BladeBoot SAN Guide

Software-Based iSCSI Boot
SAN Guide for IBM Blades

Note

Before using this information and the product it supports, read the information in “Notices”, on page 21.

1 IBM iSCSI BladeBoot

IBM iSCSI BladeBoot enables a Blade with no local disk to boot from an iSCSI Target using a standard Ethernet port. This is accomplished via a combination of firmware and operating system support.

Refer to the BladeBoot web portal for additional information.

2 SAN Configuration

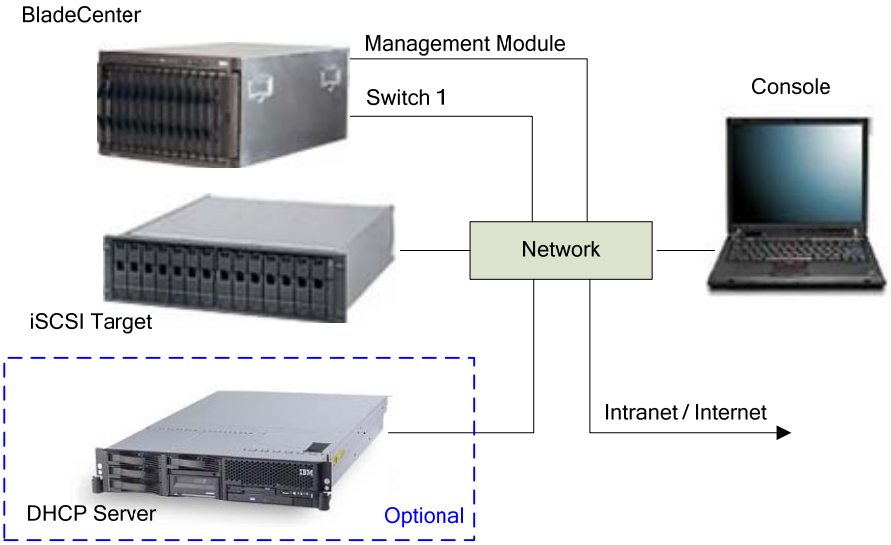
2.1 Introduction

This section describes how to set up a basic iSCSI BladeBoot SAN configuration. Start with this Reference Implementation to validate the iSCSI Boot process and then expand your SAN appropriate to your environment.

2.1.1 Overview Diagram

The diagram below shows the basic components required for an iSCSI Boot SAN. The primary components required are:

- IBM BladeCenter
- IBM Blades[1] (see iSCSI Boot Blade Support Matrix)
- iSCSI Target, e.g. IBM N3700 Filer
- Console
- iSCSI Configuration Manager
  - A utility installed on and run from the Console
- DHCP Server (optional)



The BladeCenter contains a number of Blades with no local disks. Each Blade boots from its own LUN on the iSCSI Target. The optional DHCP server provides network parameters. The Console is used to manage the SAN.

[1] IBM iSCSI BladeBoot is a feature included with select IBM Blades. Consult your IBM Representative for details regarding supported models.

For the Reference implementation have all the systems on the same subnet and use “255.255.255.0” as the netmask. If this is not possible, then use the “255.255.255.0” netmask and a gateway.

2.1.2 Console

The console system:

1. Provides browser access to the BladeCenter Management Module Web Interface
    a. The BladeCenter web interface also provides a Remote Console capability for the Blades
2. Runs the iSCSI Configuration Manager (Blade NVRAM configuration tool)
3. May provide browser access to the iSCSI Target (see your iSCSI Target documentation).

