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README.PDF

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This file presents general information about the LSI Fusion-MPT (TM) (Message Passing Technology) device drivers for Linux (TM). It also describes the features and use of the device drivers for the Linux operating system environment.

This file is divided into the following sections:

1. Introduction

The mpt3sas drivers are free software and are supported in source form. These drivers are distributed in the hope that they will be useful, but without any warranty and without even the implied warranty of merchantability or fitness for a particular purpose. You can redistribute them and/or modify them under the terms of version 2 or later of the GNU Public License as published by the Free Software Foundation. You should have received a copy of this license with your Linux kernel source tree (/usr/src/linux/COPYING). For detailed information on the GNU Public License, contact the Free Software Foundation, Inc at 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 or at URL

http://www.gnu.org/copyleft/gpl.html.

1.1 Features

- o SAS/SATA flexibility, supporting 1.5 Gb/s (SAS only), 3.0 Gb/s, 6.0 Gb/s and 12 Gb/s devices
- o PCI Express host interfaces
- o Supporting MSI-X Interrupt Routing
- o Fusion-MPT Architecture and common software interface
- o Embedded CPU in ASIC performs RAID operations
- o Integrated RAID available on certain boards
- o Supported RAID levels are (0, 1, 1E, 10)

1.2 LSI Devices Supported

SAS3004, SAS3008, SAS3108

1.3 List of supported Distro and their corresponding kernel flavors

Following are the List of supported Distro and their corresponding kernel flavors:

```
#############################################################################
SuSE:
#############################################################################

i686

      SLES 11 SP1
            Gold (2.6.32.12-0.7)    (default, pae, xen)

      SLES 11 SP2
            Gold (3.0.13-0.27)      (default, pae, xen)

      SLES 11 SP3
            Gold (3.0.76-0.11)      (default, pae, xen)

      SLES 11 SP4
            Gold (3.0.101-63)      (default, pae, xen)


x86_64


      SLES 11 SP1
            Gold (2.6.32.12-0.7)    (default, xen)
      SLES 11 SP2
            Gold (3.0.13-0.27)      (default, xen)
      SLES 11 SP3
            Gold (3.0.76-0.11)      (default, xen)
      SLES 11 SP4
            Gold (3.0.101-63)       (default, xen)


      SLES12
            Gold (3.12.28-4)        (default, xen)

PPC

      SLES 11 SP1
            Gold (2.6.32.12-0.7)    (default, ppc64)
      SLES 11 SP2
            Gold (3.0.13-0.27)      (default, ppc64)
      SLES 11 SP3
            Gold (3.0.76-0.11)      (default, ppc64)
      SLES 11 SP4
            Gold (3.0.101-63)       (default, PPC64)

#############################################################################
Red Hat, Cent OS, Oracle Enterprise Linux :
#############################################################################

Note: As the OS kernel is same for corresponding version of RHEL,OEL & CentOS
so the driver binaries of RHEL will work for corresponding OEL & CentOS.
```

