Intel® Matrix Storage Technology

OEM Technical Guide

For the Intel® Matrix Storage Manager 8.0 Software

Revision 2.4

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Revision history

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1.0	Initial Release Version	April 2005
1.1	Updated for 5.1 release	June 2005
1.2	Updated for 5.6 Release	August 2005
1.3	Updated for 5.7 Release	November 2005
1.4	Updated for 6.0 Release	December 2005
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2.2	Updated for 8.0 Beta Release	December 2007
2.3	Updated for 8.0 Beta Release	February 2008
2.4	Updated for 8.0 PV Release	April 2008

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1 About This Document

1.1 Purpose and scope of this Document

This document will assist customers in evaluating, testing, configuring, and enabling RAID and AHCI functionality on platforms using the *Intel® Matrix Storage Manager 8.0* software for the chipset components as listed in the product's Readme.txt file.

This document also describes installation procedures, RAID volume management such as creating, deleting, and modifying volumes, common usage models, and any special notes necessary to enable customers to develop their RAID-compatible products.

2 Intel® Matrix Storage Technology

Intel® Matrix Storage Technology provides added performance and reliability for systems equipped with serial ATA hard drives to enable optimal PC storage solution. It offers value add-features such as RAID and advanced Serial ATA* capabilities for the Microsoft Vista*, Microsoft Windows* XP and Microsoft Windows Server 2003 operating systems.

The RAID solution supports RAID level 0 (striping), RAID level 1 (mirroring), RAID level 5 (striping with parity) and RAID level 10 (striping and mirroring).

This helps alleviate hard drive bottlenecks by taking advantage of the dual independent Serial ATA controllers integrated in the Intel ICH9 component. System integrators can offer up to four hard drives with no additional loss of PCI resources (request/grant pair) or add-in card slots.

A configuration supporting two RAID levels can also be achieved by having two volumes in a single RAID array that use Intel Matrix RAID Technology. Targeted for desktops and workstations, this RAID solution addresses the demand for high-performance or data-redundant platforms.

2.1 Overview of RAID Levels

RAID 0 (striping)

RAID level 0 combines two or more hard drives so that all data is divided into manageable blocks called strips. The strips are distributed across the array members on which the RAID 0 volume resides. This improves read/write performance, especially for sequential access, by allowing adjacent data to be accessed from more than one hard drive simultaneously. However, data stored in a RAID 0 volume is not redundant. Therefore, if one hard drive fails, all data on the volume is lost.

The RAID 0 volume appears as a single physical hard drive with a capacity equal to twice the size of the smaller hard drive.

The Intel® ICH9 I/O Controller with Intel Matrix Storage Technology allows up to six drives to be combined into a single RAID 0 array, providing additional scaling of storage performance.

RAID 1 (mirroring)

RAID level 1 combines two hard drives so that all data is copied concurrently across the array members that the RAID 1 volume resides on. In other words, the data is mirrored across the hard drives of the RAID 1 volume. This creates real-time redundancy of all data on the first drive, also called a mirror. RAID 1 is usually used in workstations and servers where data protection is important.

The RAID 1 volume appears as a single physical hard drive with a capacity equal to that of the smaller hard drive.

RAID 5 (striping with parity)

RAID level 5 combines three or four hard drives so that all data is divided into manageable blocks called strips. RAID 5 also stores parity, a mathematical method for recreating lost data on a single drive, which increases fault tolerance. The data and parity are striped across the array members. The parity is striped in a rotating sequence across the members.

Because of the parity striping, it is possible to rebuild the data after replacing a failed hard drive with a new drive. However, the extra work of calculating the missing data will degrade the write performance to the volumes. RAID 5 performs better for smaller I/O functions than larger sequential files.

RAID 5, when enabled with volume write-back cache with Coalescer, will enhance write performance. This combines multiple write requests from the host into larger more efficient requests, resulting in full stripe writes from the cache to the RAID5 volume.

RAID 5 volume provides the capacity of (N-1) * smallest size of the hard drives, where N >= 3 and <=4.

For example, a 3-drive RAID 5 will provide capacity twice the size of the smallest drive. The remaining space will be used for parity information.

RAID 10 (striping and mirroring)

RAID level 10 uses four hard drives to create a combination of RAID levels 0 and 1. The data is striped across a two-disk array forming a RAID 0 component. Each of the drives in the RAID 0 array is mirrored to form a RAID 1 component. This provides the performance benefits of RAID 0 and the redundancy of RAID 1.

The RAID 10 volume appears as a single physical hard drive with a capacity equal to two drives of the four drive configuration (the minimum RAID 10 configuration). The space on the remaining two drives will be used for mirroring.

2.2 Typical usage model for RAID levels

RAID 0	This provides end-users the performance necessary for any disk-intensive applications; these include video production and editing, image editing, and gaming applications.
RAID 1	This provides end-users with data redundancy by mirroring data between the hard drives.
RAID 5	This provides end-users with good performance and data redundancy by striping data and parity across all the hard drives. The write performance is enhanced with volume write-back cache.
RAID 10	This provides end-users with the benefits of RAID 0 (performance) and RAID 1 (data mirroring).

RAID 0	This provides end-users the performance necessary for any disk-intensive applications; these include video production and editing, image editing, and gaming applications.
RAID 1	This provides end-users with data redundancy by mirroring data between the hard drives.
RAID 5	This provides end-users with good performance and data redundancy by striping data and parity across all the hard drives. The write performance is enhanced with volume write-back cache.
RAID 10	This provides end-users with the benefits of RAID 0 (performance) and RAID 1 (data mirroring).

3 Intel® Matrix Storage Technology

Intel Matrix Storage Technology contains three core components:

- Intel® Matrix Storage Manager 8.0 software
- Intel® Matrix Storage Manager option ROM
- Intel® RAID Configuration utility

3.1 Intel® Matrix Storage Manager 8.0

The Intel® Matrix Storage Manager 8.0 is the major software component of the Intel Matrix Storage Technology. It provides the Intel Matrix Storage Manager driver that supports RAID for Windows XP and provides the Intel® Matrix Storage Console (a 32-bit Windows application). The driver supports the Intel® 82801IR/IO Serial ATA RAID Controller and will recognize its unique device ID and sub-class code. Because of this, the driver must be installed before the Windows operating system is installed onto a RAID volume or a single SATA hard drive connected to the RAID controller. The driver, in conjunction with the Intel Matrix Storage Manager option ROM, will provide boot support for a two to four drive RAID array. The driver, with the Intel Matrix Storage Console, provides RAID volume management (create, delete, migrate) within the Windows operating system. It also displays SATA* device and RAID volume information.

3.2 Intel® Matrix Storage Manager Option ROM

The Intel Matrix Storage Manager option ROM is a standard Plug and Play option ROM that adds the Int13h services and provides a pre-OS user interface for the Intel Matrix Storage Technology solution. The Int13h services allow a RAID volume to be used as a boot hard drive. They also detect any faults in the RAID volume being managed by the RAID controller. The Int13h services are active until the RAID driver takes over after the operating system is loaded.

The Intel Matrix Storage Manager option ROM expects a BIOS Boot Specification (BBS) compliant BIOS. It exports multiple Plug and Play headers for each non-RAID hard drive or RAID volume, which allows the boot order to be selected from the BIOS's setup utility. When the system BIOS detects the RAID controller, the *RAID option ROM* code should be executed.

The Intel Matrix Storage Manager option ROM is delivered as a single uncompressed binary image compiled for the 16-bit real mode environment. To conserve system flash space, the integrator may compress the image for inclusion into the BIOS. The uncompressed option ROM image will be less than 64 KB in size. The run-time image that resides in BIOS compatibility space will be less than 20 KB in size and consumes

no more than 12 KB of system memory. System memory is taken from conventional DOS memory and is not returned.

