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Updating bhyve UEFI Firmware & UEFI HTTP Boot

Agenda

- What is UEFI and what does it have to do with bhyve?
- Why does it need updated?
- How did I update it?
- How can we keep it up to date in the future?
- UEFI HTTP Boot

What is UEFI?

"*This Unified Extensible Firmware Interface … Specification describes an interface between the operating system and the platform firmware.*"

UEFI Specification, Version 2.8, §1

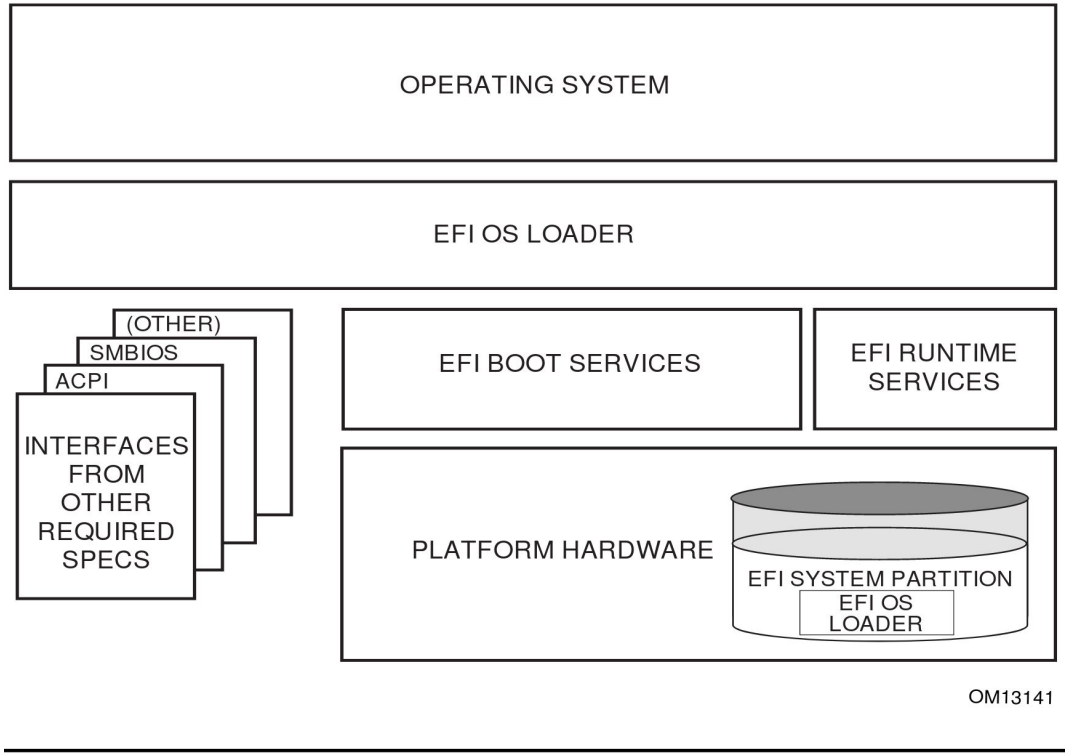

Figure 1. UEFI Conceptual Overview

What is EDK II?

TianoCore: community that supports EDK II

EDK II: (EFI Dev Kit 2) cross platform development environment for UEFI.
SPDX-License-Identifier: BSD-2-Clause.

OVMF: Open Virtual Machine Firmware, for QEMU and Xen.
One of the several platforms supported by EDK II.

What is uefi-edk2-bhyve?

Adaptation of OVMF for bhyve.

uefi-edk2-bhyve = OVMF - QEMU + bhyve.

(btw, Not the only way to run a VM in bhyve).

Why do we need to update it?

UDK2014.SP1 ← UEFI 2.4B specification, April 2014

edk2-stable201903 ← UEFI 2.7 specification, May 2017

- new ACPI/SMBIOS versions
- Bug fixes/ performance improvements
- HTTP Boot

How did I update it?

1. Archaeology, find original branch point.

from

```
commit 28b621aeb5986b648182448c9c31e4e16e5528a9
Author: Peter Grehan <grehan@nahannisys.com>
Date:   Fri Oct 16 22:44:53 2015 -0700

      Initial import of bhyve UEFI patch.

 125 files changed, 31426 insertions(+), 3 deletions(-)
```

to

```
commit c46543b586a14e288245ef6ad31b4e85152d6839
Author: Peter Grehan <grehan@nahannisys.com>
Date:   Fri Oct 16 22:44:53 2015 -0700

      Initial import of bhyve UEFI patch.

      [d.scott.phillips@intel.com] This is an attempt to reconst
      history of the bhyve patch by rephrasing it as a delta aga
      OvmfPkg and unsquashing various upstream commits that were
      squashed into it. In particular, this is commit:

      28b621aeb5 ("Initial import of bhyve UEFI patch.")

      with the following commits unsquashed from it:
[snip]
 75 files changed, 17424 insertions(+), 1210 deletions(-)
```

How did I update it?

2. Move forward minimized changeset one release at a time

→ UDK2014.SP1 → UDK2015 → UDK2017 → UDK2018

→ edk2-stable201808 → edk2-stable201811

→ edk2-stable201903

Making sure boot/basic functionality keeps working each step of the way.

How did I update it?

