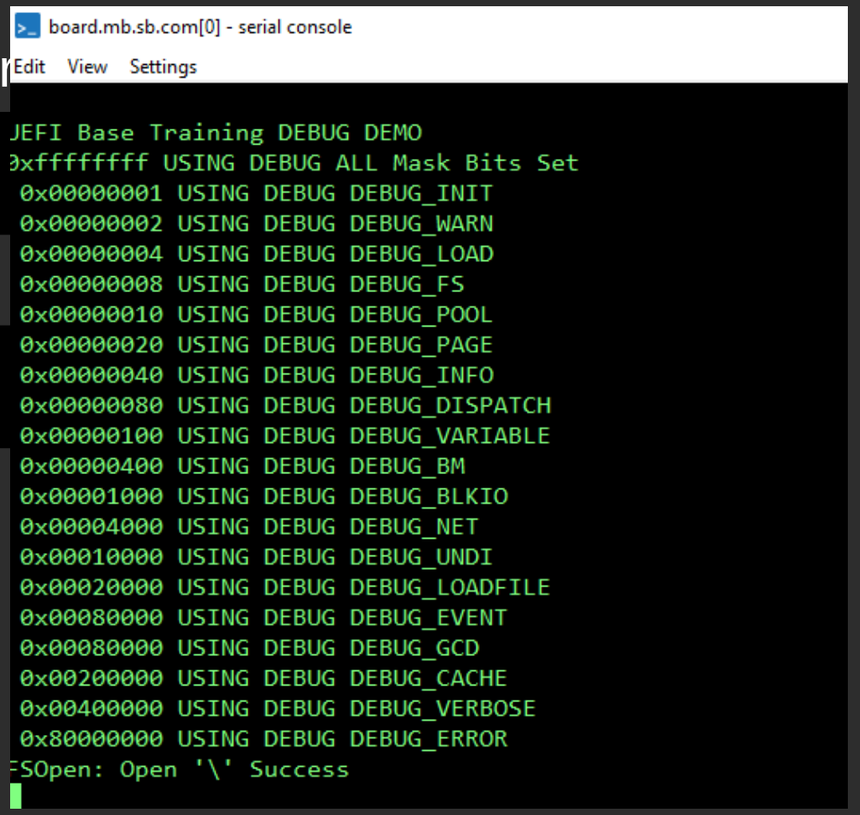
```
Copy ..\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG_VS20XX\X64\SampleApp.efi UefiAppLab Disk
```