3.3 Intel RAID Configuration Utility

The Intel RAID Configuration utility is an executable with capabilities similar to the Intel Matrix Storage Manager option ROM. It can operate in 16-bit MS-DOS* mode or in Windows operating system. It provides customers with the ability to create, delete, and manage RAID volumes on a system within a DOS environment. For ease of use, the utility has command line parameters that make it possible to perform these functions by using DOS scripts or shell commands.

The RAID Configuration utility has two main modes. The first one uses command line parameters. Below is a snapshot of the help text displayed when using the -? flag. It shows the usage for all supported command line flags necessary for creating, deleting, and managing RAID volumes.

The second mode of operation is console mode (applicable for RAIDCfg only). If this utility is executed without any command line flags, a console interface identical to that of the Intel Matrix Storage Manager option ROM is presented and is fully functional within the DOS environment. The mode requires user interaction; however, it may be used to create, delete, and manage RAID volumes from a DOS environment when the Intel Matrix Storage Manager option ROM is unavailable.

3.3.1 RAIDCfg Utility for MS-DOS*

The command syntax for the Intel RAID Configuration utility is shown below:

```
=============================================================================

RaidCfg.exe [/?] [/Y] [/Q] [/C:vol_name] [/SS:strip_size] [/L:raid_level]
            [/S:vol_sizel] [/DS:disk_ports] [/D:vol_name] [/X] [/I] [/P]
[/ST] [/STD] [/STV] [/F:vol_name] [CnG:vol_name] [/Sync]

/?    Displays Help Screen.  Other options ignored.
/Y    Suppress any user input. Used with options /C, /D, /X, & /F.

/Q    Quiet mode / No output. Should not be used with status commands.
      COMMANDS - Only one at a time.
/C    Create a volume with the specified name.
      /S, /DS, /SS, & /L can be specified along with /C.
/SS   Specify strip size in KB.  Only valid with /C
/L    Specify RAID Level (0, 1, 10, or 5).  Only valid with /C
/S    Specify volume size in GB or percentage if a '%' is appended.
      Percentage must be between 1-100.  Only valid with /C
/DS   Selects the disks to be used in the creation of volume.
      List should be delimited by spaces.
/D    Delete Volume with specified name.
/X    Remove all metadata from all disks. Use with /DS to delete
      metadata from selected disks.
/I    Display All Drive/Volume/Array Information.  /P can be specified.
/P    Pause display between sections. Only valid with /I.
/ST   Display Volume/RAID/Disk Status.
/STD  Display delimited Disk Status
```

```
      Port,Model,SerialNumber,FirmwareVersion,Array,Status,Size,Free,Type
/STV  Display delimited Volume Status
      Index,Level,StripSize,Size,Status,Bootable,Array,Name
/F    Repair failed RAID0 Volume.
/CnG  Create an Intel® Rapid Recover Technology volume. To be used with
/C  and /DS.
/Sync Set sync type for Intel® Rapid Recover Technology volume. Only
valid with /CnG
/M    Choose port number of the Master disk for Intel® Rapid Recover
Technology volume. Only valid with /CnG
=============================================================================
```

3.3.2 RAIDCfg32 Utility for Microsoft* Windows*

The command syntax for the Intel RAID Configuration utility is shown below:

```
=============================================================================
RaidCfg32.exe [/?] [/Y] [/Q] [/RD] [/SPARE:drive] [/C:vol_name]
[/SS:strip_size] [/L:raid_level] [/S:vol_sizel]
[/DS:disk_ports] [/D:vol_name] [/X] [/I] [/P] [/ST]
[/STD] [/STV] [/F:vol_name] [CnG:vol_name] [/Sync] [/M:port]

/?      Displays Help Screen.  Other options ignored.
/Y      Suppress any user input. Used with options /C, /D, /X, & /F.
/Q      Quiet mode / No output. Should not be used with status commands.
        COMMANDS - Only one at a time.
/RD     Inquire if the raid driver is running
/SPARE  Set a drive to be a spare
/C      Create a volume with the specified name.
        /S, /DS, /SS, & /L can be specified along with /C.
/SS     Specify strip size in KB.  Only valid with /C
/L      Specify RAID Level (0, 1, 10, or 5).  Only valid with /C
/S      Specify volume size in GB or percentage if a '%' is appended.
        Percentage must be between 1-100.  Only valid with /C
/DS     Selects the disks to be used in the creation of volume.
        List should be delimited by spaces.
/D      Delete Volume with specified name.
/X      Remove all metadata from all disks. Use with /DS to delete
        metadata from selected disks.
/I      Display All Drive/Volume/Array Information.  /P can be specified.
/P      Pause display between sections. Only valid with /I.
/ST     Display Volume/RAID/Disk Status.
/STD    Display delimited Disk Status

Port,Model,SerialNumber,FirmwareVersion,Array,Status,Size,Free,Type
/STV    Display delimited Volume Status
        Index,Level,StripSize,Size,Status,Bootable,Array,Name
/F      Repair failed RAID0 Volume.
/CnG    Create a Intel® Rapid Recover Technology volume. To be used with
/C  and /DS.
/Sync   Set sync type for Intel® Rapid Recover Technology volume. Only
valid with /CnG
/M      Choose port number of the Master disk for Intel® Rapid Recover
Technology volume. Only valid with /CnG
=============================================================================
```

4 Creating a RAID Volume

RAID volumes can be created three different ways. The method most widely used by end-users is to use the Intel Matrix Storage Console in Windows*. The second method to create a RAID volume is to use the Intel Matrix Storage Manager option ROM user interface. The third way, used by OEMs only, is using the RAID Configuration utility.

4.1.1 Using the Intel Matrix Storage Console

1. Run the Intel Matrix Storage Console from the following Start menu link within Windows XP:
2. Start→Programs→Intel® Matrix Storage Manager→Intel Matrix Storage Console
3. Select 'Create RAID Volume' from the Actions menu. This will launch the Create RAID Volume Wizard. Follow the instructions as prompted. It's important to understand what will occur during the migration process because all data on the destination hard drive will be lost. Note: Switch to advanced mode if the console opens in basic mode.
4. After the RAID volume is created, you will be shown a dialog box stating that the RAID volume was successfully created. Click OK to close this dialog box.
5. After the RAID volume is created, you will need to use Windows Disk Management or other third-party software to create a partition within the RAID volume and format the partition.
6. After formatting the partition, you may begin to copy files to, or install software on, the RAID volume.

4.1.2 Using the Intel Matrix Storage Manager option ROM User Interface

1. Upon re-boot, you will see the option ROM status message on the screen – press CTRL-I to enter the Intel Matrix Storage Manager option ROM user interface.
2. In the Main Menu, select option #1 'Create RAID Volume'. Enter the name you want to use for the RAID volume, then press Enter.
3. Select the RAID level by using the arrow keys, then press Enter.
4. Press Enter to select the disks to be used by the array that the volume will be created on. Press Enter when done.
5. Select the strip size (128 KB is the default for RAID 0) by using the arrow keys, then press Enter when done.

6. Enter the size for the RAID volume in gigabytes. The default value will be the maximum size. If you specify a smaller size, you will be able to create a second volume in the remaining space using the same procedure.

7. After this is done, exit the Option ROM user interface.

4.2 Using the RAID Configuration Utility

Run “raidcfg.exe” (DOS environment) or “raidcfg32.exe” (Windows environment) with the following command line flags to create a RAID volume.

