VMware* vSphere ESX 5.x
iSCSI Boot Support with VLANs
on Intel Adapters

A supplement to the VMware* vSphere 5.x Storage Administrators’
Guide and the Intel Network Connections User Guide

Intel® Networking Division

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## Revisions

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<th>Revision</th>
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<tr>
<td>May 2013</td>
<td>1.0</td>
<td>Initial Release</td>
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1 Introduction & Intended Audience

Prior to the Intel Network Division’s 17.4 software release, it was not possible to use iSCSI boot with VLANs in an ESX environment. This document covers the necessary software, eeprom configurations and processes required to use iSCSI boot with VLAN support in a SAN environment with Intel’s 17.4 software release or greater.

It is intended to supplement both the VMware vSphere 5.x Storage Administrators Guide as well as the Intel Network Connections User Guide—the companion document accompanying Intel LAD’s Ethernet SW releases. It includes specific information regarding Intel’s solution for iSCSI boot using VLAN’s Intel 1GB and 10 GB adapters.

This information is for experienced system administrators who are familiar with datacenter operations, networks, virtualization technologies and SAN storage concepts.

2 Scope

This document covers the configuration and operation of iSCSI Boot for Intel server adapters and highlights the basic active-passive redundancy use case. It covers the LAN on Motherboard and adapter setup for both primary and secondary iSCSI boot priority using VLANs.

**Note:** While all screen captures are done on 1GB (LOM & Add-In Adapter), the steps are the same for 10GB.

Parameters of switch and target configurations are only briefly discussed so we recommend that customers consult the documentation of their specific hardware vendors for boot configuration details for their switches and targets.

iSCSI storage and network configuration values referenced throughout this document are shown in the following table.

<table>
<thead>
<tr>
<th>iSCSI (Boot) Parameters</th>
<th>iSCSI Storage/Network Configuration Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLAN iSCSI</td>
<td>23</td>
</tr>
<tr>
<td>VLAN Mgmt</td>
<td>269</td>
</tr>
<tr>
<td>ESXi 5.x Mgmt IP</td>
<td>10.1.69.241 /24</td>
</tr>
<tr>
<td>Client Initiator IP/Mask - Primary</td>
<td>192.168.23.2 /24</td>
</tr>
<tr>
<td>Client Initiator Name (IQN) - Primary</td>
<td>iqn.2013-03.com.vmware:fmsnet02</td>
</tr>
<tr>
<td>Client Initiator IP/Mask - Secondary</td>
<td>192.168.23.22 /24</td>
</tr>
<tr>
<td>Client Initiator Name (IQN) - Secondary</td>
<td>iqn.2013-03.com.vmware:fmsnet02-2</td>
</tr>
<tr>
<td>Target Initiator IP</td>
<td>192.168.23.250</td>
</tr>
<tr>
<td>Target Initiator Name (IQN)</td>
<td>iqn.1992-04.com.emc:cx.apm0010601040.b8</td>
</tr>
</tbody>
</table>
Preconfiguring the Network & Storage Targets

Network configuration for iSCSI is typically a single VLAN. For this experiment, a Cisco* switch was used but most any 1G or 10G switch will work. Since this document covers iSCSI with VLANs, the port is configured using Multi-Link Aggregation or Trunking at the port level as shown in Figure 1.

```
interface Ethernet1/16
   description iSCSI_boot
   switchport mode trunk
   switchport trunk allowed vlan 23,269
   spanning-tree port type edge trunk
   speed 1000
   duplex full
```

Figure 1—Administrative Ownership Table

Note: iSCSI Boot VLANs must match VLANs on the switch when the switch is configured for Multi-Link Aggregation or Trunking. In this example, one VLAN is used for iSCSI Boot (v23) and a second VLAN (v269) for management of the ESXi 5.x host. Both VLANs are on port 1.

Additionally, two switch ports are configured identically in the example—one for primary iSCSI boot and one for secondary iSCSI boot.

For proper LUN Masking, storage configuration for primary and secondary iSCSI boot requires IP addresses for each individual NIC to be part of a storage group mapped to the target LUN as shown in Figure 2.

Figure 2—Mapped Storage Groups

Note: Each NIC port receives its own IQN; one for the primary target and one for the secondary target.
Enabling & Configuring Integrated Flash for iSCSI Boot

Intel® adapters incorporate a factory-installed, integrated flash ROM device, pre-programmed with an Intel® Boot Agent software image. The flash ROM is not enabled by default. This document shows how to configure the two primary NICS types; the LAN-on-Motherboard (LOM) and the add-in 1GB PCI-e adapter. Additionally, two different ways to enable the flash ROM are shown:

1. Enabling the LOM is through the BIOS and configuring it with the EFI version of Intel Bootutil software.
2. Configuring the add-in card using a DOS-bootable USB device with Intel Bootutil software.

Intel iSCSI Boot software is supported in these environments: DOS, EFI (x64 and 64), Linux (32 and x64) and Windows (32 and x64).

