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UEFI & EDK II TRAINING

UEFI SHELL APPLICATION

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LESSON OBJECTIVE

- Explain UEFI, the shell, and how they work together
- Define the shell components
- Use the shell API in a UEFI application
- UEFI Shell command Library
- UEFI Shell scripts

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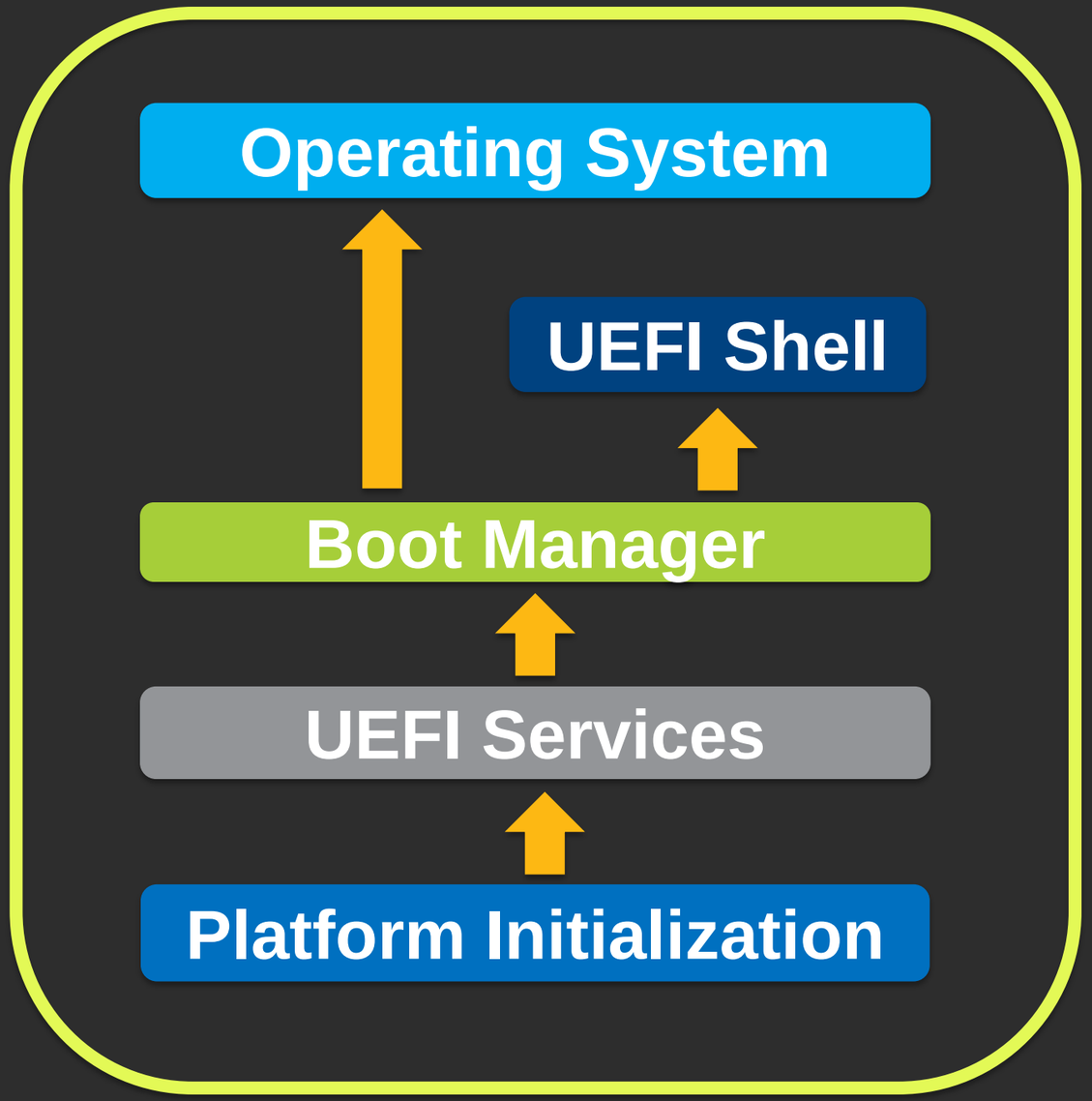
UEFI SHELL OVERVIEW

Components of the UEFI Shell

What is a UEFI Shell?