The following command line will instruct the utility to create a RAID 0 volume named “OEMRAID0” on the hard drives on Port 0 and 1 with a strip size of 128 KB and a size of 120 GB:

```
C:\>raidcfg.exe /C:OEMRAID0 /DS:0 1 /SS:128 /L:0 /S:120
```

The following command will create a RAID volume using all of the default values. It will create a RAID 0 volume with a strip size of 128 KB on the two hard drives in the system. The volume will be the maximum size allowable.

```
C:\>raidcfg.exe /C:OEMRAID0
```

The following command line will display usage for all support command line parameters:

```
C:\>raidcfg.exe /?
```

Note:

Selecting the strip size is only applicable for RAID 0, RAID 5, RAID 10 levels, but not for RAID 1

5 Deleting a RAID Volume

RAID volumes can be deleted in three different ways. The method most widely used by end-users is the Windows user interface utility. The second method is to use the Intel Matrix Storage Manager Option ROM user interface. The third way, used by OEMs only, uses the RAID Configuration utility.

5.1 Using the Windows User Interface Utility

1. Run the Intel Matrix Storage Console from the following Start menu link within Windows XP:
2. Start→All Programs→Intel® Matrix Storage Manager→Intel Matrix Storage Console
3. Right-click the RAID volume and select 'Delete Volume'. Note: Switch to advanced mode if the console opens in basic mode.
4. The 'Delete RAID Volume' Wizard will walk you through the steps to delete the volume.

5.2 Using the Option ROM User Interface

1. Upon re-boot, you will see the Intel Matrix Storage Manager option ROM status message on the screen – press CTRL-I to enter the option ROM user interface.
2. Within this UI, select option #2 'Delete RAID volume'.
3. You should be presented with another screen listing the existing RAID volume.
4. Select the RAID volume you wish to delete using the up and down arrow keys.
5. Press the Delete key to delete the RAID volume
6. Press Y to confirm.

Note: Option #3 'Reset Hard Drives to Non-RAID' in the option ROM user interface may also be used to delete a RAID volume. This resets one or more SATA hard drives to non-RAID status, by deleting all metadata on the hard drives. This has the affect of deleting any RAID volumes present. This function is provided for re-setting the hard drives when there is a mismatch in RAID volume information on the hard drives. The option #2 'Delete RAID Volume' on the contrary, will allow deleting a volume at a time, while retaining the existing RAID array metadata (for instance Matrix RAID).

5.3 Using the RAID Configuration Utility

Run “raidcfg.exe” (DOS environment) or “raidcfg32.exe” (Windows environment) with the following command line flag to delete a RAID volume. The following command line will instruct the utility to delete a RAID 0 volume named “OEMRAID0”

```
C:\>raidcfg.exe /D:OEMRAID0
```

The following command line will display usage for all support command line parameters:

```
C:\>raidcfg.exe /?
```

6 Common RAID Setup Procedures

6.1 Build a SATA RAID 0, 1, 5 or 10 System

This is the most common setup. This configuration will have the operating system striped for RAID 0, or mirrored for RAID 1, or striped with parity for RAID 5, or stripped and mirrored for RAID 10 across two or up to four SATA hard drives. To prepare for this, you must have the Intel RAID driver on a floppy disk. See the procedure for creating this floppy further down in this document.

1. Assemble the system using a motherboard that supports Intel Matrix Storage Technology and attach SATA hard drives depending on the RAID level that will be built.

2. Enter System BIOS Setup and ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult the manufacturer's user manual if necessary. When done, exit Setup.

3. Upon re-boot you will see the Option ROM status message on the screen – press CTRL-I to enter the Intel Matrix Storage Manager Option ROM user interface.

4. Within this UI, select option '1. Create RAID Volume'. When 'Create RAID Volume' menu is displayed, fill the following items:

    a. Name: Enter a volume name, and press Enter to proceed to next menu item,

    b. RAID Level: select RAID level (0, 1, 5, 10), and press Enter to proceed to next menu item;

    c. Disks: press Enter on 'Select Disks' to select the hard drives to be used for your configuration.

    d. Within the 'SELECT DISKS' window, choose the hard drives and press Enter to return to the 'MAIN MENU'.

    e. Strip Size: Applicable for RAID levels 0, 5, and 10 only. You may choose the default size or another supported size in the list and press Enter to proceed to the next item.

    f. Capacity: The default size would be the maximum allowable size summation of all the drives in your configuration. You may decrease this volume size to a lower value. If you specified a lower capacity size volume, the remaining space could be utilized for creating another RAID volume. Press Enter to proceed to the next item.

g. Create Volume: Press Enter to Create a volume.

h. Press 'Y' to confirm the creation of volume.

5. After this is done, exit the Intel Matrix Storage Manager option ROM user interface by pressing the Esc key or Option #4.

6. Begin Windows XP Setup by booting from the installation CD.

7. At the beginning of Windows Setup, press F6 to install a third-party SCSI* or RAID driver. When prompted, insert a floppy disk containing the Intel RAID driver. After reading the floppy disk, the 'Intel® ICH9 I/O Controller with RAID /RAID 5' selection will be presented -- select this driver to install.

8. Finish the Windows installation and install all necessary drivers.

9. Install the Intel Matrix Storage Manager 8.0 software via the CD-ROM included with your motherboard or download the software from Intel's website on the Internet. This will add the *Intel Matrix Storage Console* that can be used to manage the RAID configuration.

6.2 Build a SATA "RAID Ready" System

The following steps outline how to build an Intel "RAID Ready" system with Windows XP installed on a single SATA hard drive. A "RAID Ready" system can be upgraded to RAID 0, RAID 1, RAID5 or RAID 10 at a later time using the RAID migration feature built into Intel Matrix Storage Manager 8.0. This technology enables you to install additional SATA hard drives, and then migrate to a RAID level volume without re-installing the operating system.

1. Assemble the system using a motherboard that supports Intel Matrix Storage Technology and attach one SATA hard drive.

2. Enter System BIOS Setup; ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult your manufacturer's user manual if necessary. When done, exit Setup.

3. Begin Windows Setup by booting from the installation CD.

4. At the beginning of Windows Setup, press F6 to install a third-party SCSI or RAID driver. When prompted, insert a floppy disk containing the Intel RAID driver. After reading the floppy disk, select the correct controller to install the driver.

5. Finish the Windows installation and install all necessary drivers.

6. Install the Intel Matrix Storage Manager software via the CD-ROM included with your motherboard or after downloading it from Intel's website on the Internet. This will add the *Intel Matrix Storage Console* that can be used to manage the RAID configuration and to use the Intel Matrix Storage Manager migration feature to migrate a "RAID Ready" configuration to a RAID 0, RAID 1, RAID 5, RAID 10 configuration.

6.3 Migrate to RAID 0 or RAID 1 on an Existing "RAID Ready" System

If you have an existing "RAID Ready" system as defined in section 6.2, then you can use the following steps to migrate from a single-drive non-RAID configuration to a two drive RAID 0 or RAID 1 configuration. The resulting configuration will be identical to that created by the procedure in section 6.1. To prepare for this, you will need to install another SATA hard drive with a capacity equal to or greater than the capacity of the hard drive being used as the source hard drive.

1. Note the serial number of the hard drive already in the system; you will use this to select it as the source hard drive for the migration.

2. Install the second SATA hard drive on the available SATA port.

3. Boot Windows, then install the Intel Matrix Storage Manager software, if not already installed, using the setup package obtained from a CD-ROM or from the Internet. This will install the necessary Intel Matrix Storage Console and start menu links.

4. Open the Intel Matrix Storage Manager from the Start Menu and select 'Create RAID volume from Existing Hard Drive' from the Actions menu. Note: Switch to advanced mode if the console opens in basic mode.

5. The 'Create RAID volume from Existing Hard Drive' Wizard will be activated. Follow the instructions as prompted. It is important to understand what will occur during the migration process because all data on the destination hard drive will be lost.