The following examples explain the steps required to perform iSCSI boot with Intel LOM adapters in a VMware* ESX 5.x environment. While systems or switches may differ from this example, the concepts to prepare and perform iSCSI boot with Intel adapters or LOM remain similar. A USB flash drive containing the required bootutil files is used to make the changes to the Intel LOM and adapter.

For the Primary iSCSI Boot setup, the iSCSI initiator portion is setup with Bootutil inside the EFI shell. The iSCSI target portion is then configured with the iSCSI Boot Initialization tool. The syntax necessary to perform all the commands within the Bootutil EFI session follows Table 2.

The process begins within the BIOS in the LOM. Enter the BIOS by depressing F2 during system POST and navigate to the PCI Configuration area of Advanced Settings. Disable the onboard NIC ROM prior to enabling the onboard NIC iSCSI ROM as shown in Figure 3.

![Figure 3—Enable the iSCSI ROM in the BIOS](Image)
Within the BIOS, navigate to the Boot Manager tab to enter the Internal EFI Shell as shown in Figure 4.

![Figure 4—Entering the EFI Shell](image)

After entering the EFI Shell, a mapping table with system known devices will be printed to the screen. Then type “fs0” to enter the flash device containing the EFI version of bootutil as shown in Figure 5.

```
EFI Shell version 2.00 [4096.1]
Current running mode 1.1.2
Device mapping table
  fs0 : Removable HardDisk - Alias hd41d0b blk0
       Apcpi(PNP0A03.0)/Pci(1A17)/Usb(3.0)/Hd(Par1.Sig42994096)
  blk0 : Removable HardDisk - Alias hd41d0b fs0
       Apcpi(PNP0A03.0)/Pci(1A17)/Usb(3.0)/Hd(Par1.Sig42994096)
  blk1 : Removable BlockDevice - Alias (null)
       Apcpi(PNP0A03.0)/Pci(1A17)/Usb(3.0)
  blk2 : Removable BlockDevice - Alias (null)
       Apcpi(PNP0A03.0)/Pci(1D17)/Usb(1.0)

Press ESC in 1 seconds to skip startup.nsh, any other key to continue.
Shell> fs0:
```

Using the EFI version syntax of bootutil <bootutil64e>, change the iSCSI boot priority of NIC 1 to be the primary iSCSI Boot port as shown in Figure 6.
Figure 6—Setting NIC 1 to Become the iSCSI Primary Boot

Note: Bootutil looks for an iSCSI image on local FLASH. The LOM adapters have their iSCSI image integrated into BIOS. This is why FLASH/Firmware shows “Not Present”.

Next, set the VLAN for the primary iSCSI Boot port as shown in Figure 7.

Figure 7—Changing the iSCSI VLAN

The next two steps configure a static IP address and mask on the iSCSI Boot port as shown in Figure 8.
Figure 8—Adding the iSCSI Initiator IP and Mask to NIC 1

As the last step in the EFI configuration, the iSCSI Initiator Name is added to NIC 1 as shown in Figure 9.

**Note:** For more information on iSCSI Initiator names, see section 2 of the *iSCSI Quick Connect Guide for VMware*.

Before exiting the EFI Shell, type “bootutil64e -nic=1” to verify the configuration made to this point as shown in Figure 10.
To leave the EFI Shell, type exit and press the enter key. Upon entering the BIOS, hit F10 to save all changes and exit the BIOS.

The option to enter into the iSCSI Boot initialization tool is presented during POST. Enter Ctrl-D to enter the iSCSI Boot initialization tool as shown in Figure 11.

Navigate to the network adapter that will be used for the primary iSCSI Boot device on the first screen of the iSCSI Boot initialization tool as shown in Figure 12.

Note: Use the Blink LED function to verify that the network cable is plugged into the correct adapter port of the server.
Highlight the correct adapter and press enter to complete the configuration (Target Name & IP) of the iSCSI Boot parameters as shown in Figure 13.
Figure 13—Using the iSCSI Boot Initialization Tool for Verification (Port 1).

**Note:** The “target port” and “boot lun” were left in default settings for the storage appliance used in this test bed. Users should consult the documentation of their specific hardware vendors for boot configuration details for their target.

Save all change and press Esc to exit the iSCSI Boot initialization tool.

After exiting the iSCSI Boot initialization tool, the host will complete the POST and boot to the DOS bootable USB flash drive. The adapter NIC port will be configured using DOS bootutil commands to become a secondary iSCSI Boot device. DOS bootutil commands running identically to the EFI, Linux, and Windows versions of bootutil command sets.

**Note:** The secondary iSCSI Boot port was set up on a separate add-in adapter to highlight the differences in configuration. Because the secondary iSCSI Boot configuration is on a separate adapter, a unique initiator name is used. Typically two LOM ports or two add-in adapter ports would be used for primary and secondary iSCSI Boot setup. In this case the initiator name would remain constant for both primary and secondary.