Intermediate steps preserved:

https://gitlab.com/scott-ph/edk2

```
wip/2019-03/bhyve-history-reconstruct (doesn't work)
wip/2019-03/bhyve-rebase-UDK2014.SP1
wip/2019-03/bhyve-rebase-UDK2015
wip/2019-03/bhyve-rebase-UDK2017
wip/2019-03/bhyve-rebase-UDK2018
wip/2019-03/bhyve-rebase-edk2-stable201808
wip/2019-03/bhyve-rebase-edk2-stable201811
wip/2019-03/v2-bhyve-rebase-edk2-stable201903
```

(may help debugging at some point)

How will we keep it up to date in the future?

https://github.com/tianocore/tianocore.github.io/wiki/EDK-II-Release-Planning

- Update OpenSSL version from 1.1.0j to 1.1.1b
- Add new toolchain for LLVM/CLANG8.0
- Replace BSD 2-Clause License with BSD + Patent Licence

More frequent, smaller updates should be less work overall.

Upstreaming? License?

How/who/when? thoughts?

Call to action: Help test it!

Help find & squish bugs!

ports: sysutils/uefi-edk2-bhyve-devel

thanks araujo@ & bcran@

UEFI HTTP Boot

UEFI PXE Boot

network boot standard adapted from the BIOS days

DHCP server tells you where TFTP server is

TFTP server gives you something to run

Either a UEFI binary, or a UEFI-compliant file system image

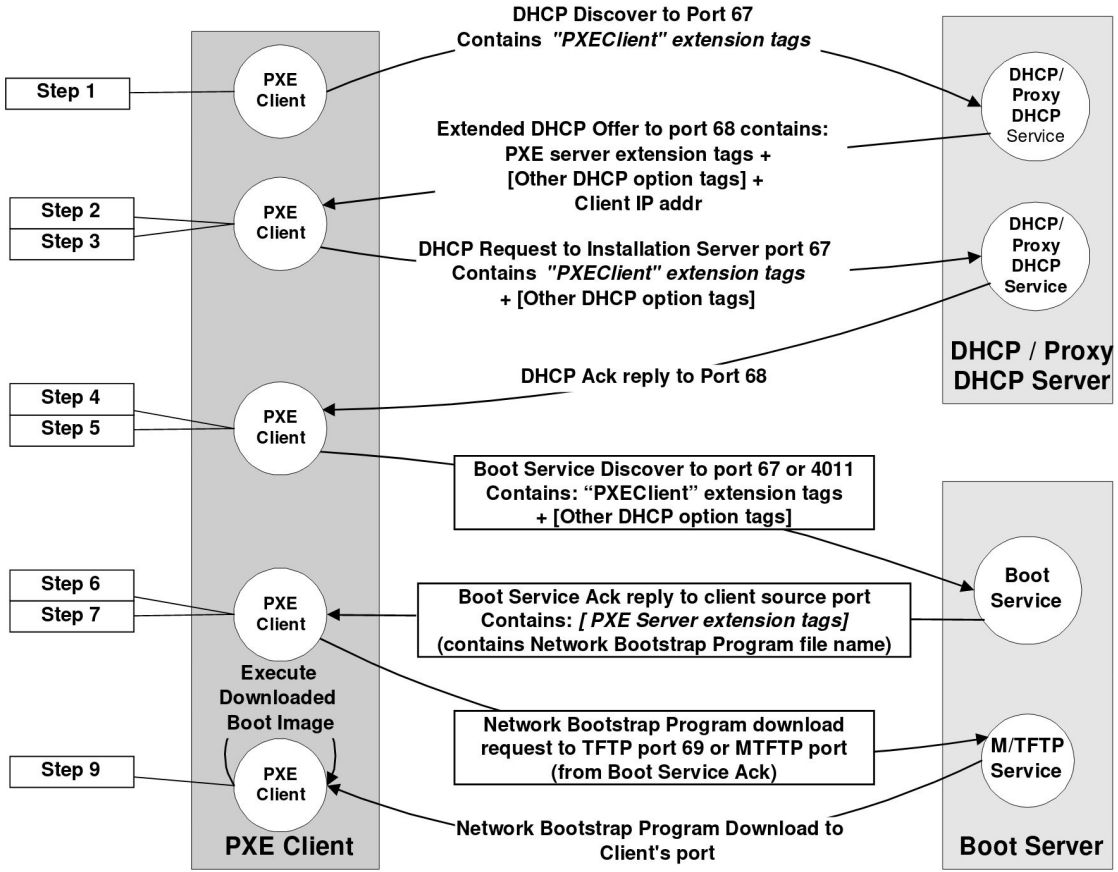

Figure 2-1 PXE Boot

UEFI HTTP Boot

Replace TFTP with HTTP

DHCP could return information to direct HTTP Boot…or not.

DNS could be used…or not.