The Console must be configured with:

1. A Java run time environment. One of the following versions (or later updates):

    a. 1.4.2_17

    http://java.sun.com/j2se/1.4.2/download.html

    b. 1.5.0_15

    Click on ‘Previous Releases’
    http://java.sun.com/javase/downloads/index.jsp

    c. 6u10

    http://java.sun.com/javase/downloads/index.jsp

2. IBM iSCSI Configuration Manager. The following version (or later update):

    a. 2.3.0c

    IBM iSCSI Configuration Manager

2.2 Overview of Blade iSCSI Boot Sequence

The basic steps for a Blade to boot via iSCSI are:

1. The Blade powers up
2. The iSCSI Boot firmware in the Blade uses one of two methods to obtain networking parameters
    a. DHCP
    b. On-board NVRAM
3. The networking parameters are obtained
4. The firmware logs in to the iSCSI Target
5. The firmware begins the boot process (by loading and executing the master boot record)
6. The operating system takes over and completes the bootstrap process.

2.3 Operating System Deployment

Note that not all operating systems necessarily support all deployment modes.

2.3.1 Install from Media to iSCSI LUN

In this mode installation is via the familiar process of booting the installation media and installing to disk. There might be a few additional steps during installation to select iSCSI Boot.

2.3.2 Image-based Deployment

In this mode installation occurs in three main steps. Step one is a traditional install to a local disk. Step two is capturing an image of the local drive and transferring the image to a storage device on the SAN. Step three is replicating the image for use by a new system.

2.4 Parameter Methodology

The firmware must obtain various network parameters to initiate iSCSI Boot. This includes but is not limited to an IP address, subnet mask, iSCSI Target IP, iSCSI Target Name, iSCSI LUN, etc. This information can be obtained from DHCP or from internal NVRAM.

2.4.1 DHCP

In a DHCP configuration a reservation must be created associating a MAC address with an IP address. A DHCP option is used to provide the iSCSI Target information.

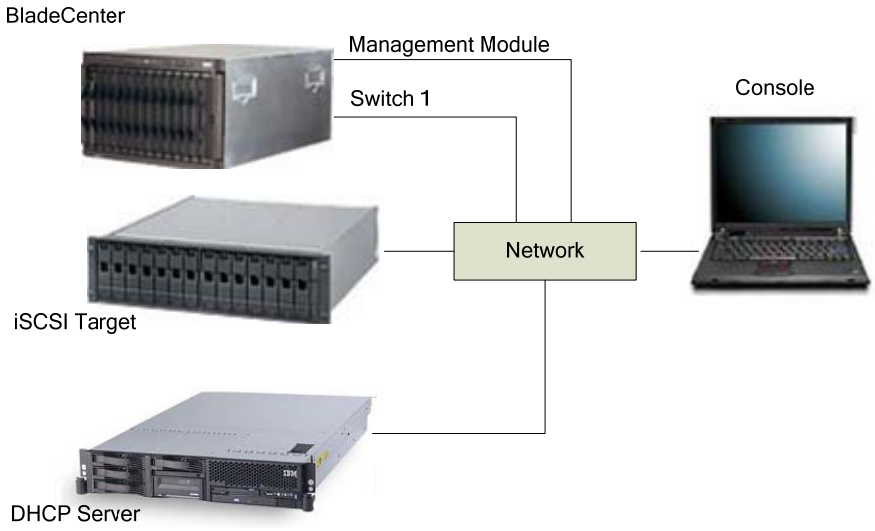
2.4.2 NVRAM

In an NVRAM configuration the parameters required by the iSCSI Boot process are stored in NVRAM.

Note that NVRAM also specifies the “mode” to use – DHCP or NVRAM. Thus a valid NVRAM configuration must be established via the IBM iSCSI Configuration Manager even if DHCP mode is selected.

2.5 SAN with DHCP

In the “SAN with DHCP” configuration a DHCP server provides the networking parameters. A DHCP reservation is required for each Blade. Each reservation has an Option which specifies the iSCSI Target boot LUN.



You specify the DHCP Option via one of two methods, Option 17 or Vendor Options.

2.5.1 Option 17

Option 17 is defined by the IETF RFC 4173:

http://www.ietf.org/rfc/rfc4173.txt

You will need a copy for complete detailed reference.