It's an

Extensive & Standardized Pre-OS UEFI Application

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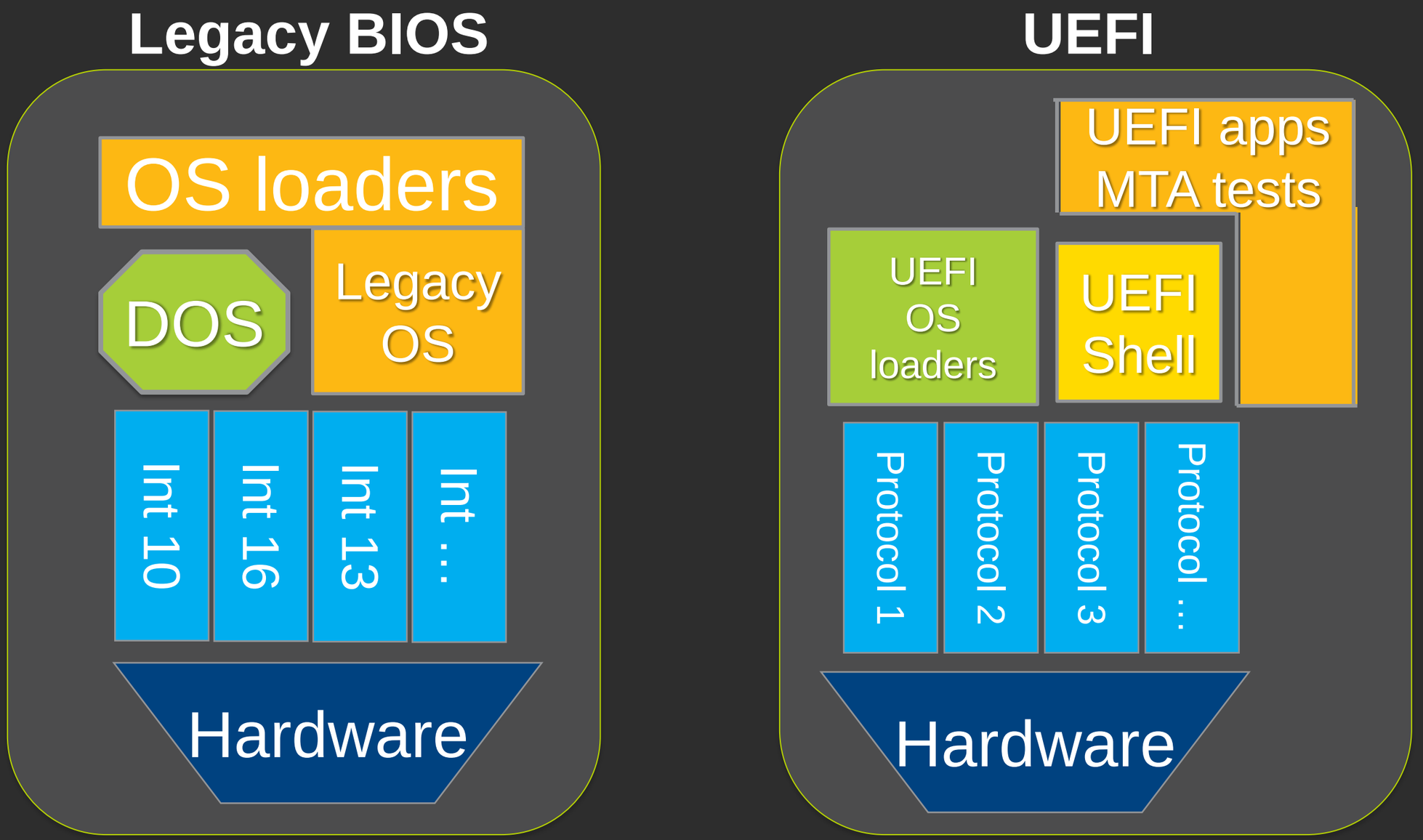
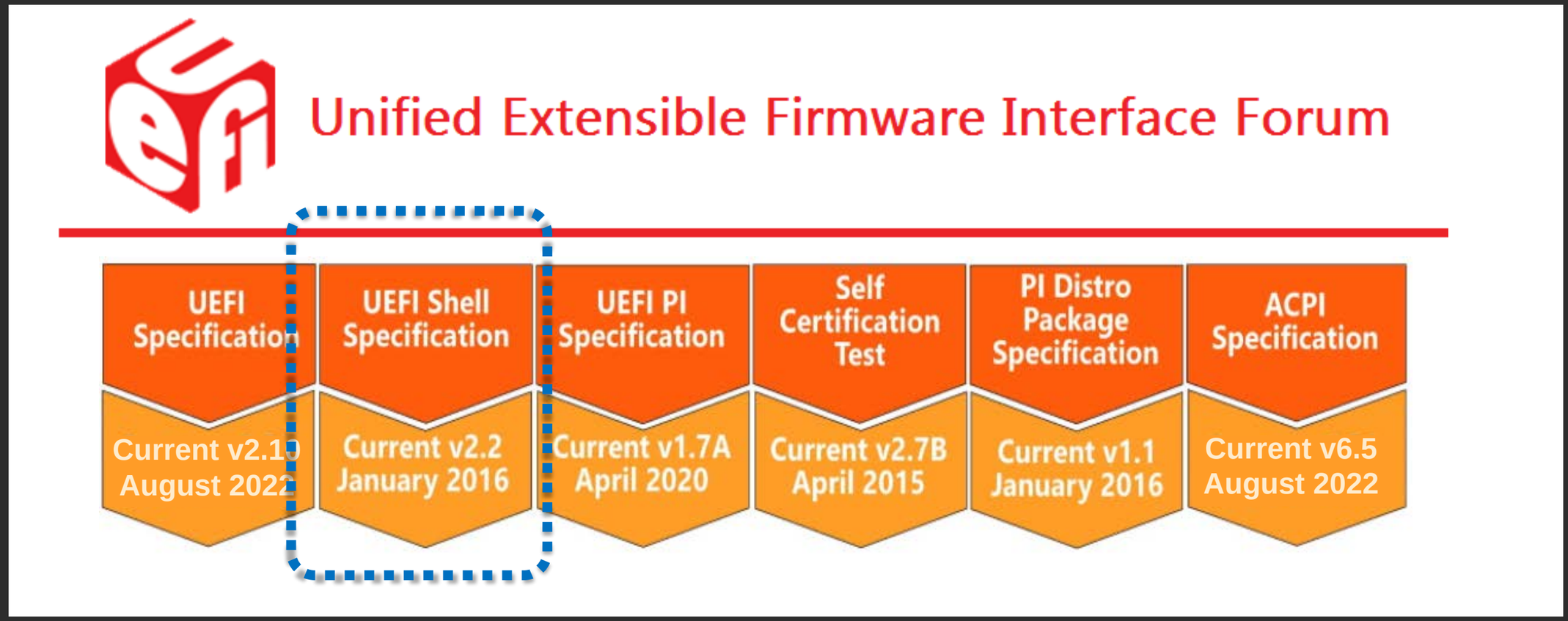
LEGACY VS. UEFI