Hence we will be providing unified binary support for RHEL,OEL & CentOS(i,e., No separate binaries for OEL & CENTOS, will be provided instead corresponding RHEL binaries should be used).

```
i686

      RHEL6

            Update 4 (2.6.32-358)               (el6)
            Update 5 (2.6.32-431)               (el6)
            Update 6 (2.6.32-504)               (el6)
            Update 7 (2.6.32-573)               (el6)

x86_64

      RHEL6

            Update 4 (2.6.32-358)               (el6)
            Update 5 (2.6.32-431)               (el6)
            Update 6 (2.6.32-504)               (el6)
            Update 7 (2.6.32-573)               (el6)

      RHEL7
            Gold (3.10.0-123)                   (el7)
            Update 1 (3.10.0-229)               (el7)
PPC

      RHEL6

            Update 4 (2.6.32-358)               (el6)
            Update 5 (2.6.32-431)               (el6)
            Update 6 (2.6.32-504)               (el6)
            Update 7 (2.6.32-573)               (el6)

      RHEL7
            Gold (3.10.0-123)                   (el7)
            Update 1 (3.10.0-229)               (el7)


#############################################################################
Oracle Enterprise Linux:
#############################################################################

i686
      OEL6
            Update 5UEK (2.6.39-400.211.1)      (el6uek)
            Update 6UEK (2.6.39-400.215.10)     (el6uek)


x86_64
      OEL6
            Update 5UEK (3.8.13-16.2.1)         (el6uek)
            Update 5UEKR3_U1 (3.8.13-26)        (el6uek)
            Update 5UEKR3_U2 (3.8.13-35)        (el6uek)
            Update 5UEKR3_U3 (3.8.13-44)        (el6uek)
            Update 6UEK (3.8.13-44.1.1)         (el6)
            Update 6UEKR3_U4 (3.8.13-55)        (el6uek)
            Update 6UEKR3_U5 (3.8.13-68)        (el6uek)

      OEL7
            Gold UEK (3.8.13-35.2.1)            (el7uek)
            UEK_U3 (3.8.13-44)                  (el7uek)
            UEKR3_U4 (3.8.13-55)                (el7uek)
            Update 1UEK (3.8.13-55.1.6)         (el7uek)
            Update 1UEKR3_U5 (3.8.13-68)        (el7uek)
Note:
With respect to UEK kernels don’t confuse with driver rpm names. For example
driver rpm name for UEKR3_U4 on oel6 OS is kmod-mpt3sas-
DriverVersrion_oel6.6_UEKR3_U4-ReleseVersion.x86_64.rpm and one can assume
that UEKR3_U4 kernel rpms needs to be installed only on OEL6.6 base OS, but
that is not true, one can install these UEK3_U4 kernel rpms on any other OEL6
OS (e.g. OEL6.5 OS) and after booting into this UEKR3_U4 kernel, one can
install the above driver rpm on this kernel.
#############################################################################
OVM3.0
#############################################################################
(NOTE: This is only x86_64 support from OS vendor)
      OVM3.0
            OVM3.0.2 (2.6.32.21-41xen)
            OVM3.0.3 (2.6.32.21-45xen)

      OVM3.2
            OVM3.2.1 (2.6.39-300.22.2.el5uek)

      OVM3.3
            OVM3.3.1 (3.8.13-26.4.2.el6uek.x86_64)


#############################################################################
Citrix:
#############################################################################
i686
        Citrix5
            Update 5 (2.6.18-128.1.6.el5.xs5.5.0.505.1024)  (kdump, xen)
            Update 6 (2.6.27.42-0.1.1.xs5.6.0.44.111158)    (kdump, xen)

        Citrix6
            Gold (2.6.32.12-0.7.1.xs6.0.0.529.170661)       (kdump, xen)
            Update 1 (2.6.32.43-0.4.1.xs1.6.10.734.170748)  (kdump, xen)
            Update 2 (2.6.32.43-0.4.1.xs1.8.0.835.170778)   (kdump, xen)
X86_64
      Citrix6
            Update 5 (3.10.0+2)
#############################################################################
Ubuntu:
#############################################################################
i686

      Ubuntu13.04-Server (3.8.0-19-generic)
      Ubuntu13.04-Desktop (3.8.0-35-generic)
      Ubuntu14.04LTS    (3.13.0-24-generic)
      Ubuntu14.10LTS    (3.16.0-23-generic)
      Ubuntu15.04       (3.19.0-15-generic)
x86_64
```

```
      Ubuntu13.04-Server (3.8.0-19-generic)
      Ubuntu13.04-Desktop (3.8.0-35-generic)
      Ubuntu14.04LTS    (3.13.0-24-generic)
      Ubuntu14.10LTS    (3.16.0-23-generic)
      Ubuntu15.04       (3.19.0-15-generic)

##############################################################################
Debian:
##############################################################################
i686
      Debian6.0.5       (2.6.32-5-686)
      Debian7.0         (3.2.0-4-486, 3.2.0-4-686-pae)
      Debian8.0         (3.16.0-4-586, 3.16.0-4-686-pae)
x86_64
      Debian6.0.5       (2.6.32-5-686)
      Debian7.0         (3.2.0-4-amd64)
      Debian8.0         (3.16.0-4-amd64)



##############################################################################
Fedora:
##############################################################################
i686
      Fedora19 (3.9.5-301)    (fc19, fc19.pae)
      Fedora20 (3.11.10-301)  (fc20, fc20+pae)
      Fedora22 (4.0.4-301)    (fc22, fc22+pae)

x86_64
      Fedora19 (3.9.5-301)    (fc19)
      Fedora20 (3.11.10-301)  (fc20)
      Fedora22 (4.0.4-301)    (fc22)
```

2 Fusion-MPT Linux Drivers

The mpt3sas drivers are provided in binary and source form to provide the greatest flexibility to LSI customers. The binaries are suitably formatted for use as installation diskettes or post-install binary upgrades. The source may be added to an existing kernel for custom kernel builds.

2.1 Installing to a Fusion-MPT Controller

LSI provides images that are suitably formatted to use as driver update disks for those installations where there is no bundled driver or when it's necessary to complete the install with the latest driver :

_ Citrix : Citrix5, Citrix6 (i386)

_ OEL : OEL5, OEL6 (i686, x86_64)

_ Red Hat : RHEL5/ RHEL6 (i686, x86_64, ppc)

_ SuSE : SLES10, SLES11 (i586, x86_64, ppc)

_ Centos : Centos6(i686, x86_64)

Here are some examples creating a driver update disk. In this example the driver version is (6.00.00.00-1). Here is the procedure:

Extract the packaging from Linux system:

```
# tar -zxvf mpt3sas-release.tar.gz
```

i) For Citrix5 Update5, architecture = i386

```
# cd citrix5/disks-1
# dd if= mpt3sas-6.00.00.00-2.6.18-128.1.6.el5.xs5.5.0.505.1024-CitrixXen5.5.iso
of=/dev/fd0
```

ii) For Citrix5 Update6, architecture = i386

```
# cd citrix5/disks-1
# dd if= mpt3sas-6.00.00.00-2.6.27.42-0.1.1.xs5.6.0.44.111158.iso of=/dev/fd0
```

iii) For Citrix6.0 , architecture = x86_64

```
# cd citrix6/disks-1
# dd if= mpt3sas-6.00.00.00_CitrixXen6.0-1.iso of=/dev/fd0
```