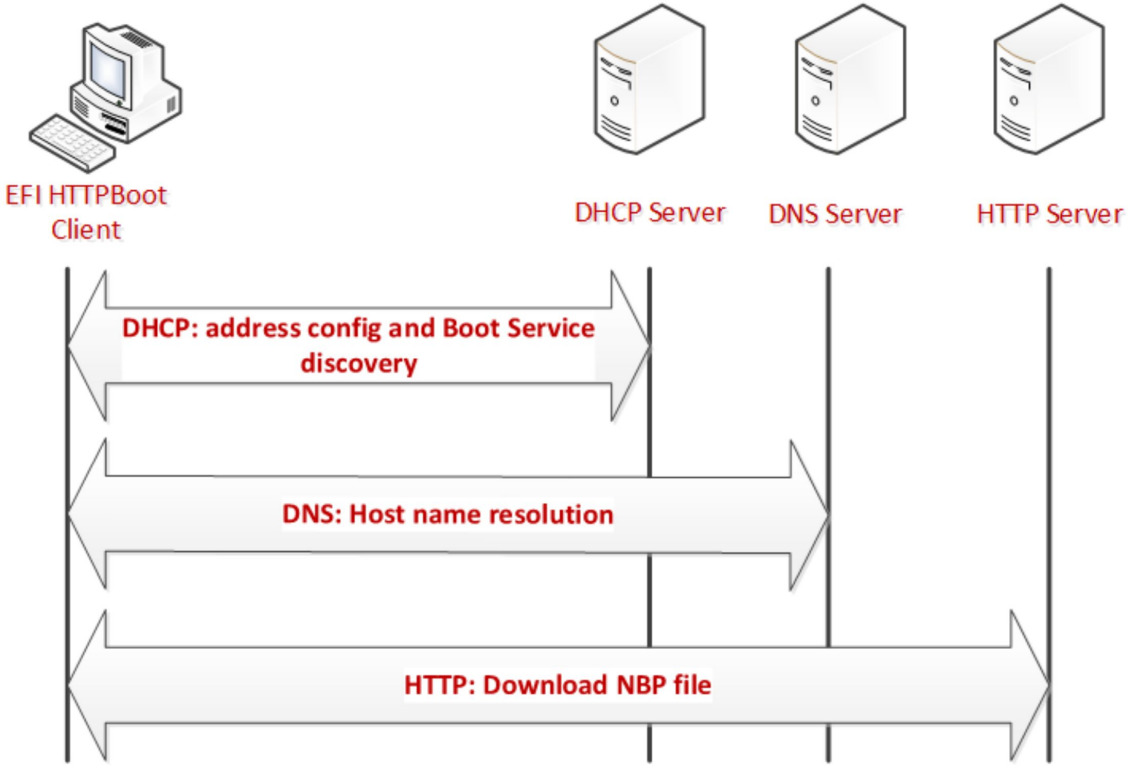

Figure 81. HTTP Boot overall flow

UEFI HTTP Boot - Ramdisk

EDK II's RamDiskDxe publishes ramdisks to the OS using ACPI 6.0's NFIT.

nvdimm.ko can consume the NFIT and present the ramdisk as a device to the system.