6. After the migration is complete, reboot the system. If you migrated to a RAID 0 volume, use Disk Management from within Windows in order to partition and format the empty space created when the two hard drive capacities are combined. You may also use third-party software to extend any existing partitions within the RAID volume.

6.4 Migrate an Existing Data Hard Drive to a RAID 0 or RAID 1 Volume

If you are booting from a parallel ATA (PATA*) drive that contains the operating system, you may use the Intel Matrix Storage Manager to create a RAID 0 or RAID 1 volume on two SATA drives. Also, if you have a single SATA hard drive that contains program or personal data, you may use the migration feature to use this hard drive as the source hard drive for a migration. After the migration is completed, you will have a two hard drive RAID 0 volume where data is striped or a two hard drive RAID 1 volume where the data is mirrored across the two SATA hard drives. To do this, the ICH9 I/O Controller must be enabled in the BIOS and you must have the Intel Matrix Storage Manager software installed.

Begin with a system where you are booting Windows* XP* from a PATA hard drive. Make sure the ICH8 I/O controller is enabled and the Intel Matrix Storage Manager software is installed. Then do the following:

1. Note the serial number of the SATA hard drive that is already installed. You will use this to select it as the source hard drive when initiating the migration.

2. Physically attach the second SATA hard drive to the available SATA port.

3. Boot to Windows, install the Intel Matrix Storage Manager software, if not already installed, using the setup package obtained from a CD-ROM or from the Internet. This will install the necessary Intel Matrix Storage Console and start menu links.

4. Open the Intel Matrix Storage Console from the Start Menu.

5. Select 'Create RAID volume from Existing Hard Drive' from the Actions menu. This will activate the Create RAID volume from the Existing Hard Drive Wizard. Follow the instructions as prompted. It is important to understand what will occur during the migration process because all data on the destination hard drive will be lost. Note: Switch to advanced mode if the console opens in basic mode. Note: Switch to advanced mode if the console opens in basic mode.

6. After the migration is complete, reboot the system.

6.5 Migrate from RAID 0/1/10 to RAID 5 system

RAID level migration allows an existing RAID configuration which could support levels 0, 1, or 10 to be migrated to RAID level 5. The following migrations are possible:

- 2-drive RAID 1 to 3- or 4-drive RAID 5
- 2-drive RAID 0 to 3- or 4-drive RAID 5
- 3-drive RAID 0 to 4-drive RAID 5
- 4-drive RAID 10 to 4-drive RAID 5

Note: In order for the migration to complete successfully, the minimum required SATA hard drives for the new RAID level 5 have to be met.

Please follow the procedure illustrated below

1. Power on the system to Windows which supports RAID levels 0, 1, 10.

2. Start the Intel Matrix Storage Console application:

3. Start Menu ->All Programs -> Intel Matrix Storage Manager -> Intel Matrix Storage Console

4. Click the View menu and select 'Advanced Mode' option.

5. Choose the RAID volume you want to migrate. Right Click and select 'Modify Volume'

6. ‘Modify RAID Volume Wizard’ will be displayed. The wizard will walk you through the procedure to migrate to RAID 5.

7. After the migration starts, the Information tab shows the migration progress in the Status field.

8. When the Status field indicates ‘Normal’, the migration is complete.

6.6 Create a RAID volume on SATA while booting to PATA

This configuration is for users who would like to use a RAID 0 volume as a high performance data hard drive or use the data redundancy properties of RAID 1. Starting with a configuration where the system is booting to a Windows XP, with installation on a Parallel ATA hard drive, the user can add two SATA hard drives and create a RAID volume on them.

1. Physically install two SATA hard drives to the system.

2. Enter System BIOS Setup; ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult your manufacturer’s user manual if necessary. When done, exit Setup.

3. Boot to Windows; install the Intel Matrix Storage Manager software, if not already installed, use the setup package obtained from a CD-ROM or from the Internet. This will install the necessary Intel Matrix Storage Console and Start menu links.

4. Use the Intel Matrix Storage Console to create a RAID 0 volume on two SATA drives according to the procedure in section 6.1 of this document.

5. After the RAID volume is created, you will need to use Windows Disk Management or other third-party software to create a partition within the RAID volume and format the partition. At this point, you may begin to copy files to, or install software on, the RAID volume.

6.7 Build a RAID 0 or RAID 1 System in an Automated Factory Environment

This is a two-part process. First, create the master image of the Windows installation; you will load these on the system before they are delivered to the customer. The second part is to apply this image to a system that has two SATA hard drives installed with a RAID 0 or RAID 1 volume. This procedure will apply the image to the RAID volume so that the system may boot from it and the operating system will be fully striped by the RAID 0 volume or mirrored by the RAID 1 volume. The same procedure, and master image, could be applied to a single SATA hard drive to create a “RAID Ready” system.

6.7.1 Part 1: Create the Master Image

1. Build a RAID 0 or RAID 1 System as described in section 6.1 of this document.

2. Install the *Intel Matrix Storage Manager 8.0* software from the CD-ROM included with your motherboard or after downloading it from the Internet. This will add the *Intel Matrix Storage Console* that can be used to manage the RAID configuration in Windows*.

3. Use third-party software to create an image of the RAID volume as if it were a physical hard drive or create an image of the partition within the RAID volume containing the operating system, program and data files.

4. Store it in a place where it can be accessed by systems on the assembly line.

6.7.2 Part 2: Apply the Master Image

1. Assemble the system using a motherboard that supports Intel Matrix Storage Technology and attach two SATA hard drives.

2. Enter System BIOS Setup; ensure that RAID mode is enabled. This setting may be different for each motherboard manufacturer. Consult your manufacturer's user manual if necessary. When done, exit Setup.

3. Within a DOS environment, use the Intel RAID Configuration utility (raidcfg.exe) to create a RAID volume. The following command line will instruct the utility to create a RAID 0 volume named "OEMRAID0" on the hard drives on Port 0 and 1 with a strip size of 128 KB and a size of 120GB:
   C:\>raidcfg.exe /C:OEMRAID0 /DS:0 1 /SS:128 /L:0 /S:120.
   The following command line will display all supported command line parameters and their usage: C:\>raidcfg.exe /?

4. The system does not need to be rebooted before moving on to the next step. If there are no PATA hard drives in the system, the RAID volume created will become the boot device upon reboot.

5. Use third-party software to apply the image created in Part 1 to the RAID volume you created in Part 2.

7 RAID Volume Data Verification and Repair Feature

This feature is available starting with Intel® Matrix Storage Manager 6.1.

7.1 Verify RAID Volume Feature

Once you create a RAID volume, it will be listed in the device pane and you will be able to access the following volume management options by right-clicking on its name

The RAID volume verification feature identifies any inconsistencies or bad data on a RAID 0, RAID 1, RAID 5, or RAID 10 volume and reports the number of inconsistencies or number of blocks with media errors found during RAID volume data verification.

When the verification process is complete, a dialog will appear that displays the number of verification errors and blocks with media errors that were found.

Follow the below steps to start RAID volume data verification

1. Go to the Advanced mode.
2. Right-click on the name of the volume whose data you wish to verify.
3. Click on Verify Volume Data

7.2 Using Verify and Repair RAID Volume Feature

Once you create a RAID volume, it will be listed in the device pane and you will be able to access the following volume management options by right-clicking on its name

The RAID volume verification and Repair feature identifies and repairs any inconsistencies or bad data on a RAID 1, RAID 5, or RAID 10 volume.

This option verifies and repairs the data on a RAID volume. When the verification and repair process is complete, a dialog will appear that displays the number of verification errors found and repaired and the number of blocks with media errors that were reassigned.

Follow the below steps to start RAID volume data verification and repair

1. Go to the Advanced mode.
2. Right-click on the name of the volume whose data you wish to verify.
3. Click on Verify and Repair Volume Data.