MTA - Manufacturing Test Applications

UEFI SHELL SPECIFICATION V. 2.2

http://www.uefi.org/specsandtesttools



UEFI Shell v2.0 specification first released 2008 – Latest V2.2 Jan 2016

UEFI SHELL ELEMENTS

Small Size Profiles

Shell Commands

New Shell API

Enhanced Scripting

Small Size Profiles

SMALL SIZE PROFILES

Level / Profile	Commands
Level 0	Shell API **Only**
Level 1	Basic scripting support
Level 2	File Support, cmds(cd, cp, mv)
Level 3	Adds interactive CLI + Profiles
UEFI Debug Profile	`bcfg, comp, dblk, dmem, dmpstore, echo, edit,`
UEFI Network Profile	`ipconfig, ping`
UEFI Driver Profile	`drvdiag, openinfo, reconnect, load, unload`

Choose the shell that best matches your product needs

Shell Commands

SHELL COMMANDS

```
help -b
```

```
attrib    -Displays or changes the attributes of files or directories.
cd        -Displays or changes the current directory.
cp        -Copies one or more source files or directories to a destination.
load      -Loads a UEFI driver into memory.
map       -Defines a mapping between a user-defined name and a device handle.
mkdir     -Creates one or more new directories.
mv        -Moves one or more files to a destination within a file system.
parse     -Command used to retrieve a value from a particular record which was output in a standard
formatted output.
reset     -Resets the system.
set       -Displays, changes or deletes a UEFI Shell environment variables.
ls        -Lists a directory's contents or file information.
rm        -Deletes one or more files or directories.
vol       -Displays the volume information for the file system that is specified by fs.
date      -Displays and sets the current date for the system.
time      -Displays or sets the current time for the system.
timezone  -Displays or sets time zone information.
stall     -Stalls the operation for a specified number of microseconds.
for       -Starts a loop based on for syntax.
goto      -moves around the point of execution in a script.
if        -Controls which script commands will be executed based on provided conditional expressions.
shift     -moves all in-script parameters down 1 number (allows access over 10).
Press ENTER to continue or ‘Q’ break:
```