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

```
$> .\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`

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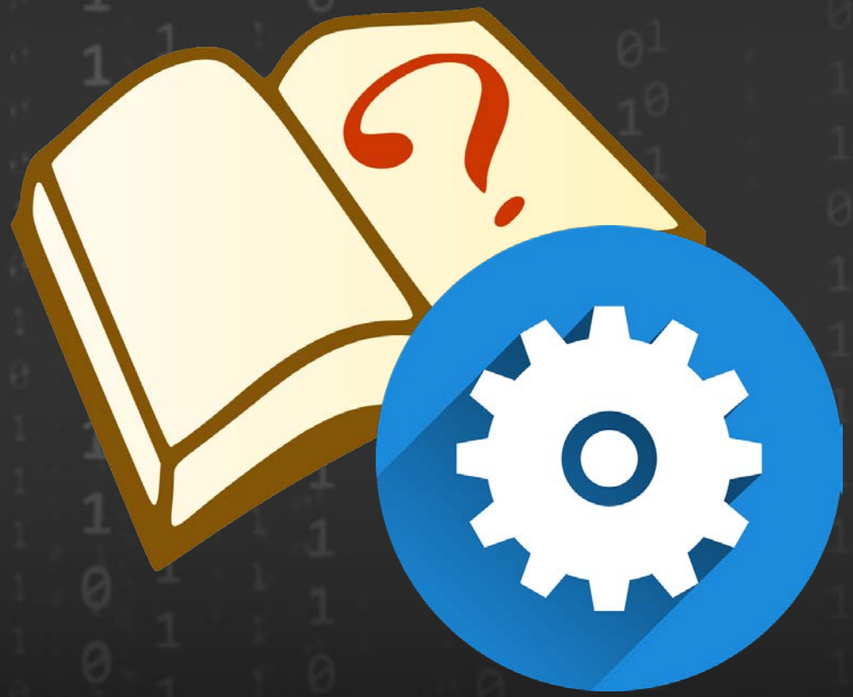
Lab 3 – Library Instances for Debugging

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

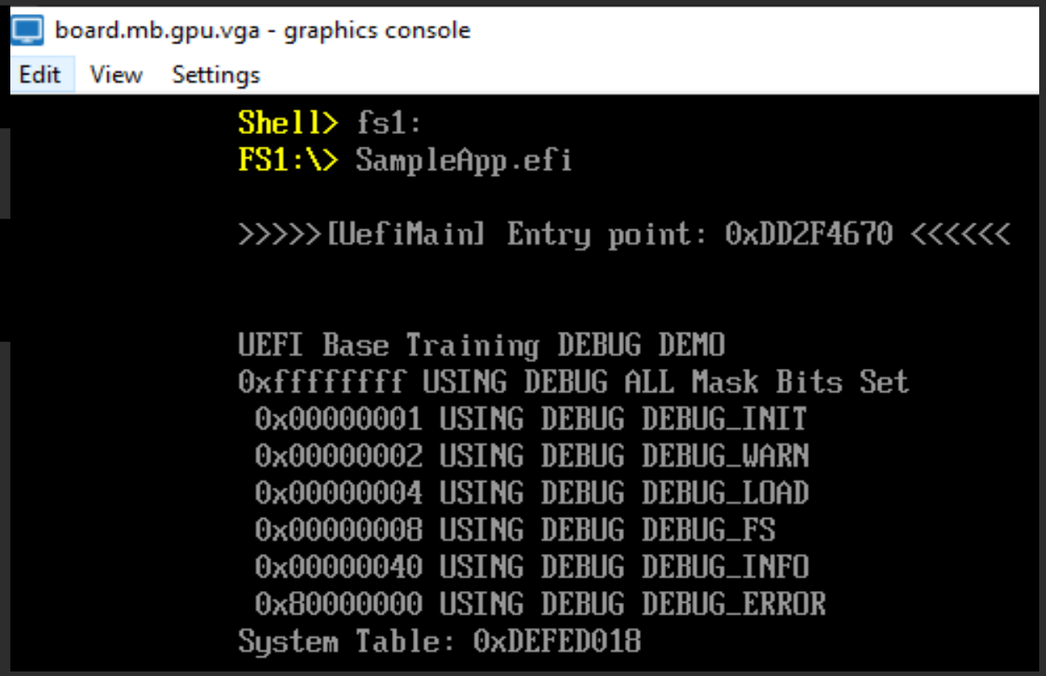
```
Copy ..\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG_VS20XX\X64\SampleApp.efi UefiAppLab Disk
```

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
```