8 Intel® Rapid Recover Technology

Intel® Rapid Recover Technology is supported on ICH8M-E and greater mobile platforms and ICH9R/DO and greater desktop platforms. This technology utilizes RAID 1 functionality to copy data from a designated Master drive to a designated Recovery drive. The size of the Mater drive must be less than or equal to the size of the Recovery drive. When a Recovery volume is created, complete capacity of the Master drive will be used as the Master volume. Only one Recovery Volume can exist on a system. There are 2 methods of updating the data on the Master to the Recovery drive. They are:

- Continuous Update Policy
- On Request Update Policy

When using the continuous update policy, changes made to the data on the master drive while the recovery drive is not available are automatically copied to the recovery drive becomes available. When using the Update on request policy, the master drive data can be restored to a previous state by copying the data on the recovery drive back to the master drive.

Some of the advantages of Intel® Rapid Recover Technology are:

- More control over how data is copied between master and recovery drives
- Fast volume updates (only changes to the master drive since the last update are copied to the recovery drive)
- Member hard drive data can be viewed in Windows* Explorer
- Better power management on mobile systems by spinning down the Recovery drive when in On Request Update Policy mode or when the Recovery drive goes offline when in Continuous Update Policy mode.

Applications: Critical data protection for mobile systems; fast restoration of the master drive to a previous or default state.

8.1 Creating a Recovery Volume through the RAID Option ROM

A Recovery volume consists of two disks – a primary disk and a recovery disk.

A Recovery volume can be created through the RAID Option ROM or through Intel® Matrix Storage Manager Console application.

Follow the below steps to create a Recovery volume through the OROM

1. Enter the OROM by pressing the Ctrl and I keys early during system POST.
2. Under the ‘Create RAID’ volume option, select the option to create a Recovery volume.
3. Select the Primary disk and the Recovery disk.

Note: The Primary disk size must be less than or equal to the Recovery disk size.

OROM Recovery menu provides the following options

1. Enable Only Recovery Disk
2. Enable Only Master Disk

8.2 Creating a Recovery Volume through the Basic Mode

To create a Recovery volume through the Matrix Storage Console, the system needs to be configured in RAID mode with 2 drives. Boot the system and open the Matrix Storage Console application. A Recovery volume can be created through the Basic mode or through the Advanced mode.

Follow the below steps to create a Recovery Volume through the Basic mode

1. Click on ‘Protect data using Intel® Rapid Recover Technology’.
2. Click on ‘Create a Recovery Volume’.

A dialog box will pop up. Selecting ‘Yes’ will start the volume creating process which can be monitored on the progress bar.

8.3 Creating a Recovery Volume through the Advanced Mode

There are 2 ways of going to the Advanced View mode.

- Using the View Menu Bar option
- Using the actions button in the right pane under View Volumes and Hard Disk Drivers

Follow the below steps to create a Recovery volume through the Advanced mode

1. Go to the Advanced mode screen.
2. Click on the’ Action’ menu in the menu bar.
3. Click on ‘Create a Recovery Volume’.
4. Select the Primary disk and the Recovery disk

5. Select the Update policy – ‘Continuous Update’ or’ Update on request’.

Select ‘Finish’ to complete the creation of the Recovery volume.

The system will synchronize the Primary with the Recovery disk once after the creation of the Recovery volume.

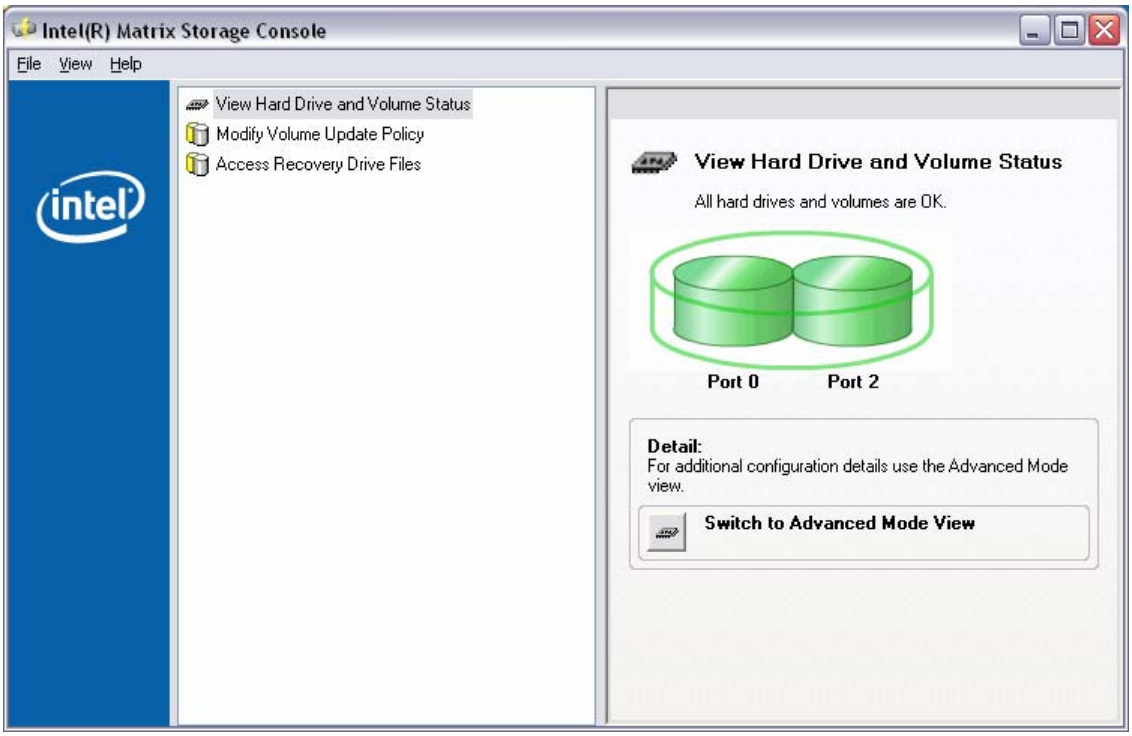
There are two modes of updating or synchronizing the Recovery disk with the Master disk