Briefly, option 17 is formatted as:

iscsi:<servername>:<protocol>:<port>:<LUN>:<targetname>

For example:

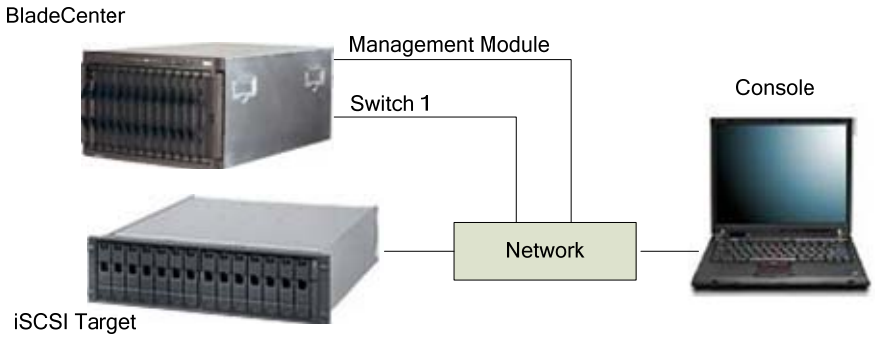
iscsi:192.168.70.20:6:3260:0:iqn.1986-03.com.ibm:sn.12345678

2.5.2 Vendor Options

An advanced mode via DHCP Vendor Options is also supported. The Vendor Options mode is an advanced mode and is not necessary to complete the Reference SAN exercise.

2.6 SAN without DHCP

In the “SAN without DHCP” configuration the networking parameters are stored in Blade NVRAM.



The networking parameters you determine are input to the IBM iSCSI Configuration Manager for storage into NVRAM. Note that each Blade Server has its own NVRAM.

2.7 iSCSI Configuration Manager

The iSCSI Configuration Manager must be run for both DHCP and NVRAM modes. The iSCSI Configuration Manager downloads the NVRAM table into a Blade Server.

See the IBM iSCSI Configuration Manager Guide for further details.

2.8 iSCSI Target

Please refer to your iSCSI Target documentation.

2.8.1 LUN Types

If your iSCSI Target has an option for “LUN Type” I suggest selecting “raw” or “image” or whatever your device calls an un-typed collection of disk blocks. However, consult your Target documentation since there might be performance or other advantages to selecting a specific LUN type (if available).

2.8.2 Access Control

Your iSCSI Target may provide a number of ways to set up access control for the system running iSCSI Boot. This might be by Initiator “iqn”, or MAC address, or IP address.

In DHCP Option 17 mode the default Initiator iqn name that the IBM iSCSI Boot firmware generates is:

When DHCP Option 12 is present:

iqn.1986-03.com.ibm<:DHCP Option 12 String>

When DHCP Option 12 is not present

iqn.1986-03.com.ibm<:Boot NIC MAC Address>

When operating in NVRAM mode or DHCP Vendor Options mode the iqn name is provided by the administrator. For example, the following iqn can used:

iqn.1986-03.com.ibm<:Blade Serial Number>

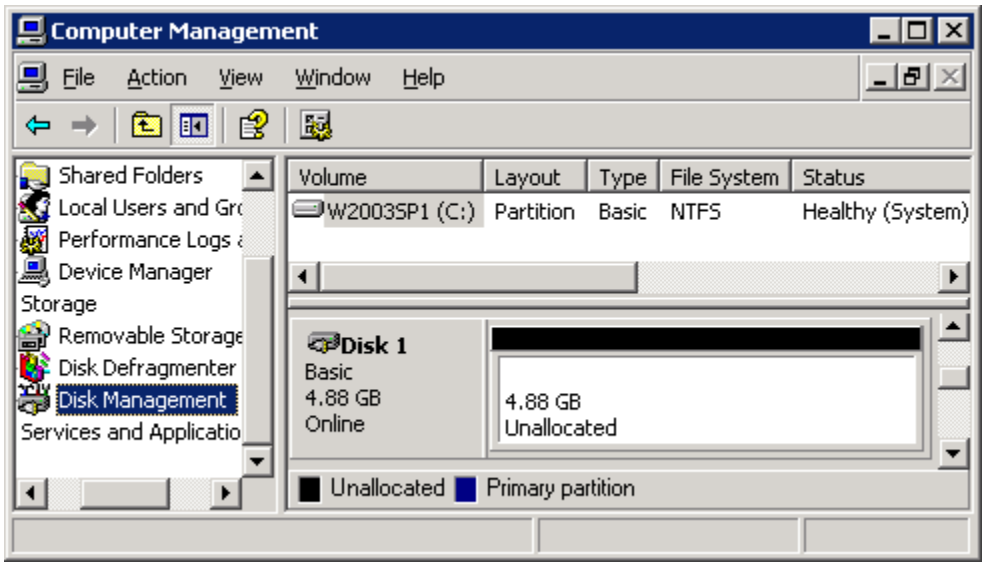
2.9 Quick Tests (Optional)