iv) For OEL5 Update 7, architecture = x86_64

```
# cd oel5/disks-1
# gunzip mpt3sas-6.00.00.00-1-oel5.7.x86_64.iso.gz
# dd if= mpt3sas-6.00.00.00-1-oel5.7.x86_64.iso of=/dev/fd0
```

v) For OEL6 Update2, architecture = x86_64

```
# cd oel6/disks-1
# gunzip mpt3sas-6.00.00.00_oel6.2-1.x86_64.iso.gz

# dd if= mpt3sas-6.00.00.00_oel6.2-1.x86_64.iso of=/dev/fd0
```

vi) For RHEL5 Update 3, architecture = x86_64

```
# cd rhel5/disks-1

# gunzip mpt3sas-6.00.00.00-1-rhel5.3.x86_64.iso.gz

# dd if=mpt3sas-6.00.00.00-1-rhel5.3.x86_64.iso of=/dev/fd0
```

vii) For RHEL6 Update2, architecture = x86_64

```
# cd rhel6/disks-1

# gunzip mpt3sas-6.00.00.00_rhel6.2-1.x86_64.iso.gz

# dd if=mpt3sas-6.00.00.00-1-rhel6.2-1.x86_64.iso of=/dev/fd0
```

viii) For SLES10 Service Pack 4, architecture = x86_64

```
# cd sles10/disks-1

# gunzip mpt3sas-6.00.00.00-1-sles10sp4.x86_64.iso.gz

# dd if=mpt3sas-6.00.00.00-1-sles10sp4.x86_64.iso of=/dev/fd0
```

ix) For SLES11, architecture = x86_64

```
# cd sles11/disks-1

# gunzip mpt3sas-6.00.00.00-1-sles11sp2.x86_64.iso.gz

# dd if=mpt3sas-6.00.00.00-1-sles11sp2.x86_64.iso of=/dev/fd0
```

x) For Centos6 Update3, architecture = x86_64

```
# cd centos6/disks-1

# gunzip mpt3sas-6.00.00.00_centos6.3-01.x86_64.iso.gz

# dd if= mpt3sas-6.00.00.00_centos6.3-01.x86_64.iso of=/dev/fd0
```

The driver disk image can be transferred to floppy disk / USB disk with the rawrite tool from dos, or the ddutility in Linux. Here is the URL for rawrite:

http://www.tux.org/pub/dos/rawrite.

2.2 Adding Pre-Compiled Binaries to an Existing Installation

RPMs should be used to upgrade the driver post-install. The RPMs contain binaries for the install kernel and the released updates from Red Hat or OEL or OVM or Citrix or service packs from SuSE at the time the RPM was created. The packaging provides three forms of RPMs; they are called SuSE KMP, DKMS(Dynamic Kernel Module Support), and Generic. Source RPMs are provided for the SuSE KMP and Generic RPMs. This allows one to generate binary RPM themselves for errata kernels that are released in between the normal release cycle. See the release notes file for a listing of the kernels supported by the RPM. The driver update disks should be used for architectures not supported by RPM.

The rpms are supported for

_ Citrix : Citrix5, Citrix6 (i386)

_ OEL : OEL5, OEL6 (i686, x86_64)

_ OVM : OVM3 .0, OVM3.2 (x86_64)

_ Red Hat : RHEL5/ RHEL6 (i686, x86_64, ppc)

_ SuSE : SLES10, SLES11 (i586, x86_64, ppc)

_ Ubuntu : Ubuntu11.10, Ubuntu12.04, Ubuntu13.04 (i386, amd64)

_ Centos : Centos(i686, x86_64)

_ Debian : Debian6, Debian7(i386, amd64)

_ Fedora : Fedora 17-20(i686, x86_64)

Generic RPMs

Here is an example installing the generic RPMs: In this example the driver version is (6.00.00.00-1).

Here is the procedure:

Extract the packaging from Linux system:

```
# tar -zxvf mpt3sas-release.tar.gz
```

i) For Citrix 5 (Update 5), architecture = i386

```
# cd citrix5/rpms-1
# rpm -ivh mpt3sas-modules-kdump-2.6.18-128.1.6.el5.xs5.5.0.505.1024-6.00.00.00-1.i386.rpm
```

ii) For Citrix 5 (Update 6), architecture = i386

```
# cd citrix5/rpms-1
# rpm -ivh mpt3sas-modules-kdump-2.6.27.42-0.1.1.xs5.6.0.44.111158-6.00.00.00-1.i386.rpm
```

iii) For Citrix 6, architecture = i386

```
# cd citrix6/rpms-1
# rpm -ivh mpt3sas-modules-kdump-6.00.00.00_CitrixXen6.0-1.i386.rpm
```

iv) For OEL5 (Update 7), architecture = x86_64

```
# cd oel5/rpms-1
# rpm -ivh kmod-mpt3sas-6.00.00.00-1-oel5.7.x86_64.rpm
```

v) For OEL5 (Update 7) UEK, architecture = x86_64

```
# cd oel5/rpms-1
# rpm -ivh kmod-mpt3sas-6.00.00.00-1-oel5.7_UEK.x86_64.rpm
```