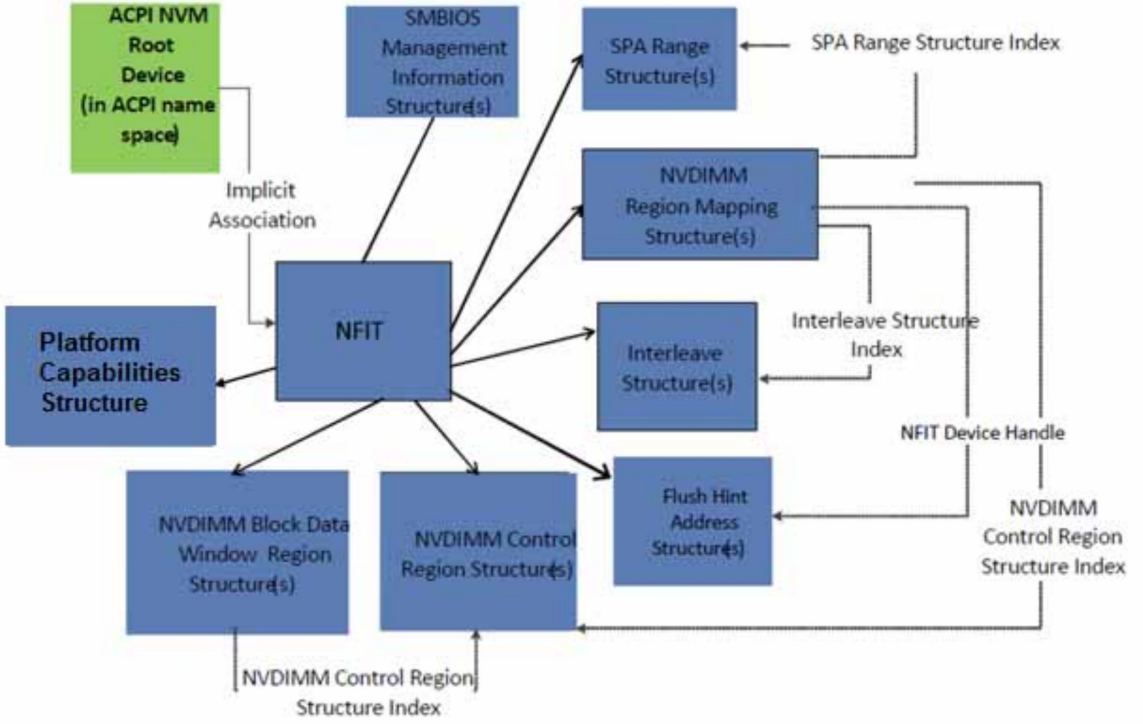

Figure 5-22 NVDIMM Firmware Interface Table (NFIT) Overview

UEFI HTTP Boot - Demo