New Shell API

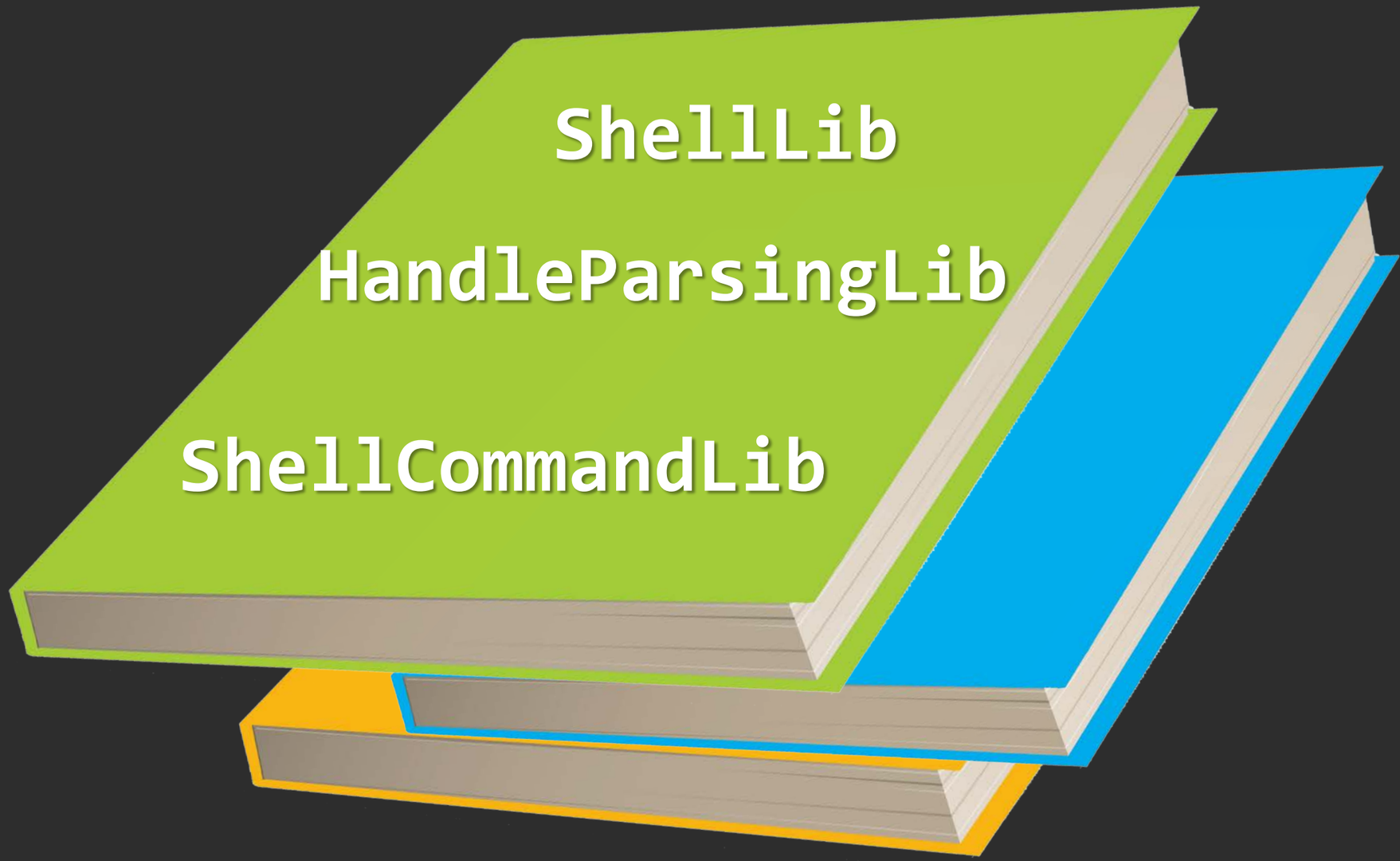
New Shell API

EFI_SHELL_PROTOCOL

Group	Functions
File Manipulation	OpenFileByName(), WriteFile(), etc. . .
Mapping, Alias & Environmental Variables	GetMapFromDevicePath(), GetFilePathFromDevicePath(), etc . . .
Launch Application or Script	Execute(), BatchIsActive(), IsRootShell(),etc
Miscellaneous	GetPageBreak(), EnablePageBreak() ,etc . .

EFI_SHELL_PROTOCOL is installed on each application image handle

ShellPkg Main Libraries



EDK II ShellPkg

Supports binary portability

Shell protocols

Shell parameters

```
#Include <Library/ShellLib.h>
gEfiShellParametersProtocol
gEfiShellProtocol
```

Shell Call Example

```
// use UEFI shell 2.x interface
//
 if (gEfiShellParametersProtocol != NULL) {
       Argc = gEfiShellParametersProtocol->Argc;
       Argv = gEfiShellParametersProtocol->Argv;
//Create the file with Argv[1] with
//                 read/write/create
     Status = gEfiShellProtocol->OpenFileByName
          (Argv[1], &Handle,
           EFI_FILE_MODE_READ |
           EFI_FILE_MODE_WRITE |
           EFI_FILE_MODE_CREATE);

// . . .
// Write the buffer data to the file
  Status = gEfiShellProtocol->WriteFile( Handle,
          (UINTN *)&BufferSize, (void *)Buffer);
```

Enhanced Scripting

Enhanced Scripting

- Contains .nsh extension
- "`Startup.nsh`" Runs first
- Supports:
  - ✓Command-line arguments
  - ✓Standard script commands
  - ✓Input & output redirection & pipes

Shell Scripts (Benefits)

Perform basic flow control

Allows branching/looping

Users can control input, output and script nesting

Script that Detects Shell Capabilities

```
# check if Shell supports level 3 commands
 # Exit on error
  if %uefishellsupport% ult 3 then
    echo Must support UEFI Shell, Level 3
    exit /b 2
  endif
  # check that Shell supports Debug1 profile.
  if profiles(Debug1)then
    echo UEFI Shell supports Debug1 profile
  endif
```

UEFI Shell Script Example

Script1.nsh

```
# Simple UEFI Shell script file
echo -off
script2.nsh
if exist %cwd%Mytime.log then
     type Mytime.log
endif
echo "%HThank you.” “%VByeBye:) %N”
```