vi) For OEL6 (Update 2), architecture = x86_64

```
# cd oel6/rpms-1
# rpm -ivh kmod-mpt3sas-6.00.00.00_oel6.2-1.x86_64.rpm
```

vii) For OEL6 (Update 2), UEK architecture = x86_64

```
# cd oel6/rpms-1
```

```
# rpm -ivh kmod-mpt3sas-6.00.00.00_oel6.2_UEK-1.x86_64.rpm
```

viii) For RHEL5 (Update 8), architecture = x86_64

```
# cd rhel5/rpms-1
```

```
# rpm -ivh kmod-mpt3sas-6.00.00.00-1-rhel5.8.x86_64.rpm
```

ix) For RHEL6 (Update 2), architecture = x86_64

```
# cd rhel5/rpms-1
```

```
# rpm -ivh kmod-mpt3sas-6.00.00.00_rhel6.2-1.x86_64.rpm
```

x) For SLES10 (Service Pack 4) architecture = x86_64 flavor = default

```
# cd sles10/rpms-1
```

```
# rpm -ivh lsi-mpt3sas-kmp-default-6.00.00.00_sles10sp4-1.x86_64.rpm
```

xi) For SLES11 (Service Pack 2), architecture = x86_64 flavor = default

```
# cd sles11/rpms-1
```

```
# rpm -ivh lsi-mpt3sas-kmp-default-6.00.00.00_sles11sp2-1.x86_64.rpm
```

xii) For Ubuntu11 (Update 11.10), architecture = amd64

```
# cd ubuntu/rpms-1
```

```
# dpkg -i mpt3sas-6.00.00.00-1_Ubuntu11.10.amd64.deb
```

xiii) For Ubuntu12 (Update 12.04), architecture = amd64

```
# cd ubuntu/rpms-1
# dpkg -i mpt3sas-6.00.00.00-1_Ubuntu12.04.amd64.deb
```

xiv) For OVM , architecture = x86_64

```
#cd ovm3/rpms-1
#rpm –ivh kmod-mpt3sas-xen-6.00.00.00-1-ovm3.0.1.x86_64.rpm
```

xv) For Centos6 (Update 3), architecture = x86_64

```
# cd centos6\rpms-01
# rpm –ivh kmod-mpt3sas-6.00.00.00_centos6.3-01.x86_64.rpm
```

xvi) For Debian (Update 6.0.5), architecture = amd64

```
# cd debian\rpms-01
# dpkg –i mpt3sas-6.00.00.00-01_Debian6.0.5.amd64.deb
```

xviii) For Fedora (Update 17), architecture = x86_64

```
# cd fedora17\rpms-01
# rpm –ivh kmod-mpt3sas-6.00.00.00-01-fc17.x86_64.rpm
```

you will need to reboot for the driver to be loaded with newer version

```
# reboot
```

DKMS RPM

Here is an example installing the DKMS RPMs: In this example the driver version is (6.00.00.00-1). Here is the procedure:

Extract the packaging from Linux system:

```
# tar -zxvf mpt3sas-release.tar.gz
```

```
# cd dkms-1
```

```
# tar -zxvf mpt3sas-6.00.00.00-1.dkms.tar.gz
```

install DKMS framework

```
# rpm -ivh dkms-2.0.2.21.1-1.noarch.rpm
```

install DKMS rpm

```
# rpm -ivh mpt3sas-6.00.00.00-1dkms.noarch.rpm
```

you will need to reboot for the driver to be loaded with newer version

```
# reboot
```

NOTE: The DKMS packaging is providing only for RHEL5(x86 and x86_64), and SLES10(x86_64), and SLES11(x86_64) pre-compiled binaries.

Uninstalling RPM

Here is an example of un-installing the RPM:

```
# rpm -qa | grep mpt3sas
```

look for the string having mpt3sas, and copy

```
# rpm -e mpt3sas-6.00.00.00-1-rhel5
```

```
# reboot
```

Source RPM

Here is an example building the Generic Binary RPM from the source RPM. In this example the driver version is (6.00.00.00-1).

Here is the procedure:

Extract the packaging from Linux system:

```
# tar -zxvf mpt3sas-release.tar.gz
```

i) For OEL5, any update

```
# cd oel5/rpm-1
```

```
# rpm -ivh mpt3sas-kmod-6.00.00.00-1.src.rpm
```

build the binary

```
# cd /usr/src/redhat/SPECS
```

```
# rpmbuild -bb mpt3sas.spec
```

ii) For OEL6, Update 2

```
# cd oel6/rpm-1
```

```
# rpm -ivh mpt3sas-6.00.00.00_oel6.2-1.src.rpm
```

build the binary

```
#cd /root/rpmbuild /SPECS/
```

```
# rpmbuild -bb mpt3sas.spec
```

iii) For OEL6, Update 2, UEK

```
# cd oel6/rpm-1
```

```
# rpm -ivh mpt3sas-6.00.00.00_oel6.2_UEK-1.src.rpm
```

build the binary

```
#cd /root/rpmbuild /SPECS/
```

```
# rpmbuild -bb mpt3sas.spec
```

iv) For OVM 3, any update 2

```
# cd ovm3/rpm-1
```

```
# rpm -ivh mpt3sas-kmod-6.00.00.00-1.src.rpm
```