If you’d like to test your SAN configuration here are some (optional) methods.

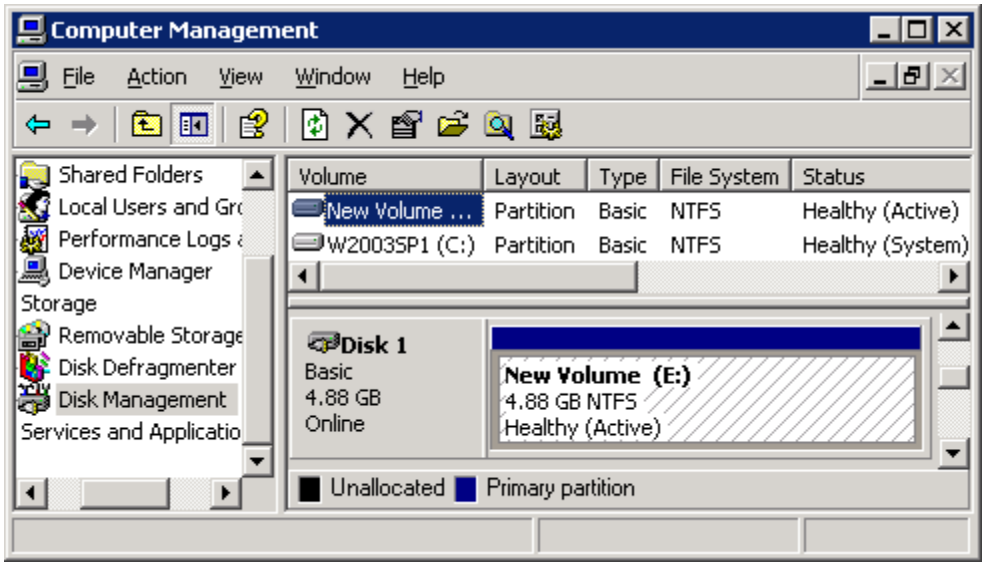
For the system that you will be using to test booting from SAN do not have a local disk installed – for these tests.

2.9.1 Windows Partition

1. Create a LUN on your iSCSI Target and configure the SAN
2. Attach to the LUN via the Microsoft Windows Initiator from the Console or other suitable system.
3. Run Disk Management
   My Computer -> Manage -> Disk Management
   a. If your LUN was created and initialized with all zeros, as is often the case then Windows will prompt you to Initialize the disk, follow the prompts and defaults.



b. Right click on the white box (next to Disk 1 in the example above) and Partition, Format, and Mark Active



4. Boot a Blade Server with iSCSI Boot enabled.
5. The IBM iSCSI Boot Firmware Initiator should log in successfully.
6. The empty Windows partition should boot and display an error message.