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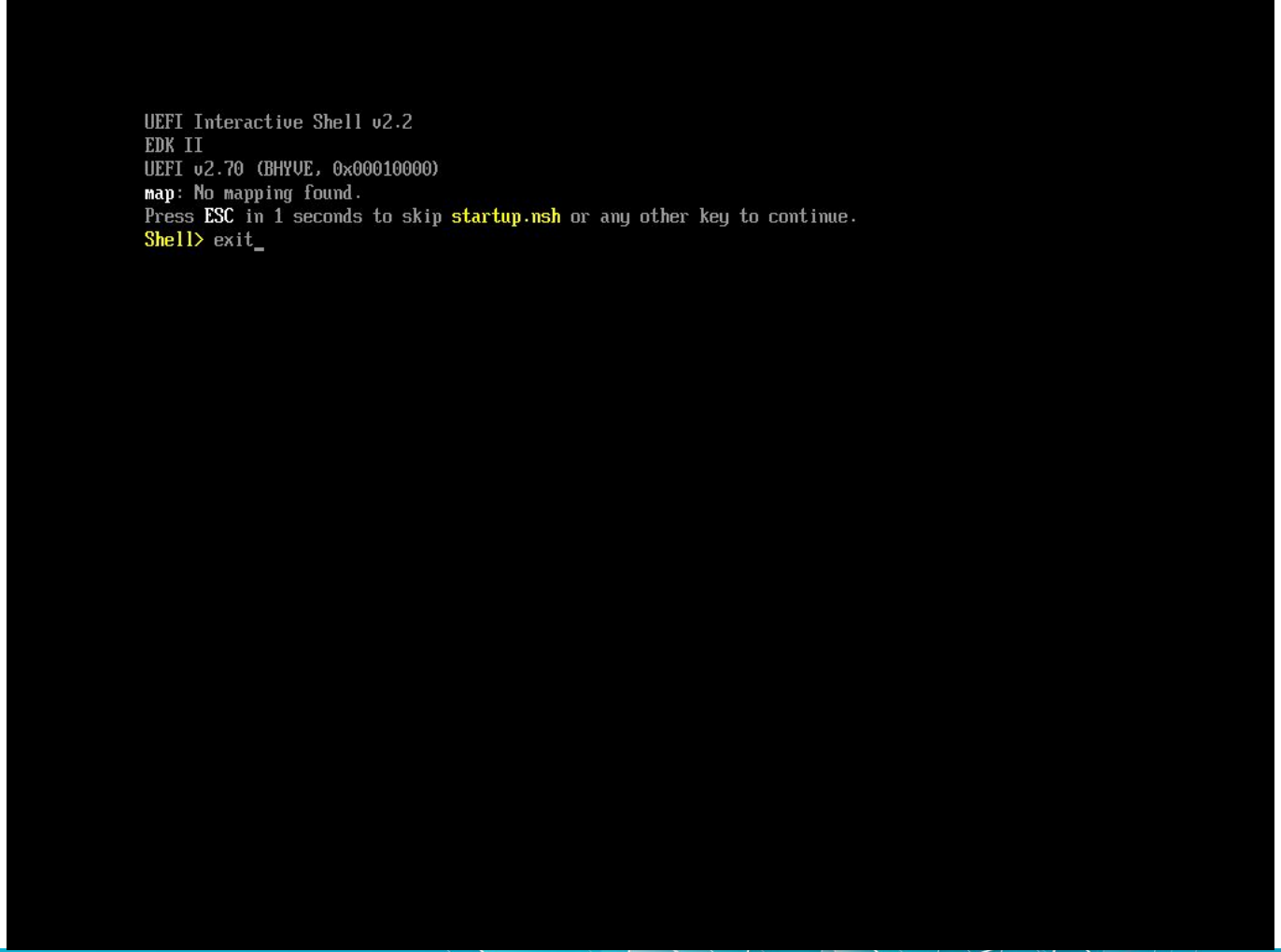
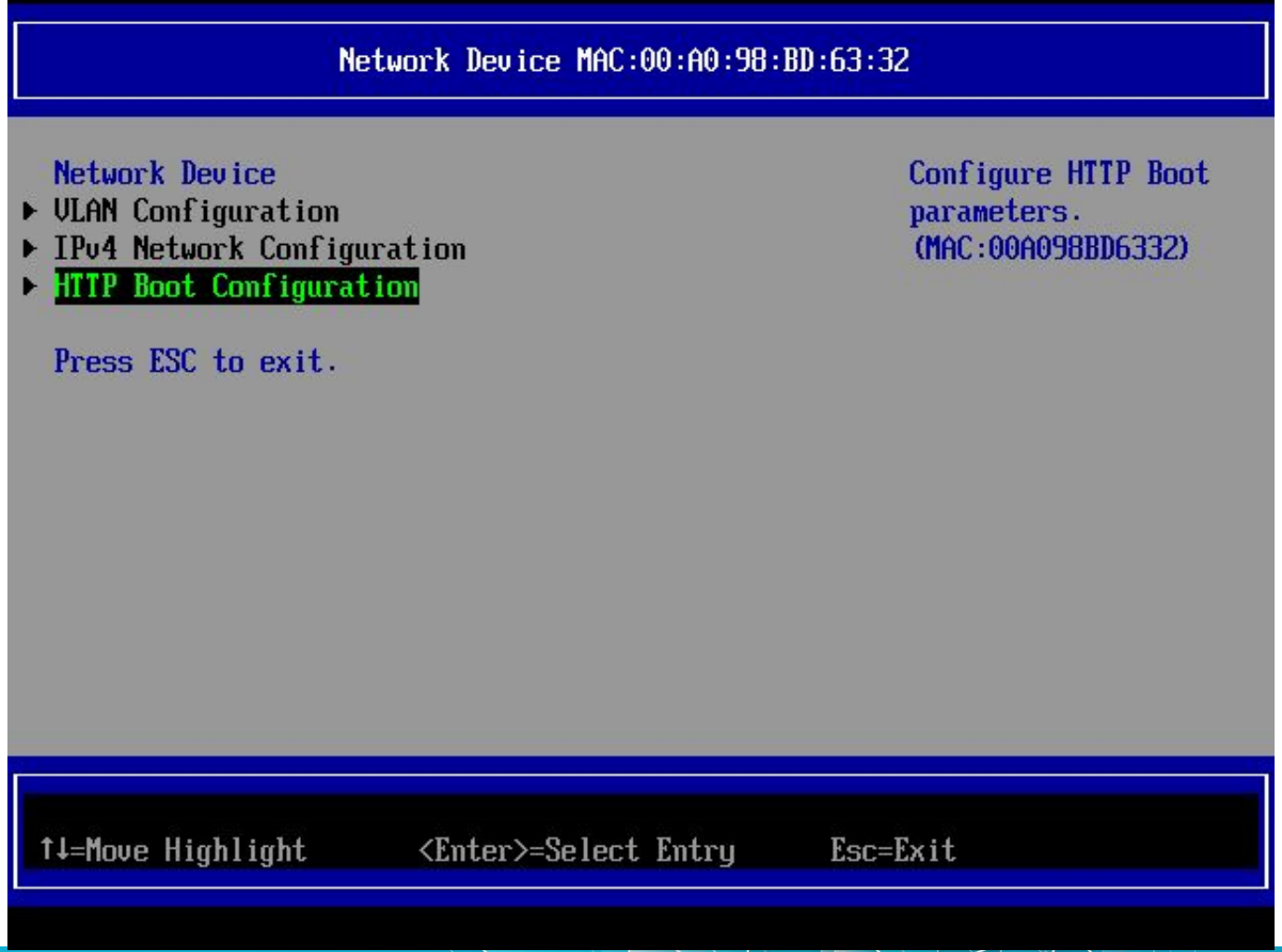
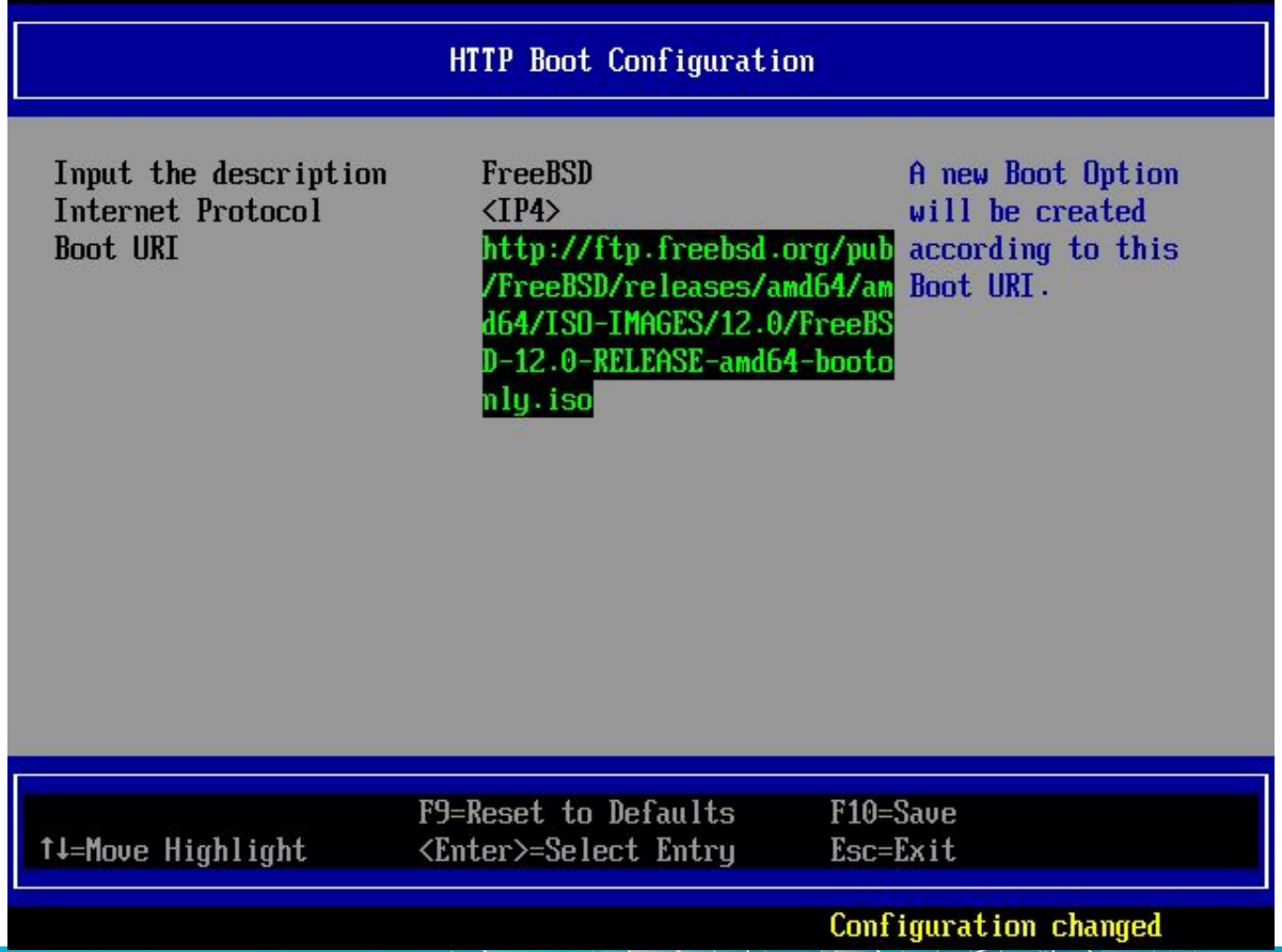