build the binary

```
#cd /usr/src/redhat/SPECS
```

```
# rpmbuild -bb mpt3sas.spec
```

v) For RHEL5, any update

```
# cd rhel5/rpm-1
# rpm -ivh mpt3sas-kmod-6.00.00.00-1.src.rpm
```

build the binary

```
# cd /usr/src/redhat/SPECS
# rpmbuild -bb mpt3sas.spec
```

vi) For RHEL6, Update2

```
# cd rhel6/rpm-1
# rpm -ivh mpt3sas-6.00.00.00_rhel6.2-1.src.rpm
```

build the binary

```
# cd /root/rpmbuild /SPECS/
# rpmbuild -bb mpt3sas.spec
```

vii) for SLES10 any update

```
cd sles10/rpm-1
rpm –ivh lsi-mpt3sas-6.00.00.00-1.src.rpm
# cd /usr/src/packages/SPECS
```

build the binary

```
# rpmbuild -bb mpt3sas.spec
```

viii) For SLES11

```
cd sles11/rpm-1
```

```
rpm –ivh lsi-mpt3sas-6.00.00.00-1.src.rpm
# cd /usr/src/packages/SPECS
```

build the binary

```
# rpmbuild -bb mpt3sas.spec
```

binary rpm located in this folder:

```
# cd ../RPMS/`uname -m`
```

ix) For Ubuntu

for example : ubuntu12.04

```
cd ubuntu/rpms-1
rpm –ivh mpt3sas-6.00.00.00-1_Ubuntu12.04.src.rpm
#cd  /root/rpmbuild/SPECS
```

Build the binary

```
#rpmbuild –bb mpt3sas.spec
```

LSI recommends that you save the original source:

```
# tar zcvf mpt3sas.orig.tar.gz /usr/src/linux/drivers/scsi/mpt3sas
```

Continue with the instructions in "Adding or Updating the Fusion-MPT Source to the Linux Kernel”

2.3 Adding or Updating the Fusion-MPT Source to the Linux Kernel

In the generic RPMs, the driver source will be placed in your installations RPM SOURCES directory; for SuSE (/usr/src/packages/SOURCES), and for RHEL5 / OEL5 / OVM3 (/usr/src/redhat/SOURCES), for RHEL 6 (/root/rpmbuild /SOURCES) . It’s also in the top folder of the packaging. In this example the driver version is (6.00.00.00-1). Here is the procedure:

Extract the packaging from Linux system:

```
# tar -zxvf mpt3sas-release.tar.gz
# tar -zxvf mpt3sas-6.00.00.00-src.tar.gz
```

copy driver source code to kernel tree

```
# mkdir -p /usr/src/linux/drivers/scsi/mpt3sas

# cp -fRv drivers/scsi/mpt3sas/* /usr/src/linux/drivers/scsi/mpt3sas
```

2.3.1 Driver Build Instructions

The following examples show how to configure and build the LSI Fusion-MPT driver(s) as kernel modules. In this example the driver version is (6.00.00.00-1). Here is the procedure to build the drivers out of kernel tree:

Extract the packaging from Linux system:

```
# tar -zxvf mpt3sas-release.tar.gz
# tar -zxvf mpt3sas-6.00.00.00-src.tar.gz
# cd mpt3sas
# ./compile.sh
# ./load.sh
```

Alternatively, here is the procedure to build driver in kernel tree

1. From the /usr/src/linux directory, ensure a clean kernel source tree by executing the following command:

```
# make mrproper
```

2. From the /usr/src/linux directory, run the normal kernel configuration routine:

```
# make oldconfig
# make config
# make menuconfig
# make xconfig
```

3. Here are the directions for finding the entry in menuconfig ncurses display

```
Device Drivers --->
SCSI device support --->
SCSI low-level drivers --->
<M> LSI MPT Fusion SAS 3.0 Device Driver
(128) LSI MPT Fusion Max number of SG Entries (16 - 128) (NEW)
[*] LSI MPT Fusion logging facility
```

On the sub menu, select the "LSI MPT Fusion SAS 3.0 Device Driver" line, and then enter "m" to configure for building this support as a module. (Alternatively, you can enter "y" to have this support built into the kernel.)

NOTES:

- CONFIG_SCSI_MPT3SAS_MAX_SGE: This option allows you to specify the maximum number of scatter-gather entries per I/O. The driver default is 128, which matches MAX_HW_SEGMENTS. However , it may decreased down to 16. Decreasing this parameter will reduce memory requirements on a per controller instance.
- CONFIG_SCSI_MPT3SAS_LOGGING: This turns on a logging facility.

4. Save the kernel configuration changes. Follow any post configuration instructions, and do everything needed on your platform to rebuild the kernel. This typically includes:

```
# make dep
```

and:

```
# make bzImage # varies on non-Intel platforms
```

5. Rebuild the kernel modules:

```
# make modules
```

6. Optionally, (and potentially dangerous!), do everything needed on your platform to install a newly built kernel. (possibly temporarily, for sanity testing)

Be careful with this step, and be sure you know what you're doing!

It is easy to wipe out a good/stable kernel from this point forward

in the procedure!