2.9.2 DOS

1. Set up the SAN with a LUN
2. Boot DOS from floppy diskette
3. Run FDISK and partition the drive

    a. Mark the partition active
    b. You will have to reboot
4. Boot DOS from floppy diskette
5. format c: /s
6. Remove the diskette from the drive
7. Reboot
    a. You should boot into DOS and a C:\ prompt

3 Blade Hardware Guide

3.1 iSCSI BladeBoot Support Matrix

Model		BladeBoot Support	Minimum BIOS Level		Minimum BMC Level	
			Build ID	Revision	Build ID	Revision
HS12						
HS12	8014	Yes	N1E125AUS	1.00	N1BT07LUS	1.01
HS12	8028	Yes	N1E125AUS	1.00	N1BT07LUS	1.01
HS20						
HS20	1883	Yes	BWE131BUS	1.12	BWBT40AUS	1.33
HS20	1884	No	n/a	n/a	n/a	n/a
HS20	7981	No	n/a	n/a	n/a	n/a
HS20	8678	No	n/a	n/a	n/a	n/a
HS20	8832	No	n/a	n/a	n/a	n/a
HS20	8843	Yes	BWE131BUS	1.12	BWBT40AUS	1.33
HS21						
HS21	1885	Yes	BCE135AUS	1.12	BCBT47BUS	1.12
HS21	8853	Yes	BCE135AUS	1.12	BCBT47BUS	1.12
HS21 XM						
HS21	1915	Yes	MJE127AUS	1.09	MJBT22A	1.13
HS21	7995	Yes	MJE127AUS	1.09	MJBT22A	1.13
HS40						
HS40	8839	No	n/a	n/a	n/a	n/a
LS20						
LS20	8850	Yes	BKE127A	1.27	BKBT29AUS	2.21
LS21						
LS21	7971	Yes	BAE145AUS	1.06	BABT46A	1.24
LS41						
LS41	7972	Yes	BAE145AUS	1.06	BABT46A	1.24

3.2 URLs

3.2.1 General Links

IBM Support Home Page
Blade Matrix
IBM iSCSI Boot Main Page
IBM iSCSI Boot Commander Utility

3.2.2 IBM iSCSI Configuration Manager

IBM iSCSI Configuration Manager Utility
IBM iSCSI Configuration Manager User Guide

3.2.3 Broadcom NetXtreme I

Broadcom NetXtreme Firmware Update Utility
Broadcom NetXtreme Drivers

3.2.4 Broadcom NetXtreme II

Broadcom NetXtreme II Firmware Update Utility
Broadcom NetXtreme II Drivers

3.3 Chassis and Blade Preparation

1. Update the BladeCenter Management Module(s) to the latest level of firmware.
2. Update the network switch(es) to the latest level of firmware.
3. Update the Blade Server BMC
4. Update the Blade Server BIOS

Note: All NIC firmware updates must be performed with F1 Setup values set to "Default". That is, you cannot be logged in to an iSCSI Target when running the NIC update procedure.

5. Update the Blade Server NIC Microcode

   Note that for the built-in NICs this utility updates the microcode. The PXE agent is part of the BIOS update.

   Note: Selecting either "0" or "1" updates both network ports. Selecting "0" will place Serial over LAN (SoL) on the first network port, selecting "1" will place SoL on the second network port.