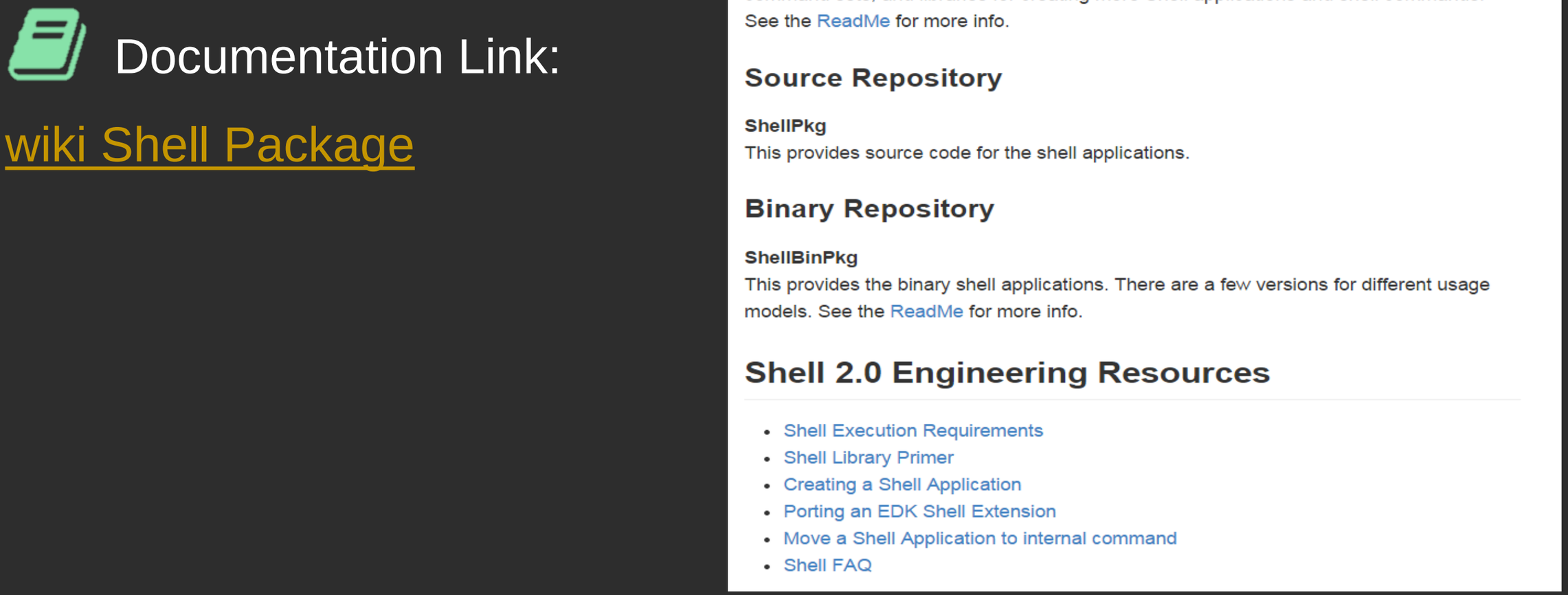
Script2.nsh

```
# Show nested scripts
time > Mytime.log
for %a run (3 1 -1)
    echo %a counting down
endfor
```

Documentation for EDK II ShellPkg

Documentation Link:

wiki Shell Package



Getting the Shell 2.0

This provides a shell application, a set of NULL-named libraries that provide configurable command sets, and libraries for creating more Shell applications and shell commands. See the ReadMe for more info.

Source Repository

ShellPkg
This provides source code for the shell applications.

Binary Repository

ShellBinPkg
This provides the binary shell applications. There are a few versions for different usage models. See the ReadMe for more info.

Shell 2.0 Engineering Resources

- Shell Execution Requirements
- Shell Library Primer
- Creating a Shell Application
- Porting an EDK Shell Extension
- Move a Shell Application to internal command
- Shell FAQ

UEFI Shell 2.2 Vs. EFI Shell 1.0

- **UEFI Shell 2.x** - EFI_SHELL_PARAMETERS_PROTOCOL
- **EFI Shell 1.0** - EFI_SHELL_INTERFACE

```
//
#include <Protocol/EfiShellInterface.h> //GUID protocol for EFI Shell 1.0
#include <Protocol/ShellParameters.h>   //GUID protocol for UEFI Shell 2.x

// . . .

 EFI_SHELL_PARAMETERS_PROTOCOL     *mEfiShellParametersProtocol;
 EFI_SHELL_INTERFACE               *mEfiShellInterface;
//
```