7. (Re)Install newly compiled kernel modules:

```
# make modules_install
```

The output from the last step should look something like this:

```
Installing modules under /lib/modules/2.6.30/block

Installing modules under /lib/modules/2.6.30/net

Installing modules under /lib/modules/2.6.30/ipv4

Installing modules under /lib/modules/2.6.30/scsi

Installing modules under /lib/modules/2.6.30/fs

Installing modules under /lib/modules/2.6.30/fs

Installing modules under /lib/modules/2.6.30/cdrom

Installing modules under /lib/modules/2.6.30/video

Installing modules under /lib/modules/2.6.30/net

Installing modules under /lib/modules/2.6.30/misc
```

8. Update your /boot sector with the new System .map and bzImage, re-create your ramdisk image (refer to your vendor literature), and update your boot manager--i.e., lilo.conf, grub.conf. If you are using lilo, you must run lilo -v prior to reboot.

9. Shut down the system :

Example:

```
# shutdown -r now
```

and then reboot with the newly built Linux kernel.

2.4 Loading the Drivers As Modules

Follow the following step to load the driver binary:

Example: load the Fusion-MPT mpt3sas driver.

```
# insmod mpt3sas.ko

mpt3sas version 6.00.00.00 loaded

scsi4 : Fusion MPT SAS Host

ACPI: PCI Interrupt 0000:0b:00.0[A] -> GSI 16 (level, low) -> IRQ 177

PCI: Setting latency timer of device 0000:0b:00.0 to 64

mpt3sas0: 64 BIT PCI B US DMA ADDRESSING SUPPORTED, total mem (6092056 kB)

mpt3sas0: PCI-MSI-X enabled: IRQ 122

mpt3sas0: iomem(0xfc47c000), mapped(0xffffc20000058000), size(16384)

mpt3sas0: ioport(0xdc00), size(256)

mpt3sas0: Allocated physical memory: size(1028 kB)

mpt3sas0: Current Controller Queue Depth(435), Max Controller Queue Depth(942)

mpt3sas0: Scatter Gather Elements per IO(128)

mpt3sas0: LSISAS 3108: FWVersion(04.250.00.00), ChipRevision(0x03),

BiosVersion(00.00.00.00)

mpt3sas0: Protocol=(Initiator,Target), Capabilities=(TLR,EEDP,Snapshot Buffer, Diag Trace

Buffer, Task Set Full,NCQ)

mpt3sas0: sending port enable !!

mpt3sas0: port enable: SUCCESS

mpt3sas0: host_add: handle(0x0001), sas_addr(0x500605b0006b9310), phys(8)
```

3 Boot Setup Commands

3.1. Syntax

Setup commands can be passed to the SCSI host driver mpt3sas as a string variable using 'insmod'. The command line options can be found by typing the modinfo command.

Example:

```
# modinfo mpt3sas.ko

filename:      mpt3sas.ko

version:       6.00.00.00

license:       GPL

description:    LSI MPT Fusion SAS 3.0 Device Driver

author:        LSI Corporation <DL-MPTFusionLinux@lsi.com>

srcversion:     66655F27F1D0534E6DCBB9C

alias:         pci:v00001000d00000095sv*sd*bc*sc*i*

alias:         pci:v00001000d00000094sv*sd*bc*sc*i*

alias:         pci:v00001000d00000091sv*sd*bc*sc*i*

alias:         pci:v00001000d00000090sv*sd*bc*sc*i*

alias:         pci:v00001000d00000097sv*sd*bc*sc*i*

alias:         pci:v00001000d00000096sv*sd*bc*sc*i*

depends:       scsi_mod,scsi_transport_sas,raid_class,configfs

supported:      yes

vermagic:      3.0.76-0.11-xen SMP mod_unload modversions Xen

parm:          logging_level: bits for enabling additional logging info (default=0)

parm:          sdev_queue_depth: globally setting SAS device queue depth

parm:          max_sectors:max sectors, range 64 to 32767  default=32767 (ushort)

parm:          command_retry_count: Device discovery TUR command retry count: (default=144) (int)

parm:          missing_delay: device missing delay , io missing delay (array of int)
```

```
parm:           unblock_io: unblocks I/O if set to 1 when device is undergoing addition (default=0) (int)
parm:           host_lock_mode:Enable SCSI host lock if set to 1(default=0) (int)
parm:           max_lun: max lun, default=16895  (int)
parm:           mpt3sas_multipath: enabling mulipath support for target resets (default=0) (int)
parm:           disable_eedp: disable EEDP support: (default=0) (uint)
parm:           sriov_enabled: sriov support enabled: (default=0) (uint)
parm:           max_vfs: max virtual functions allocated per physical function (default=16) (uint)
parm:           diag_buffer_enable: post diag buffers (TRACE=1/SNAPSHOT=2/EXTENDED=4/default=0) (int)
parm:           disable_discovery: disable discovery  (int)
parm:           prot_mask: host protection capabilities mask, def=0x07  (int)
parm:           protection_guard_mask: host protection algorithm mask, def=3  (int)
parm:           issue_scsi_cmd_to_bringup_drive: allow host driver to issue SCSI commands to bring the drive to READY state, default=1  (int)
parm:           max_queue_depth: max controller queue depth  (int)
parm:           max_sgl_entries: max sg entries  (int)
parm:           msix_disable: disable msix routed interrupts (default=0) (int)
parm:           max_msix_vectors: max msix vectors (int)
parm:           mpt3sas_fwfault_debug: enable detection of firmware fault and halt firmware - (default=0)
```

3.2. Available Arguments

1. The following command enables additional info sent to the Linux system log which can be used for troubleshooting problems. The default is to pass the logging level in hex format. Each bit is bitwise setting. Please refer to in mpt3sas_debug.h where the logging levels are defined.