6. Update any add-in expansion cards that may be present.

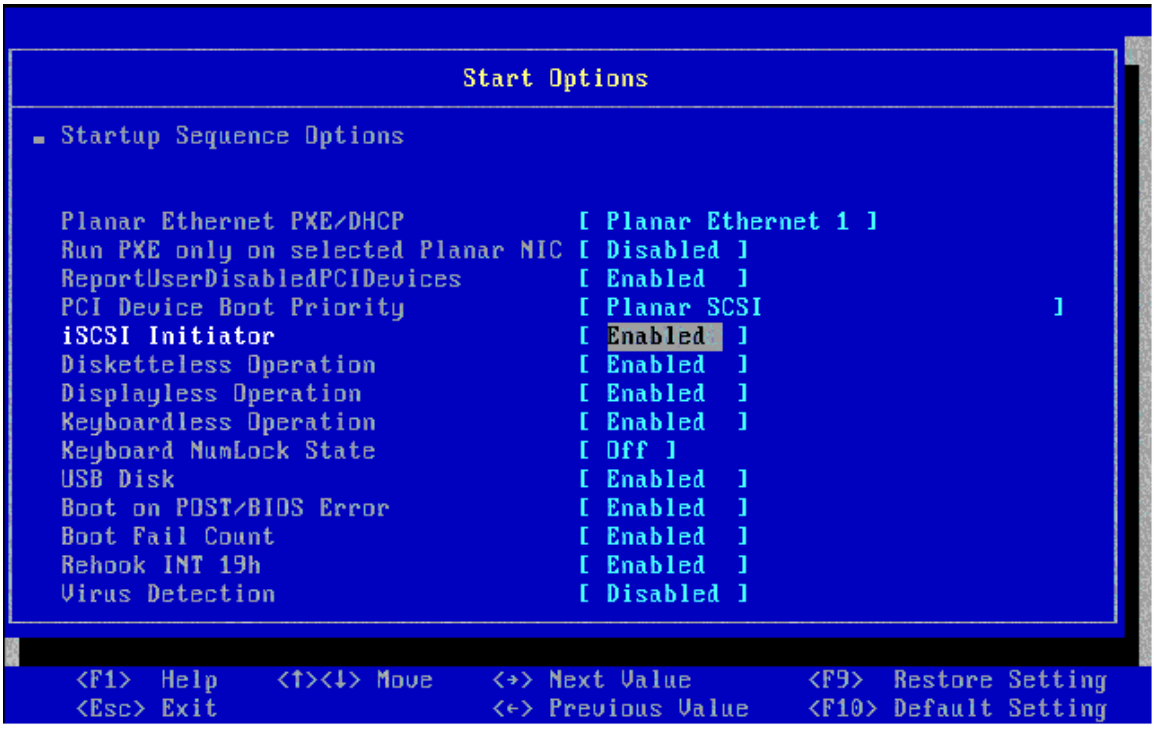
   Note that for add-in expansion cards this updates both the microcode and the PXE agent on the card.

3.4 Considerations

1. When iSCSI Boot is enabled you cannot use PXE boot.

3.5 BIOS Setup

1. For each Blade configure BIOS Setup:
   a. Power on the system. Press F1 to enter Setup.
   b. Load Default Settings
   c. Start Options -> iSCSI Initiator -> Enabled, Esc
   d. Save Settings



Note: If an 1801 error occurs then configure PXE to run on only the Ethernet port being used for iSCSI Boot. See Frequently Asked Questions.

3.6 Firmware Login Screen

A successful firmware login should look similar to the following screen shot.

3.7 iSCSI Firmware Error Messages

There are two levels of error codes for iSCSI Boot. One code is displayed by the iSCSI Boot firmware and the other is displayed by the system POST.

3.7.1 iSCSI Boot Error Codes

The displayed error code is four characters (two bytes).