See example C file: MyShellApp.c

UEFI Shell 2.x Vs. EFI Shell 1.0

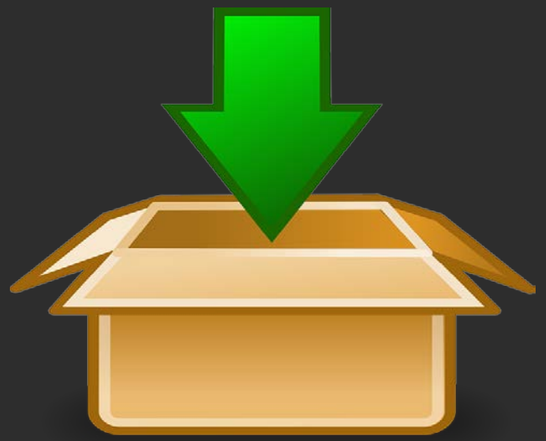
```
. . .
//Check for UEFI Shell 2.x
  Status = gBS->OpenProtocol(ImageHandle,
                             gEfiShellParametersProtocolGuid,
                            VOID **)&mEfiShellParametersProtocol,
                            ImageHandle,
                             NULL
                             EFI_OPEN_PROTOCOL_GET_PROTOCOL
                            );
    if (!EFI_ERROR(Status)) {
//
// use UEFI Shell 2.x Parameter Protocol
//
      Argc = mEfiShellParametersProtocol->Argc;
      Argv = mEfiShellParametersProtocol->Argv;
. . .
    {// Check if EFI shell 1.0 interface
```

See example C file: MyShellApp.c

Shell Usage

Execute preboot programs

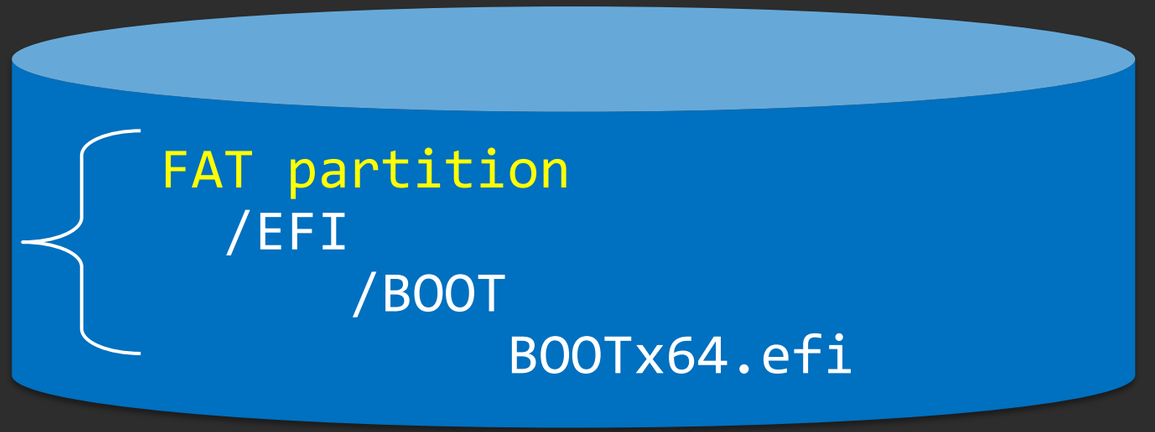
Move files between devices



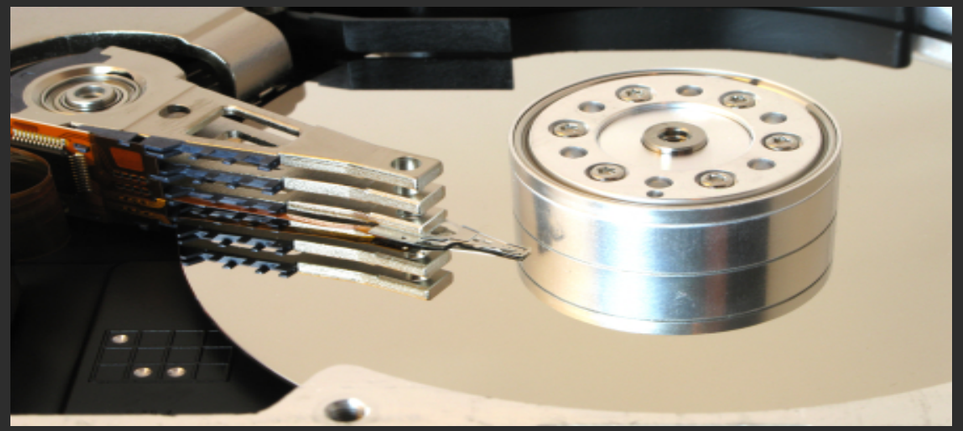
Load a preboot UEFI driver (.efi)