Example: this enables firmware events and reply with additional info

```
#insmod mpt3sas.ko logging_level=0x218
```

Example: this enables handshake and initialization logging

```
#insmod mpt3sas.ko logging_level=0x420
```

Example: this enables application using IOCTLS logging

```
#insmod mpt3sas.ko logging_level=0x8000
```

Example: this enables manufacture configuration logging

```
#insmod mpt3sas.ko logging_level=0x800
```

Example: this enables host reset and task management logging

```
#insmod mpt3sas.ko logging_level=0x2100
```

Example: this enables task set full logging

```
#insmod mpt3sas.ko logging_level=0x80000
```

NOTE: Many of the driver debug prints are using KERN_DEBUG and KERN_INFO logging level. Red Hat and SuSE tend to set the default logging level set to a higher level, perhaps KERN_WARNING. When set to KERN_WARNING you will be missing most the debug info. To turn on the additional logs, you will need to see the set klogd to KERN_DEBUG. In both SuSE and Red Hat offer configuration of klogd from the file /etc/sysconfig/syslog. Please refer to the klogd manual page for more info.

2. The following command allows configuration of the command_retry_count. This tunable is for configuring the retry count for discovering devices. This is to handle some devices which report BUSY status for long duration of time.

Example: this sets the retry count to 300

```
#insmod mpt3sas.ko command_retry_count=300
```

3. The following command allows configuration max number of luns. The default is 511 luns. Please note that the scsi-mid layer global parameter is max_report_luns default is 511. You will need to modify max_report_luns parameter if you plan to use more than 511 luns in mpt3sas.

Example: this sets the max lun to 100

```
#insmod mpt3sas.ko max_lun=100
```

4. The following command allows configuration the controller queue depth. The default is 600. The maximum upper limit is set by controller firmware in facts->RequestCredit.

Example: this sets the max queue depth to 3000

```
#insmod mpt3sas.ko max_queue_depth=3000
```

5. The following command allows configuration the controller maximum scatter gather entries. This is maximum number of scatter-gather entries per I/O. The driver default is 128, which matches MAX_HW_SEGMENTS. However , it may be decreased down to 16. Decreasing this parameter will reduce memory requirements on a per controller instance.

Example: this sets the scatter gather limit to 32

```
#insmod mpt3sas.ko max_sgl_entries=32
```

6. The following command allows disabling the EEDP support in the driver.

Example: this will disable the EEDP support

```
#insmod mpt3sas.ko disable_eedp=1
```

4.Troubleshooting

1. Sense translation is built into the Linux kernel; providing SCSI-3 opcode string lookup and a LARGE sorted table of 463 unique SCSI-3 Additional Sense Code & Qualifier (ASC/ASCQ) strings, translated directly from a text file from the SCSI T10.org's ftp site:

ftp://ftp.t10.org/t10/drafts/spc2/asc-num.txt

Example enabling sense decoding

```
#sysctl -w dev.scsi.logging_level=0x1000
```

2. Additional debug logging for device discovery can be enabled in the Linux kernel:

Example:

```
#sysctl -w dev.scsi.logging_level=0x1C0
```

3. Several SCSI debug application tools are available; for example lsscsi, sdparm, SMP tools for expanders, and a variety of sg tools. These can be obtained from this URL:

http://sg.danny.cz/sg

Typically these tools are provided by default in SuSE distributions.

For example, to obtain all the SAS address for your attached devices:

```
# lsscsi -t
[4:0:1:0] disk sas:0x5000c50000be5cf2 /dev/sdi
[4:0:2:0] disk sas:0x5000c50001263246 /dev/sdj
[4:0:3:0] disk sas:0x5000c500012632c2 /dev/sdk
[4:0:4:0] disk sas:0x5000c50005b04c8a /dev/sdl
[4:0:5:0] disk sas:0x5000c50005b06f0e /dev/sdm
[4:0:6:0] disk sas:0x5000c50005b04f3a /dev/sdn
[4:0:7:0] disk sas:0x5000c50005b04d4e /dev/sdo
[4:0:8:0] enclosu sas:0x500605b0ffff003d -
[4:0:9:0] disk sas:0x50010b900000337d /dev/sdp
[4:0:10:0] disk sas:0x50010b9000002579 /dev/sdq
[4:0:11:0] disk sas:0x50010b900004537f /dev/sdr
[4:0:12:0] disk sas:0x50010b9000029d72 /dev/sds
[4:0:13:0] disk sas:0x50010b900000272a /dev/sdt
[4:0:14:0] disk sas:0x50010b910003389e /dev/sdu
[4:0:15:0] disk sas:0x50010b91000338a6 /dev/sdv
[4:0:16:0] disk sas:0x50010b91000338ae /dev/sdw
```

4. Additional scripts in the sub folder scripts are provided with the driver source code, they can be useful in obtaining detailed info pertaining to your configuration.