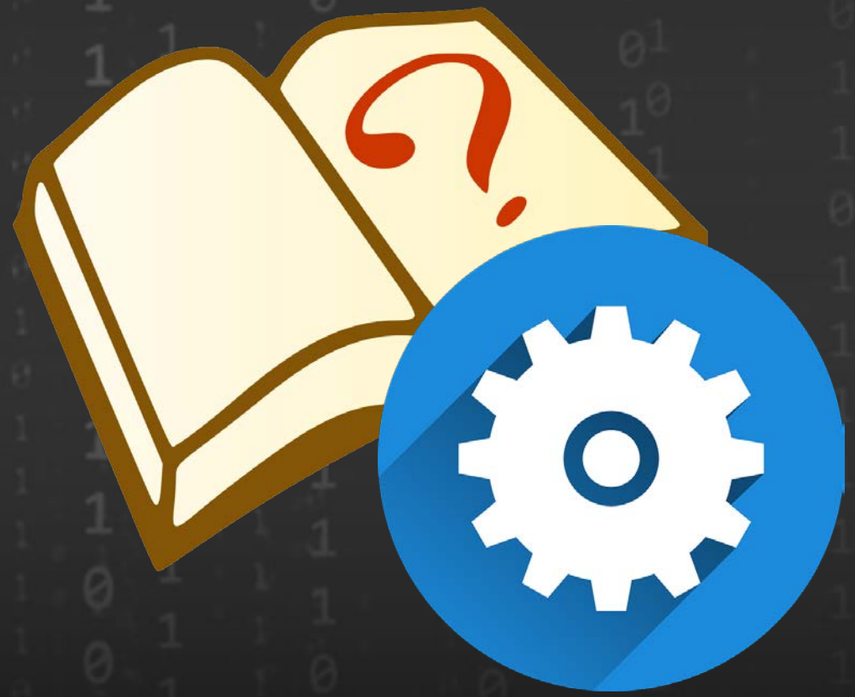


See that the output from the Debug statements now goes to the Simics VGA console

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

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

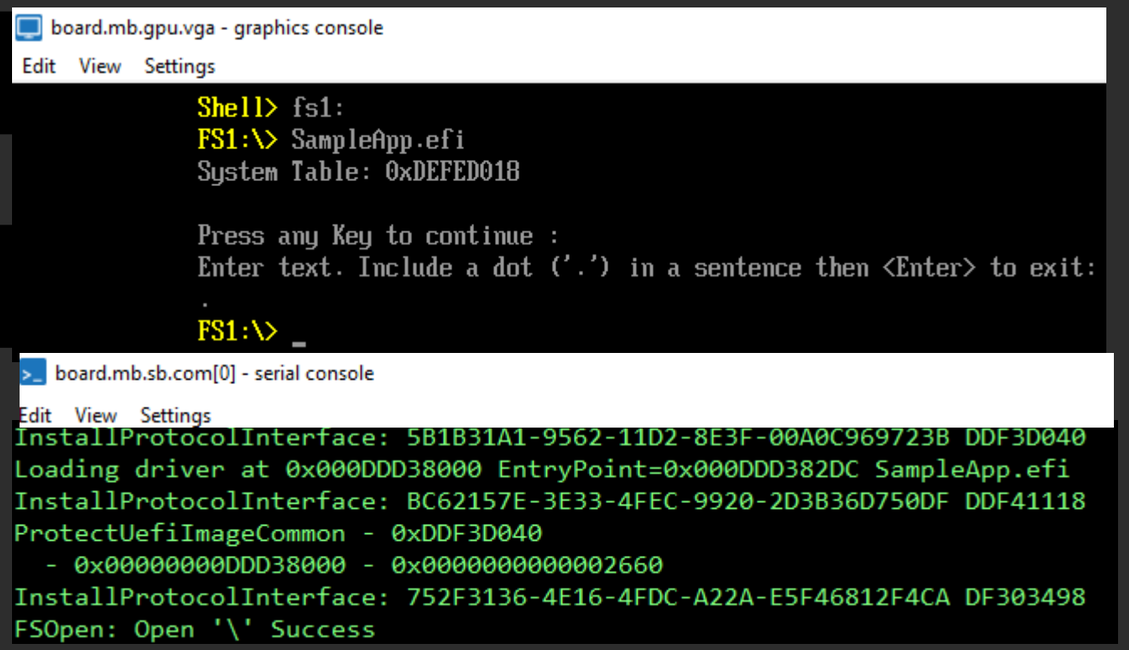
```
Copy ..\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG_VS20XX\X64\SampleApp.efi UefiAppLab Disk
```