Upper Byte: First Target
Lower Byte: Second Target

```
POST SUCCESSFUL                          0x00
POST NO ATTEMPT TO CONNECT TO TARGET     0x01
UNEXPECTED                               0x02

UNABLE TO SEND DHCP PACKET               0x10
DIDNT GET ANY DHCP OFFER                 0x11
DIDNT RECEIVE VALID DHCP ACK             0x12
DIDNT GET ANY VALID ISCSI DHCP OFFER     0x13
```

```
DHCP ACK IS NOT ISCSI VALID                0x14
DHCP INFORM INVALID DISCOVERY IP           0x15
DHCP INFORM FAILED GET DHCP2 MAC           0x16
DIDNT GET VALID DHCP INFORM ACK            0x17

MISSING OPTION 203                         0x30
UNABLE TO GET INITIATOR MAC                0x31
INITIATOR NAME TOO LONG                    0x32
TARGET OPTION FORMAT ERROR                 0x33
TARGET OPTION INVALID IP                   0x34
TARGET OPTION INVALID PROTOCOL             0x35
TARGET OPTION INVALID PORT                 0x36
TARGET OPTION INVALID LUN                  0x37
TARGET OPTION NAME TOO LONG                0x38
MISSING OPTION 17                          0x39
MISSING OPTION HOSTNAME                    0x3A
ERROR PARSING OPTION RETRY                 0x3B
ERROR PARSING OPTION SCOPE                 0x3C
BOTH DHCP OPTION 43 AND 17 DEFINED         0x3D

START UNIT FAILED                          0x50
TEST UNIT READY FAILED                     0x51
FIND BLOCK SIZE FAILED                     0x52

PARAM SIGNATURE INVALID                    0x60
PARAM VERSION INVALID                      0x61
PARAM LEVEL INVALID                        0x62
PARAM ROM LENGTH INVALID                   0x63
ROM TABLE CHECKSUM ERROR                   0x64
MISSING TARGET CHAP ID                     0x65
MISSING TARGET CHAP PASSWORD               0x66
MISSING INITIATOR CHAP ID                  0x67
MISSING INITIATOR CHAP PASSWORD            0x68
UNSUPPORTED SECURITY MODE                  0x69
TARGET IP INVALID                          0x6A
TARGET NAME INVALID                        0x6B
IPV6 UNSUPPORTED                           0x6C
LUN INVALID                                0x6D
NO TARGET PRESENT                          0x6E
INVALID INITIATOR IP                       0x6F

INVALID INITIATOR NAME                     0x70
UNSUPPORTED S D TYPE                       0x71
TARGET PORT INVALID                        0x72
UNSUPPORTED DISCOVERY TYPE                 0x73
GATEWAY REQUIRED                           0x74
TARGET CHAP SECRET INVALID                 0x75
```



```
INITIATOR CHAP SECRET INVALID              0x76
FAILED TO READ MBR                         0x77
UNABLE TO LOCATE NETWORK                   0x78
UNDI INIT FAILED                           0x79

UNABLE TO CREATE TCP CONNECTION TO TARGET 0x80
SECURITY PHASE FAILED                      0x81
OPERATIONAL PARAMS PHASE FAILED            0x82
CHAP AUTHENTICATION FAILED                 0x83
```

3.7.2 POST Error Codes

POST error codes for iSCSI Boot. The format of the error code is as follows:

0018XYSS VVVV DDDD

where XY is the specific “1800” error code, SS represents the slot number of the device which had the failure (00 indicates planar device), VVVV is the PCI vendor ID of the failing device and DDDD is the PCI device ID of the failing device if applicable. The following XY values are defined:

XY value	Error code meaning
01	No ROM Space Available
80	Invalid parameter structure
81	Unsupported parameter version
82	No network connection
83	No target response (timeout)
84	Target found, but not ready
85	No DHCP server response
86	No valid DHCP data found
87	Target rejected initiator IQN
89	CHAP login failure
90	Target CHAP identification failure
91	Other communication error
94	No iSCSI parameter data
95	Invalid hardware
96	Target not responding during SMI
99	Other SMI communication failure

4 IBM System Storage N Series Filers

4.1 OnTap Revision Level

The OnTap code must be at level 7.1.1 or later.

N Series Data OnTap Download Matrix

5 Frequently Asked Questions

1. I'm getting an 1801 error during POST and did not see the IBM iSCSI Firmware Initiator banner. What do I do?

   An 1801 means that you need to reduce the number of option ROMs being executed during POST. Try disabling PXE for all the NICs except the one being used for iSCSI Boot.

2. Why must PXE be enabled at all?

   There is a section of PXE called UNDI. It is the UNDI portion that provides the API to the NIC used by iSCSI Boot.

3. I'm getting an 1880 error during POST. What do I do?

   An 1880 error can usually be resolved by loading or reloading your iSCSI parameters using IBM's iSCSI Configuration Manager (ICM) v2.0.3c or later. After running ICM allow POST to complete. If the 1880 error remains then a reboot should resolve the issue.

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