UEFI Interactive Shell v2.2
EDK II
UEFI v2.70 (BHYVE, 0x00010000)
map: No mapping found.
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.
Shell> exit_

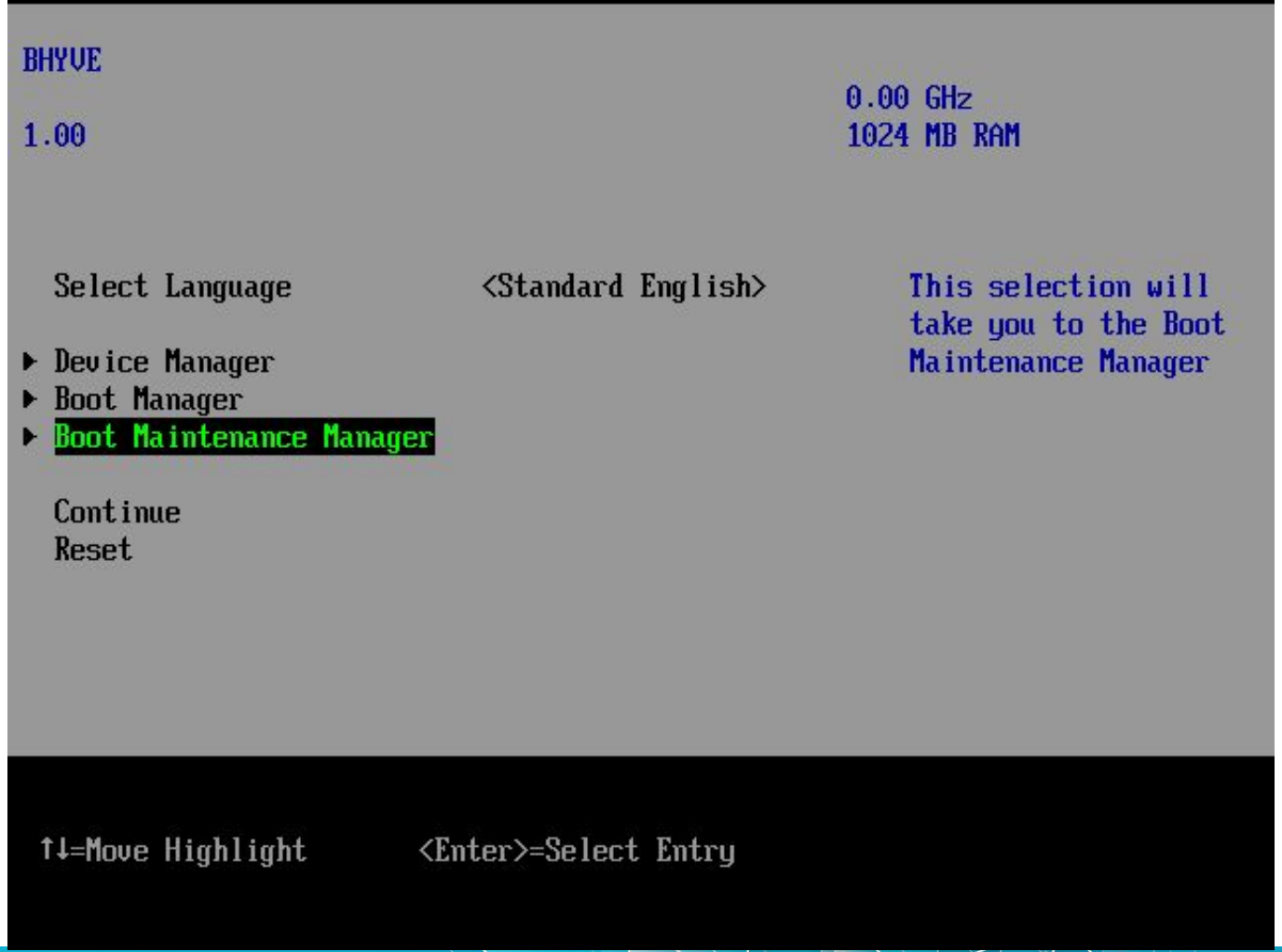

BHYVE
0.00 GHz
1.00
1024 MB RAM
Select Language
<Standard English>
This selection will take you to the Device Manager
Device Manager
Boot Manager
Boot Maintenance Manager
Continue
Reset
↑↓=Move Highlight
<Enter>=Select Entry


Device Manager
Devices List
Driver Health Manager
RAM Disk Configuration
OVMF Platform Configuration
iSCSI Configuration
Network Device List
Select the network device according the MAC address
Press ESC to exit.
↑↓=Move Highlight
<Enter>=Select Entry
Esc=Exit