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
```

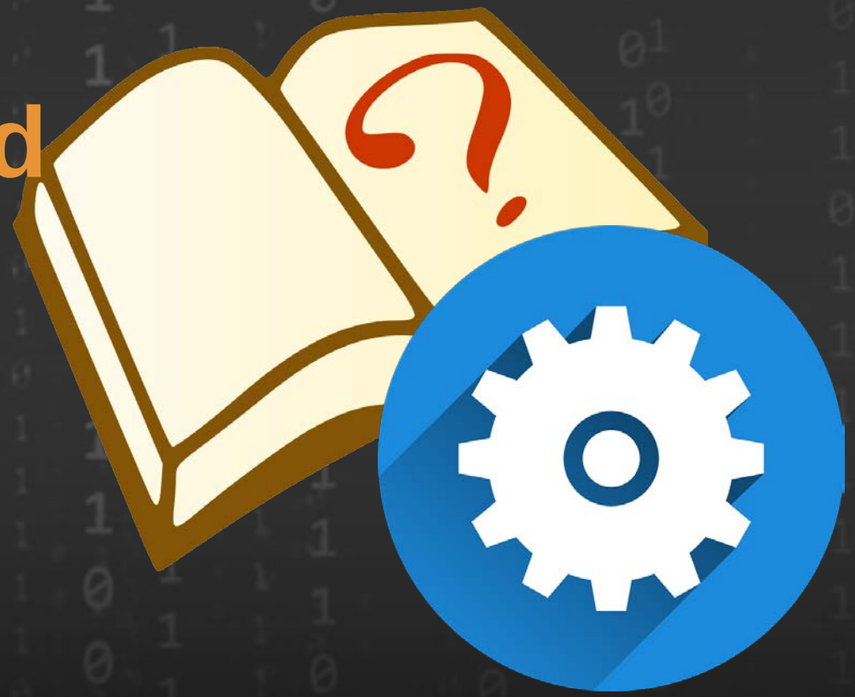


See that there is **NO** Debug output

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

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

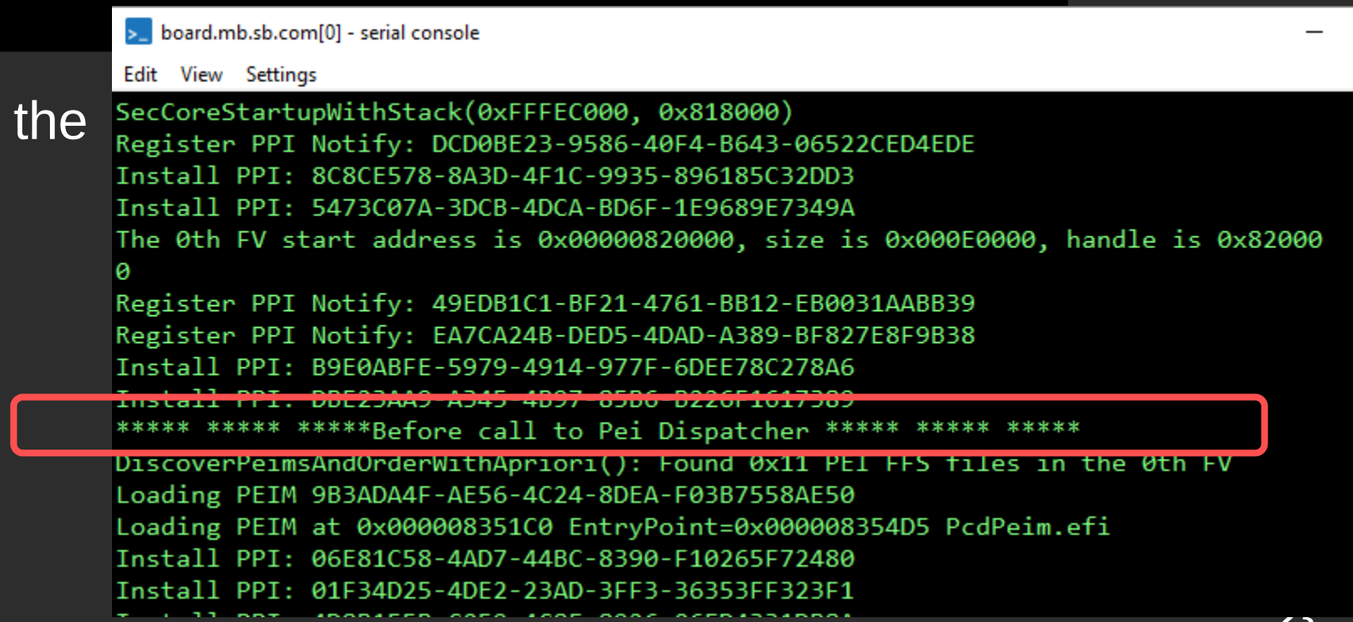
C:\fw\edk2-ws\Build\SimicsOpenBoardPkg\BoardX58Ich10\DEBUG_VS20*XX*\FV\BOARDX58ICH10.fd To *%USERPROFILE%*\AppData\Local\Programs\Simics\simics-qsp-x86-6.0.57\targets\qsp-x86\images

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`



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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ACKNOWLEDGEMENTS