Starting with adapter 3, the NIC is set to iSCSI Boot as shown in Figure 14.
To configure the iSCSI Boot command set for a secondary port, all naming and IP commands are simply repeated with the values. Enter the commands in Table 2 at the command prompt as shown in Figure 14.

<table>
<thead>
<tr>
<th>Command Set</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>bootutil –nic=3 –up=iscsi</td>
<td>Turn iSCSI Boot on</td>
</tr>
<tr>
<td>bootutil –nic=3 –bootpriority=secondary</td>
<td>Set Boot Priority</td>
</tr>
<tr>
<td>bootutil –nic=3 -initiatordhcp=disable</td>
<td>Turn off DHCP</td>
</tr>
<tr>
<td>bootutil –nic=3 iscsivlan=23</td>
<td>Set iSCSI VLAN</td>
</tr>
<tr>
<td>bootutil –nic=3 -initiatorip=192.168.23.22</td>
<td>Set Client IP</td>
</tr>
<tr>
<td>bootutil –nic=3 -netmask=255.255.255.0</td>
<td>Set Client Mask</td>
</tr>
<tr>
<td>bootutil –nic=3 –targetip=192.168.23.250</td>
<td>Set Target IP</td>
</tr>
<tr>
<td>bootutil –nic=3 /p</td>
<td>View iSCSI settings</td>
</tr>
</tbody>
</table>

**Note:** For additional command line syntax for Intel Bootutil, please refer to the online help (bootutil -?), the documentation provided on the CD accompanying the adapter or search www.intel.com for Ethernet Controllers. The Bootutil documentation is available in the Apps/Bootutil directory.
All configuration changes made for the iSCSI Boot Secondary port shown in Figure 15 can be viewed via the command line by typing `bootutil -nic=3 /p`.

```
bootpriority=secondary
initiatorname=iqn.2013-03.com.vmware:fmsnet02-2
initiatordhcp=disable
expansionrommenu=enable
connwaittime=15
initiatorip=192.168.23.22
netmask=255.255.255.0
gateway=0.0.0.0
iscsivlan=23
targetname=iqn.1992-04.com.emc:cx.apm00110601040.b0
targetdhcp=disable
targetip=192.168.23.250
targetport=3260
bootlun=0
authenticationmethod=none
chapusername=
chapsecret=
mutualchapsecret=
```

Figure 15—bootutil -nic=x Fully Configured

To leave bootutil, simply reboot the system.

The option to enter into the iSCSI Boot initialization is presented again during the POST. Enter Ctrl-D to start the initialization tool again then navigate to the desired network adapter for the secondary iSCSI Boot device on the first screen as shown in Figure 16.
Highlight the correct adapter and press Enter to verify the configuration of the iSCSI Boot parameters as shown in Figure 17.
Note: It is possible to have combination images supporting iSCSI boot, FCoE Boot and PXE boot concurrently depending on the size of the adapter flash or eeprom. This discussion is beyond the scope of this paper. Please contact your Intel representative with any questions.

5 Booting, Install OS, & Post-Build Check

With the adapter, switch and target correctly configured, booting from iSCSI to VMware* ESX 5.x is now possible. With two ports configured (primary & secondary), the iSCSI boot initialization shows both ports but boots only from the Primary iSCSI Boot port as shown in Figure 18.
To verify the secondary works and redundancy is functioning as expected, the cable to NIC 1 was disconnected. As shown in figure 19, the host failed to detect a link on the Primary iSCSI Boot port and failed over to the Secondary port.
With the target attached, the system is now ready for the VMware* ESXi 5.x software installation. While the full installation of VMware* ESXi 5.x is outside the scope of this document, it is worth noting that installation must be to the correct storage device. When asked to select a disk for the software to be installed, choose the remote or VRAID volume as shown in Figure 20.

![Figure 20—Choosing the Correct Volume for Software Load](image)

Once VMware* ESXi 5.x is installed, add the host to vSphere as in any other installation. From the Hosts and Cluster view, navigate to the Network area of the Configuration tab to view the VMware* vSwitch settings that reflect two VLANs—the iSCSI (Boot) Datastore and the Management Network as shown in Figure 21.
While still on the VMware* vSphere configuration tab of the Host and Clusters view, navigate to the storage area to view the datastore as shown in Figure 22.

![Figure 21—Verifying VLAN Tagging within ESXi 5.x](image)

**Figure 21—ESXi 5.x View of iSCSI Boot Target**

# 6 Summary

Intel’s Server adapter line in both 1gigabit and 10 gigabit solutions fully support a wide range of storage capabilities. Customers get the ease of Ethernet support along with VMware* storage support in a single adapter.

For more information on iSCSI on VMware* ESXi 5.0, see the [vSphere Storage for ESXi 5.1 and vCenter Server 5.1 Administrators Guide](#).

For more iSCSI Boot configuration information on Intel® Server Adapters, get the [User Guide for Intel® Ethernet Adapters](#)