1. Continuous Update Policy
2. On Request Update Policy

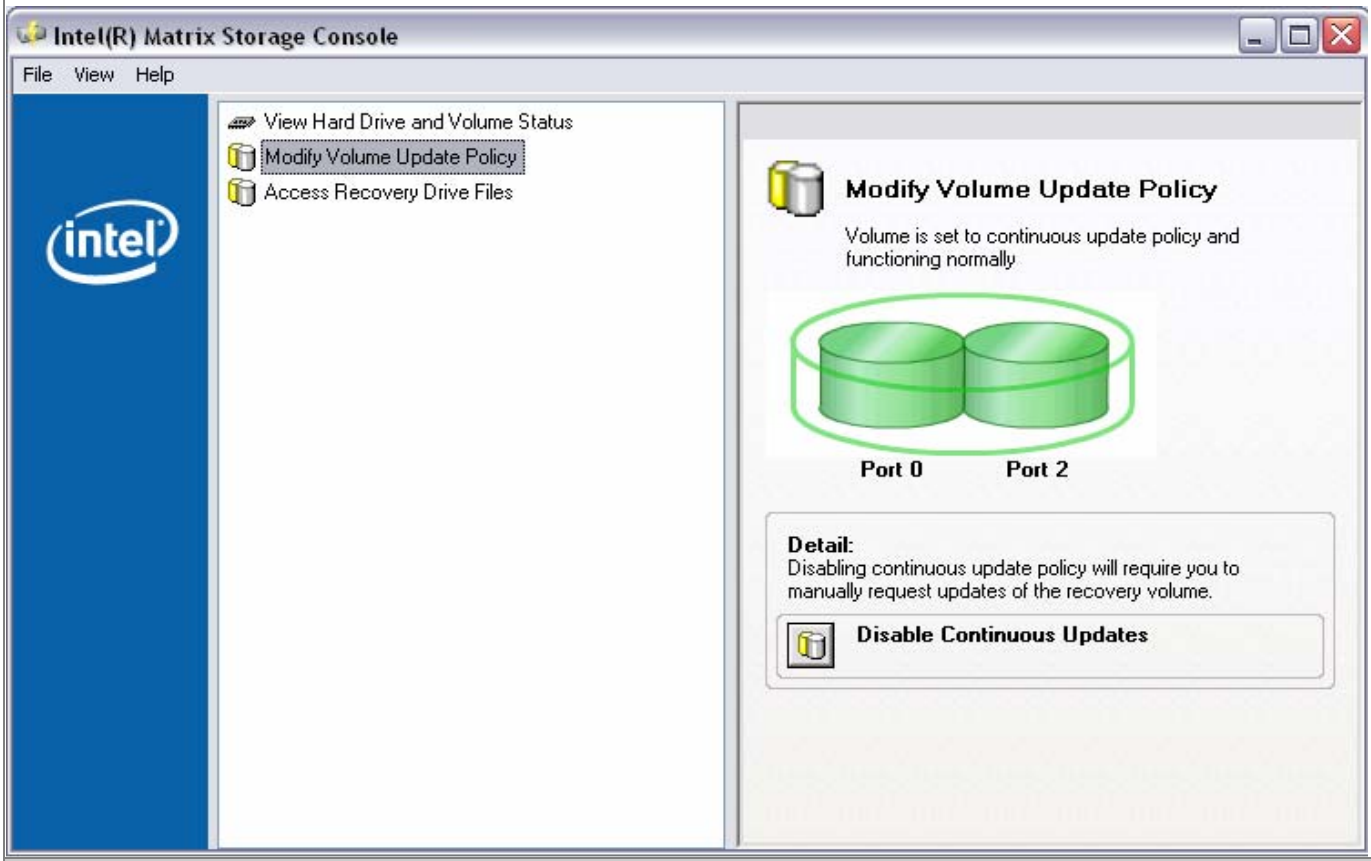
8.4 Intel(R) Rapid Recover Technology Basic Mode

Basic Mode Default dialog following all Intel Rapid Recover Technology actions

Intel Matrix Storage Console opens in defaults to View Hard Drive and Volume Status with recovery volume created as shown in the figure below.



8.5 Disable Continuous Update Policy

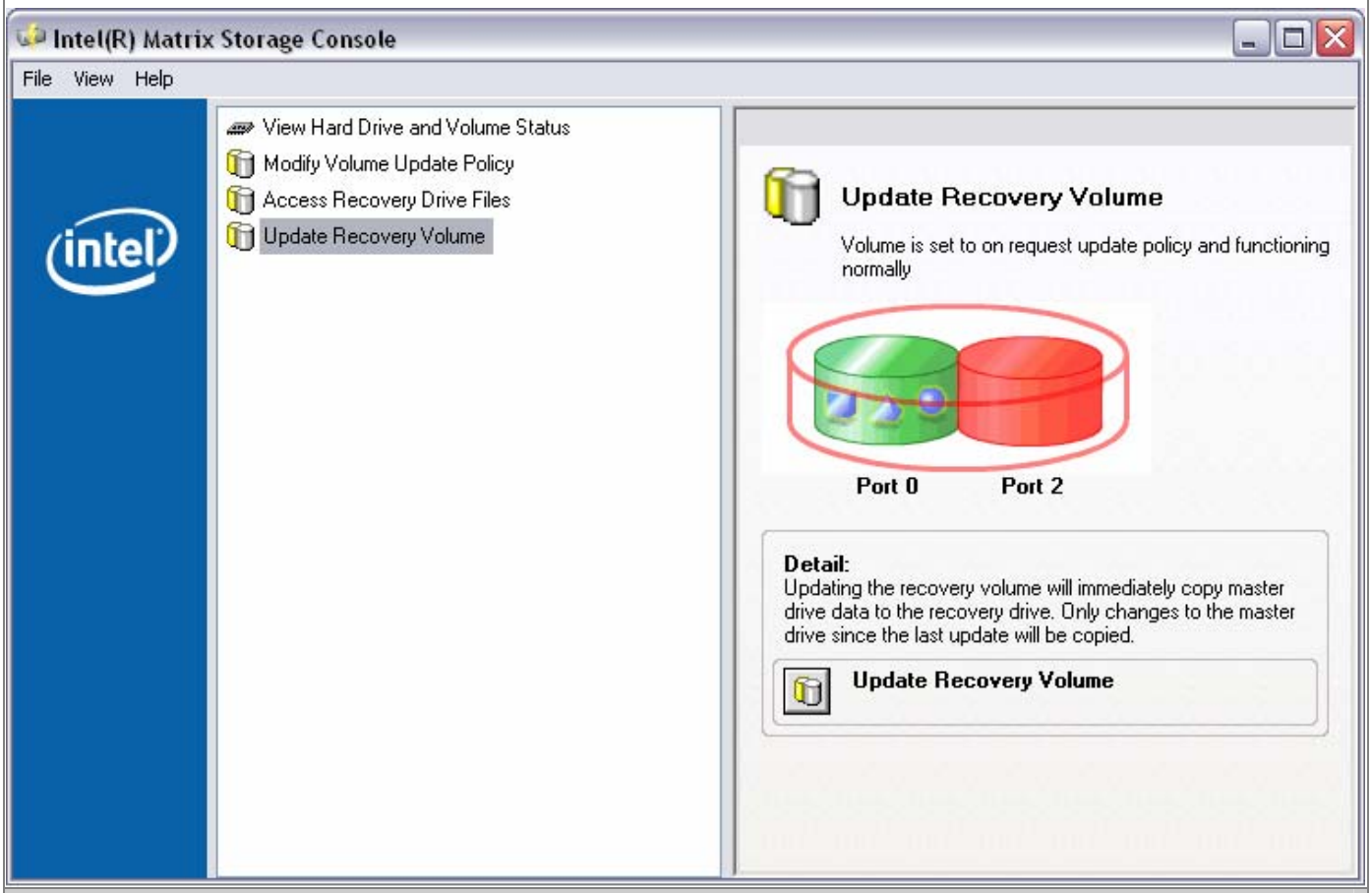


1.1 Asset Table – Disable Continuous Update Policy

Use Case(s)	Disable continuous updates
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created
State	Normal, In Continuous Update Policy
Purpose	Change volume to on request update policy
Action 1 Left Pane	→ Click Modify Volume Update Policy
Action 2 Right Pane	→ Click Disable Continuous Updates

Event information	Disabling the continuous update policy requires the end-user to request updates manually by selecting Update Volume. Only changes since the last update process are copied. The recovery volume will remain in On Request Policy until the end-user enables continuous updates. The right panel will display detailed information about the selected feature, giving the end-user the option to execute or move on to a different task. This feature has no impact on the Advanced Mode.