Extract the packaging from Linux system:

```
# tar -zxvf mpt3sas-release.tar.gz
# tar -zxvf mpt3sas-6.00.00.00-src.tar.gz
# cd mpt3sas/scripts
```

The hba_properties provide configuration info pertaining the host controller; the controller firmware, bios, and driver versions.

Example:

```
# ./hba_properties
host4: ioc0: fw=04.250.00.00 bios=00.00.00.00 driver=6.00.00.00 mpi=200.0b
LSISAS3108: board_name=Eval Board assembly= tracer=
nvdata_persistent=00h nvdata_default=00h
io_delay=08 device_delay= 144
logging_level=00000000h
fw_queue_depth=942
sas_address=0x500605b0006b9310
```

Additional controller configuration info:

```
# ./shost_attributes
host4
board_assembly:
board_name:Eval Board
board_tracer:
cmd_per_lun:7
device_delay:144
fw_queue_depth:942
host_busy:0
host_sas_address:0x500605b0006b9310
```

```
io_delay:08
logging_level:00000000h
proc_name:mpt3sas
scan:cat: scan: Permission denied
sg_tablesize:128
state:running
uevent:cat: uevent: Permission denied
unchecked_isa_dm a:0
unique_id:0
version_bios:00.00.00.00
version_fw:04.250.00.00
version_mpi:200.0b
version_nvdata_default:00h
version_nvdata_persistent:00h
version_product:LS ISAS3108
```

Expander configuration info

```
# ./expander_attribute
expander-4:0
component_id:547
component_revision_id:2
component_vendor_id:LSI
level:1
product_id:Bobcat
product_rev:B0
uevent:cat: uevent: Permission denied
```

```
vendor_id:LSI CORP
expander-4:1
component_id:547
component_revision_id:4
component_vendor_id:LSI
level:1
product_id:Bobcat
product_rev:0200
uevent:cat: uevent: Permission denied
vendor_id:LSI CORP
expander-4:2
component_id:531
component_revision_id:0
component_vendor_id:LSI
level:1
product_id:DE5300-SAS
product_rev:0216
uevent:cat: uevent: Permission denied
vendor_id:LSI
```

Device configuration info

```
# ./sdev_attributes
4:0:20:0
delete: device_blocked:0
iocounterbits:32
iodone_cnt:0x26
```

```
ioerr_cnt:0x0
iorequest_cnt:0x26
model:ST973402SS
queue_depth:254
queue_type:simple
rescan: retries:5
rev:MS00
sas_address:0x5000c5000f21798e
sas_device_handle:0x0020
scsi_level:6
state:running
timeout:60
type:0
uevent: vendor:SEAGATE
4:0:22:0
delete: device_blocked:0
iocounterbits:32
iodone_cnt:0x26
ioerr_cnt:0x0
iorequest_cnt:0x26
model:ST973402SS
queue_depth:254
queue_type:simple
rescan: retries:5
rev:MS00
```

```
sas_address:0x5000c5000f21783e

sas_device_handle:0x0022

scsi_level:6

state:running

timeout:60

type:0

uevent: vendor:SEAGATE
```

5. Known Limitations

5.1 On System with large number of CPU core and LSI's SAS3 controllers, on repeated load and unload of mpt3sas driver module, if kernel fails to allocate the memory requested for higher queue depth, we can observe that the loading of mpt3sas module fails. Below messages will be logged to /var/log/messages,

```
mpt3sas0: chain_lookup: __get_free_pages failed

mpt3sas0: Reduce the module parameter max_queue_depth to a value lower than (“CURRENT_VALUE_OF_QUEUE_DEPTH”) and retry.
```

The work-around for this issue is to load mpt3sas driver with module parameter max_queue_depth set to value less than CURRENT_VALUE_OF_QUEUE_DEPTH.

The max_queue_depth module parameter could be set as follows

a. While loading the driver

modprobe mpt3sas max_queue_depth=NEW_VALUE_OF_QUEUE_DEPTH (if driver

rpm is already installed)

(Or)

```
insmod mpt3sas.ko max_queue_depth=NEW_VALUE_OF_QUEUE_DEPTH
```

(if you have a mpt3sas.ko file)

b. If driver is in ramdisk, then in RHEL5/SLES/OEL5 OS, following line has to be added in /etc/modprobe.conf and reboot the system

```
options mpt3sas max_queue_depth=NEW_VALUE_OF_QUEUE_DEPTH
```

(Or)

Add below word at the end of kernel module parameters line in /boot/grub/menu.lst or /boot/grub/grub.conf file and reboot the system

```
mpt3sas.max_queue_depth=NEW_VALUE_OF_QUEUE_DEPTH
```

5.2 When Target Reset is issued using below command to DIF type2 drive present in the topology then kernel panic is observed on few kernels.

```
echo 4 > sys/class/scsi_host/host(number)/task_management
```

The users can apply below patch if applicable otherwise can check with the kernel vendors for the appropriate patch

http://marc.info/?l=linux-scsi&m=135186352200668&q=raw

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