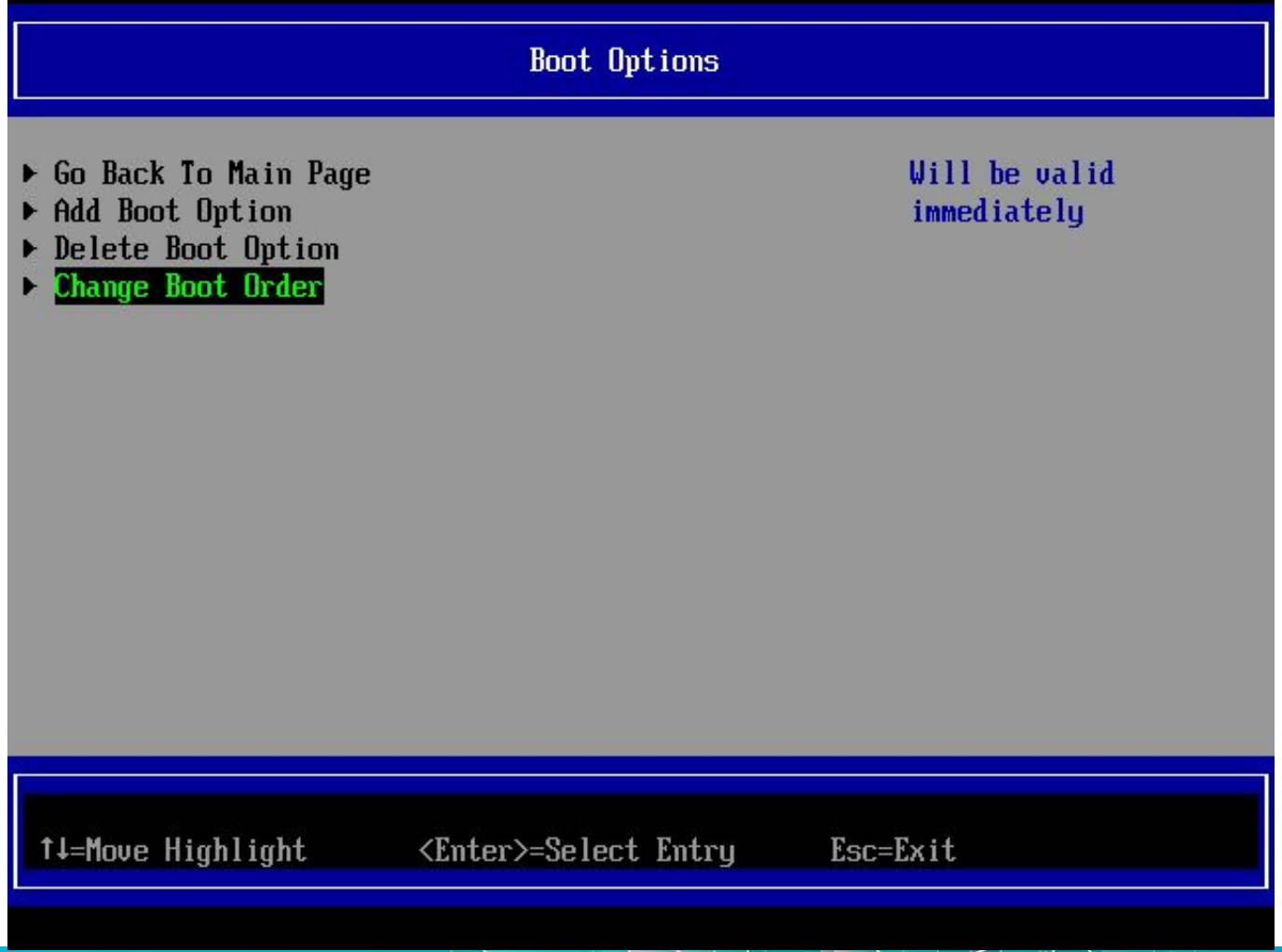

Network Device List
Network Device List
Network Device
MAC:00:A0:98:BD:63:32
Press ESC to exit.
↑↓=Move Highlight
<Enter>=Select Entry
Esc=Exit