ACCESSING THE SHELL

`/EFI/boot/BOOTx64.efi`



`BOOTx64.efi` = OS loader, UEFI application, or UEFI Shell



Shell Handle Database - “Dh”

```
Shell> dh -b
```

Displays the device handles associated with UEFI drivers

```
01: LoadedImage
02: Decompress
03: UnknownDevice DevicePath(yMapped(0xB,0x800000,0xFFFFFF))
 UnknownDevice
04: UnknownDevice DevicePath(ped(0xB,0x17A8E000,0x17FBDFFF))
 UnknownDevice
05: UnknownDevice
06: ImageDevicePath LoadedImage
07: UnknownDevice Pcd
08: ImageDevicePath LoadedImage
09: UnknownDevice
0A: ImageDevicePath LoadedImage
0B: UnknownDevice
0C: ImageDevicePath LoadedImage
0D: UnknownDevice UnknownDevice
0E: DebugSupport EBCInterpreter ImageDevicePath LoadedImage
0F: UnknownDevice
10: ImageDevicePath LoadedImage
11: UnknownDevice
12: ImageDevicePath LoadedImage
13: UnknownDevice
14: ImageDevicePath LoadedImage
15: UnknownDevice
16: ImageDevicePath LoadedImage
Press ENTER to continue or 'Q' break:_
```

UEFI Terminology

Protocols	• Interfaces consisting of functions and data structures named by a GUID and stored in the Handle Database
Handle Database	• Everything in the platform system gets a handle, drivers, devices, Images, etc.
GUIDs	• The UEFI Platform only knows items in the Handle Database by its GUID

UEFI File System & Device Path

```
Shell> map
Device mapping table
fs0  : Acpi(PNP0A03,1)/Pci(1F|0)/Pci(2|0)/Scsi(Pun0,Lun0)/
HD(Part1,Sig8983DFE0-F474-01C2-507B-9E5F8078F531)
blk0 : Acpi(PNP0A03,0)/Pci(1F|1)/Ata(Primary,Secondary)
blk1 : Acpi(PNP0A03,0)/Pci(1F|1)/Ata(Primary,Main)
blk2 : Acpi(PNP0A03,1)/Pci(1F|0)/Pci(2|0)/Scsi(Pun0,Lun0)
blk3 : Acpi(PNP0A03,1)/Pci(1F|0)/Pci(2|0)/Scsi(Pun0,Lun0)/
HD(Part1,Sig8983DFE0-F474-01C2-507B-9E5F8078F531)
blk4 : Acpi(PNP0A03,1)/Pci(1F|0)/Pci(2|0)/Scsi(Pun0,Lun0)/
HD(Part2,Sig898D07A0-F474-01C2-F1B3-12714F758821)
blk5 : Acpi(PNP0A03,1)/Pci(1F|0)/Pci(2|0)/Scsi(Pun0,Lun0)/
HD(Part3,Sig89919B80-F474-01C2-D931-F8428177D974)
```