8.6 Update Recovery Volume in On Request Update Policy

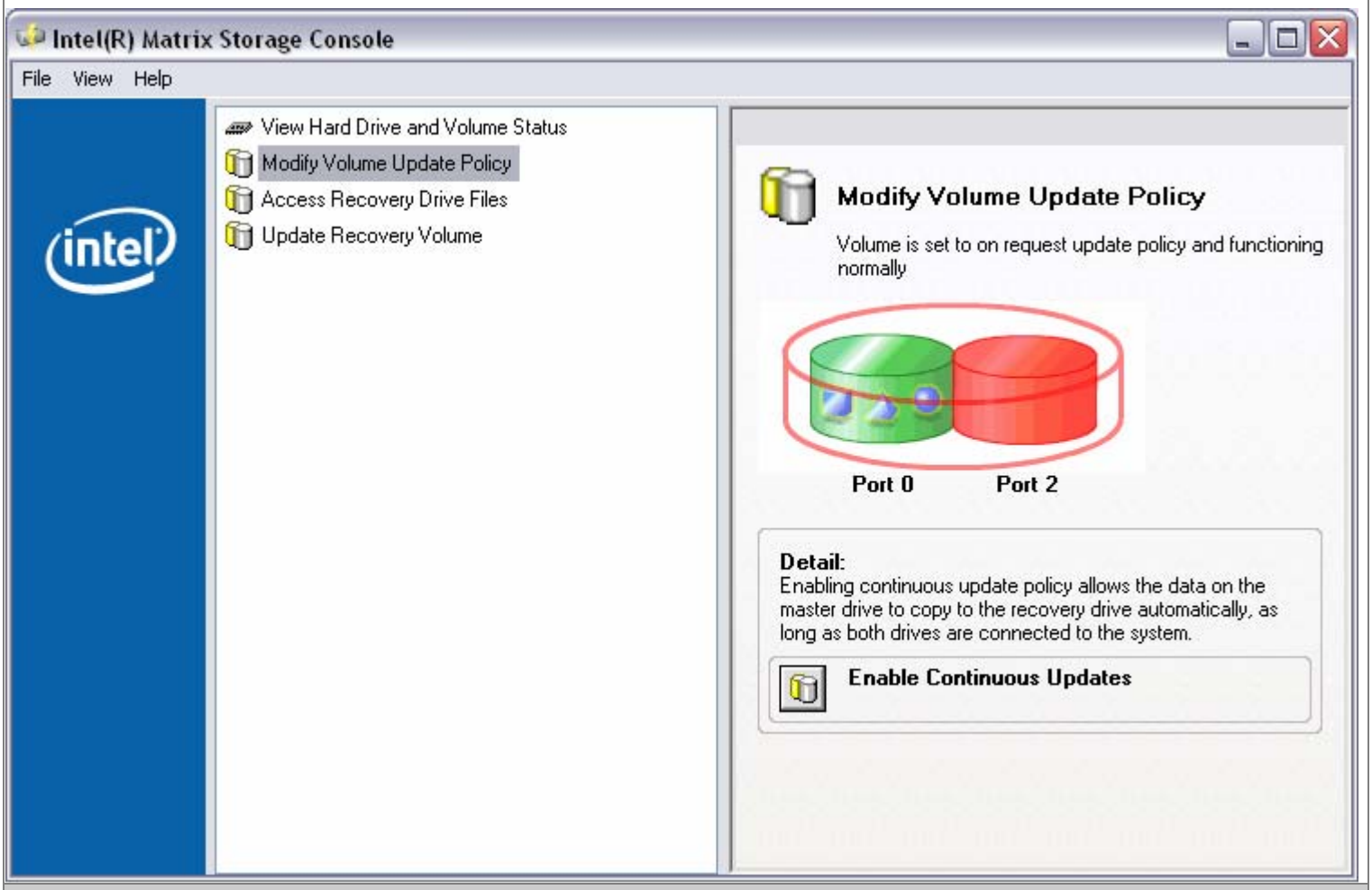


1.2 Asset Table – Update Recovery Volume in On Request Update Policy

Use Case(s)	Update recovery volume manually
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.

System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created
State	In On Request Update Policy
Purpose	Update the recovery volume instantly
Action 1 Left Pane	→ Click Update Recovery Volume
Action 2 Right Pane	→ Click Update Recovery Volume
Event information	Once the end-user disables continuous updates, he/she will need to request manual updates by selecting Update Recovery Volume (left pane and right pane). The detail field in the right panel will inform the end-user that the update will occur instantly and only changes since the last update will be copied.

8.7 Enable Continuous Update Policy



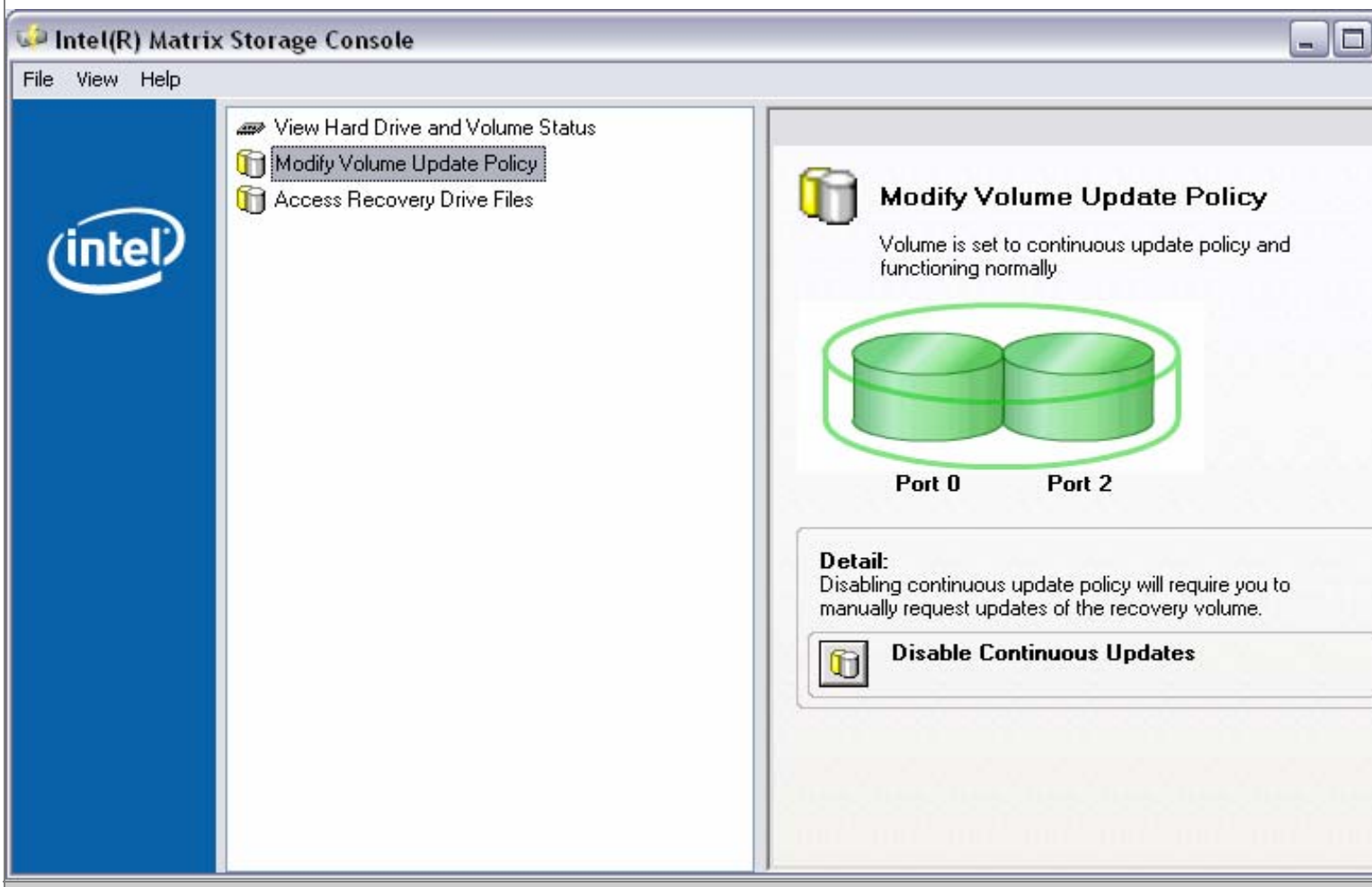
1.3 Asset Table – Enable Continuous Update Policy

Use Case(s)	Enable continuous updates
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created
State	In On Request Update Policy
Purpose	Change volume to continuous update policy
Action 1 Left Pane	→ Click Modify Volume Update Policy

Action 2 Right Pane	→ Click Enable Continuous Updates
Event information	Enabling continuous updates allows data on the master drive to copy automatically to the recovery drive. This action will put the volume in continuous update policy.