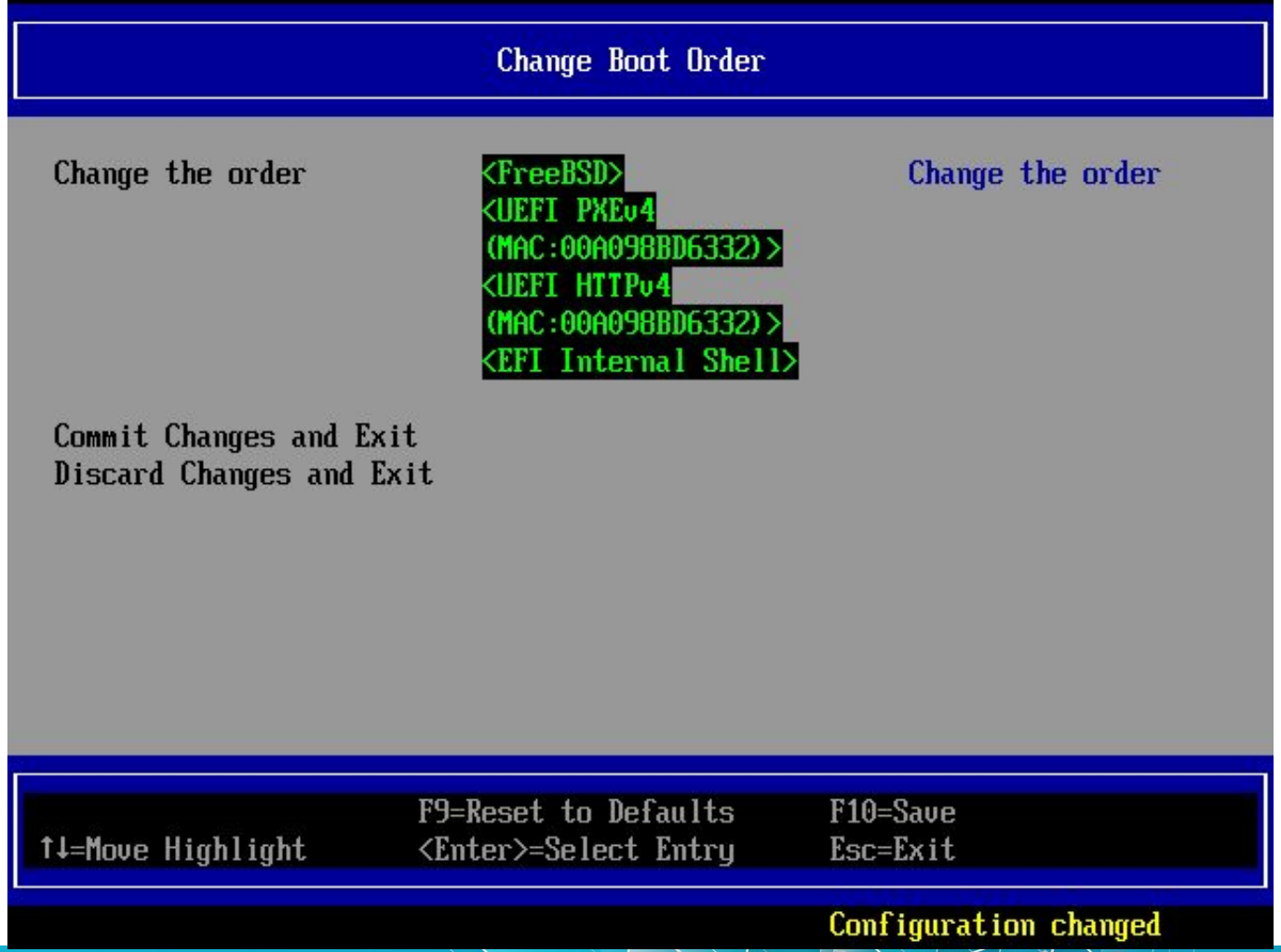

Network Device MAC:00:A0:98:BD:63:32
Network Device
VLAN Configuration
IPv4 Network Configuration
HTTP Boot Configuration
Press ESC to exit.
Configure HTTP Boot parameters.
(MAC:00A098BD6332)
↑↓=Move Highlight
<Enter>=Select Entry
Esc=Exit


HTTP Boot Configuration
Input the description
FreeBSD
Internet Protocol
<IP4>
Boot URI
http://ftp.freebsd.org/pub/FreeBSD/releases/amd64/amd64/ISO-IMAGES/12.0/FreeBSD-12.0-RELEASE-amd64-bootonly.iso
A new Boot Option will be created according to this Boot URI.
F9=Reset to Defaults
F10=Save
↑↓=Move Highlight
<Enter>=Select Entry
Esc=Exit
Configuration changed


BHYVE
0.00 GHz
1.00
1024 MB RAM
Select Language
<Standard English>
This selection will take you to the Boot Maintenance Manager
Device Manager
Boot Manager
Boot Maintenance Manager
Continue
Reset
↑↓=Move Highlight
<Enter>=Select Entry


Boot Maintenance Manager
Boot Options
Driver Options
Console Options
Boot From File
Modify system boot options
Boot Next Value <NONE>
Auto Boot Time-out [0]
F9=Reset to Defaults
F10=Save
↑↓=Move Highlight
<Enter>=Select Entry
Esc=Exit


Boot Options
Go Back To Main Page
Add Boot Option
Delete Boot Option
Change Boot Order
Will be valid
immediately
↑↓=Move Highlight
<Enter>=Select Entry
Esc=Exit


Change Boot Order
Change the order
<FreeBSD>
<UEFI PXEv4
(MAC:00A098BD6332)>
<UEFI HTTPv4
(MAC:00A098BD6332)>
<EFI Internal Shell>
Change the order
Commit Changes and Exit
Discard Changes and Exit
F9=Reset to Defaults
F10=Save
↑↓=Move Highlight
<Enter>=Select Entry
Esc=Exit
Configuration changed


BHYVE
0.00 GHz
1.00
1024 MB RAM
Select Language
<Standard English>
Continue
Device Manager
Boot Manager
Boot Maintenance Manager
Continue
Reset
↑↓=Move Highlight
<Enter>=Select Entry


Welcome to FreeBSD
1. Boot Multi user [Enter]
2. Boot Single user
3. Escape to loader prompt
4. Reboot
Options:
5. Kernel: default/2kernel (1 of 1)
6. Boot Options
Exiting menu!
Type '?' for a list of commands, 'help' for more detailed help.
OK set boot_serial=no
OK set boot_verbose=yes
OK load /boot/kernel/kernel
/boot/kernel/kernel text=0x1678a68 data=0x1cd288+0x768b40 syms=[0x8+0x174cd8+0x8+0x19224a]
OK load /boot/kernel/nvdimm.ko
/boot/kernel/nvdimm.ko size 0x7098 at 0x263d000
OK boot