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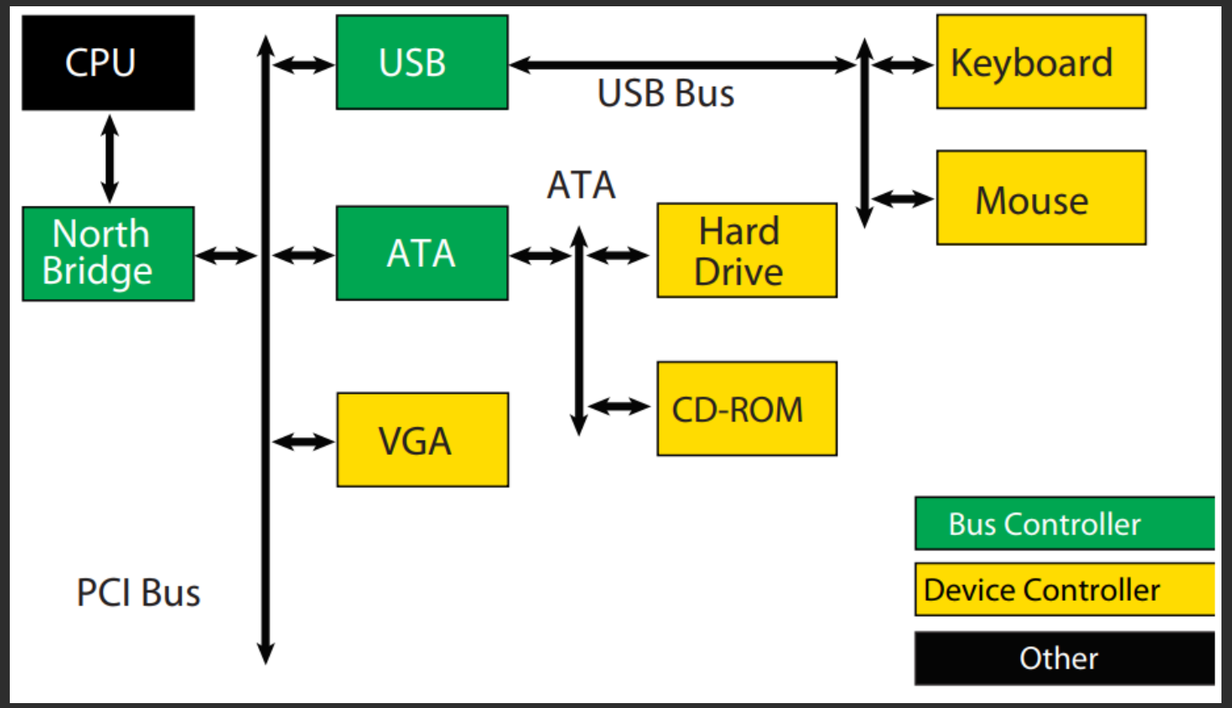
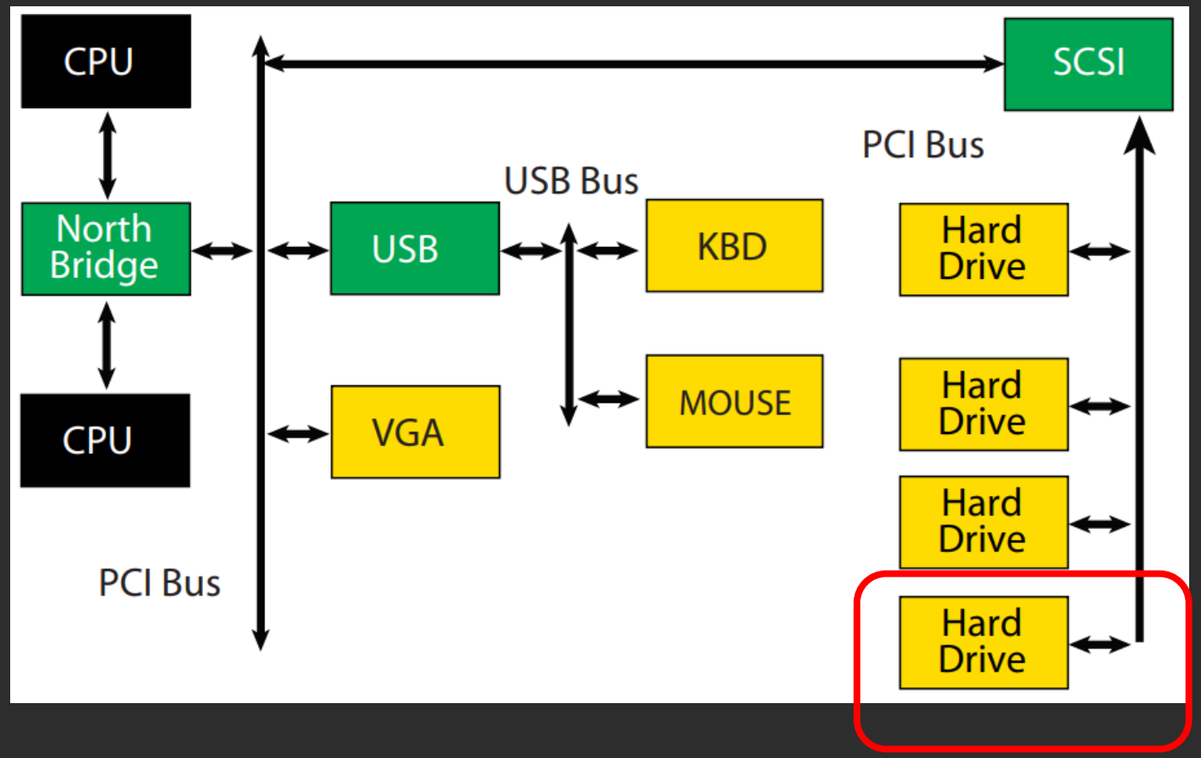
Device Path





What if the Boot Loader is on the Hard Drive attached to the SCSI?

UEFI File System & Device Path

```
fs0   : Acpi(PNP0A03,1)/Pci(1F|0)/Pci(2|0)/
Scsi(Pun0,Lun0)/HD(Part1, Sig8983DFE0-F474
01C2-507B-9E5F8078F531)
```

- fs0:
- Acpi(PNP0A03,1)
- Pci(1F|0)/Pci(2|0)
- Scsi(Pun0,Lun0)
- HD(Part1,Sig8983DFE0-F474-01C2-507B-9E5F8078F531)

EFI Variable **BOOT0000** == *Some Device Path*

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SUMMARY

- Explain UEFI, the shell, and how they work together
- Define the shell components
- Use the shell API in a UEFI application
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- UEFI Shell scripts

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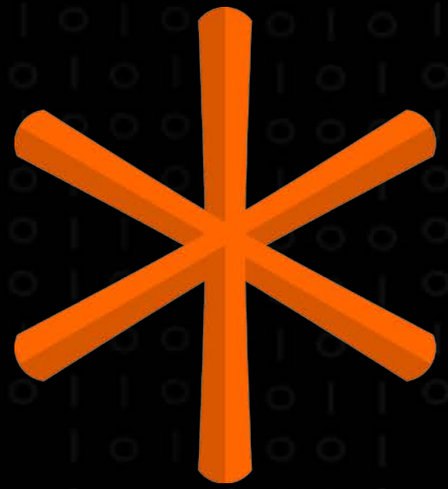

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ACKNOWLEDGEMENTS

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BACKUP