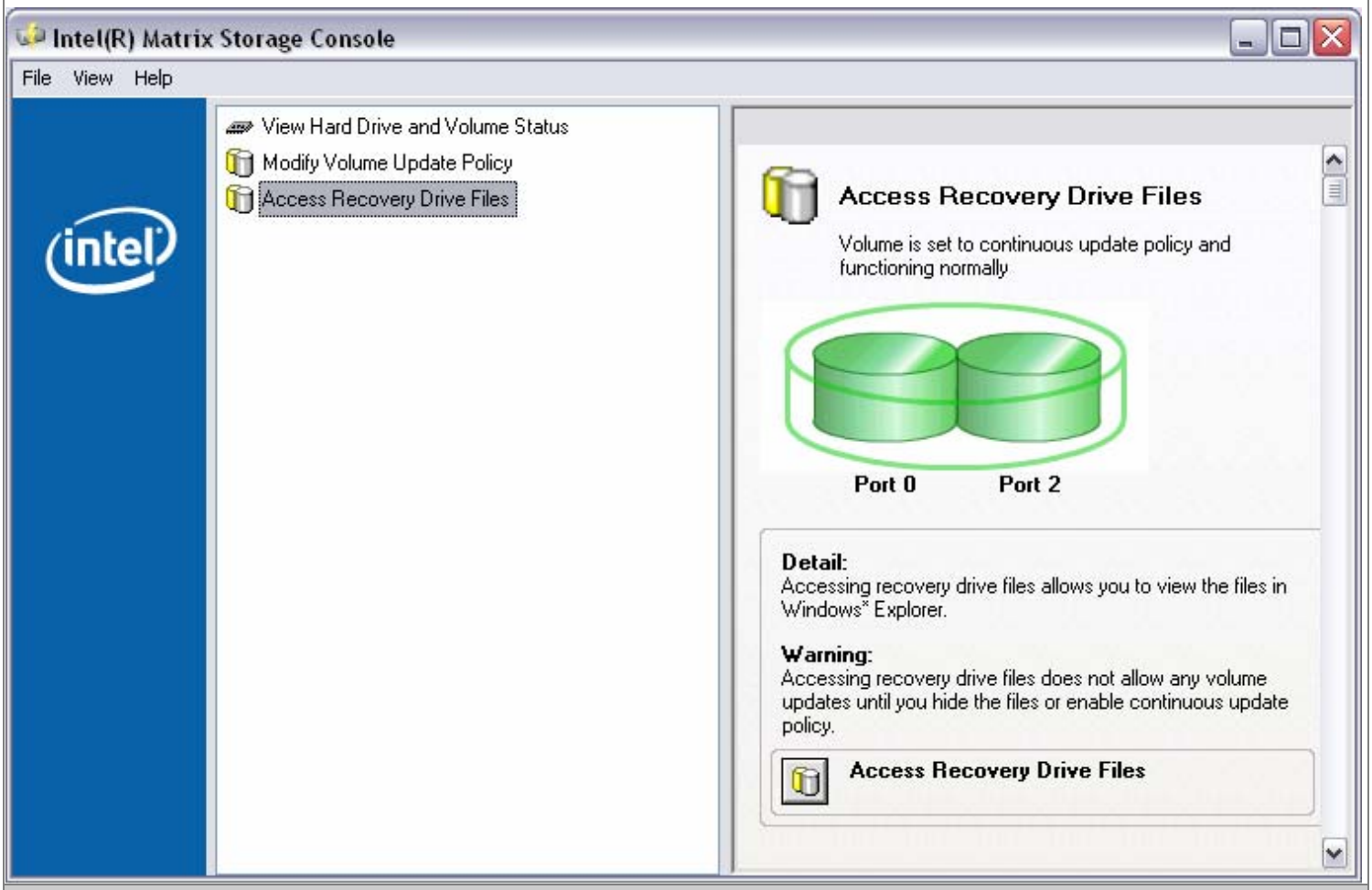
8.8 Landing screen: Continuous Updates Enabled Access / Hide Recovery Drive Files

8.8.1 Access Recovery Drive Files



1.4 Asset Table – Landing screen: Continuous Updates Enabled

Use Case(s)	Continuous updates enabled
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created
State	In Continuous Update Policy
Purpose	Show dialog after end-user enables continuous updates
Action 1 Left Pane	→ Click Modify Volume Update Policy
Action 2 Right Pane	N/A
Event information	After enabling continuous updates, the end-user will go back to the screenshot shown above. Data on the master drive will copy automatically to the recovery drive.

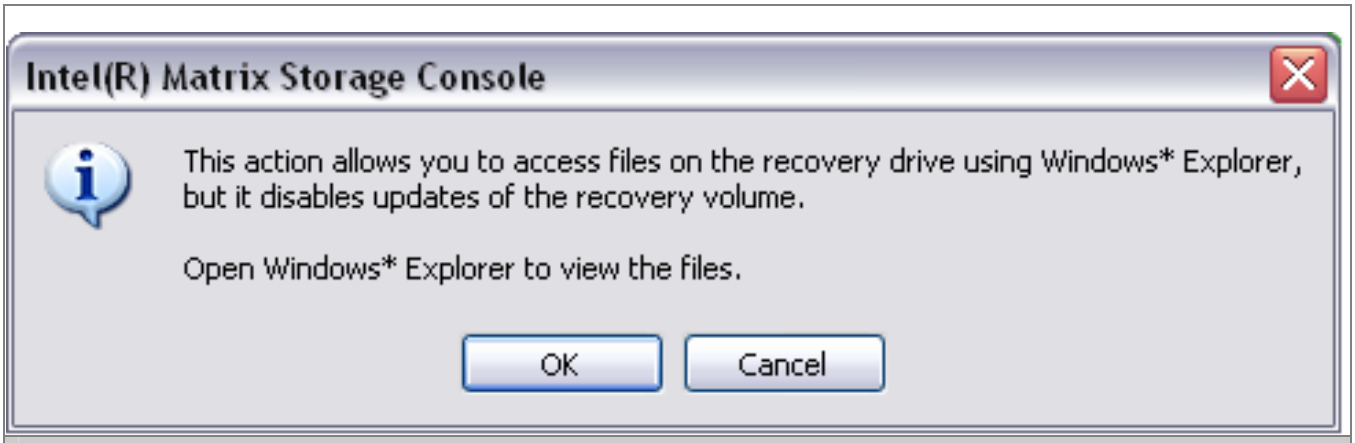


2.1.1 Asset Table – Access Recovery Drive Files

Use Case(s)	Accessing recovery drive files
Localization Notes	The Detail and Warning text boxes will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	
State	In continuous update policy
Purpose	Access the recovery drive files using Windows* Explorer
Action 1 Left Pane	→ Access Recovery Drive Files
Action 2 Right Pane	→ Access Recovery Drive Files
Event information	This action allows the end-user to access files on the recovery drive using Windows* Explorer.

	Accessing the recovery drive files doesn't permit any volume updates as long as the files are exposed. Upon making a selection, an information pop-up message will prompt the user to open Windows* Explorer to view the recovery drive files (see 2.1.2)

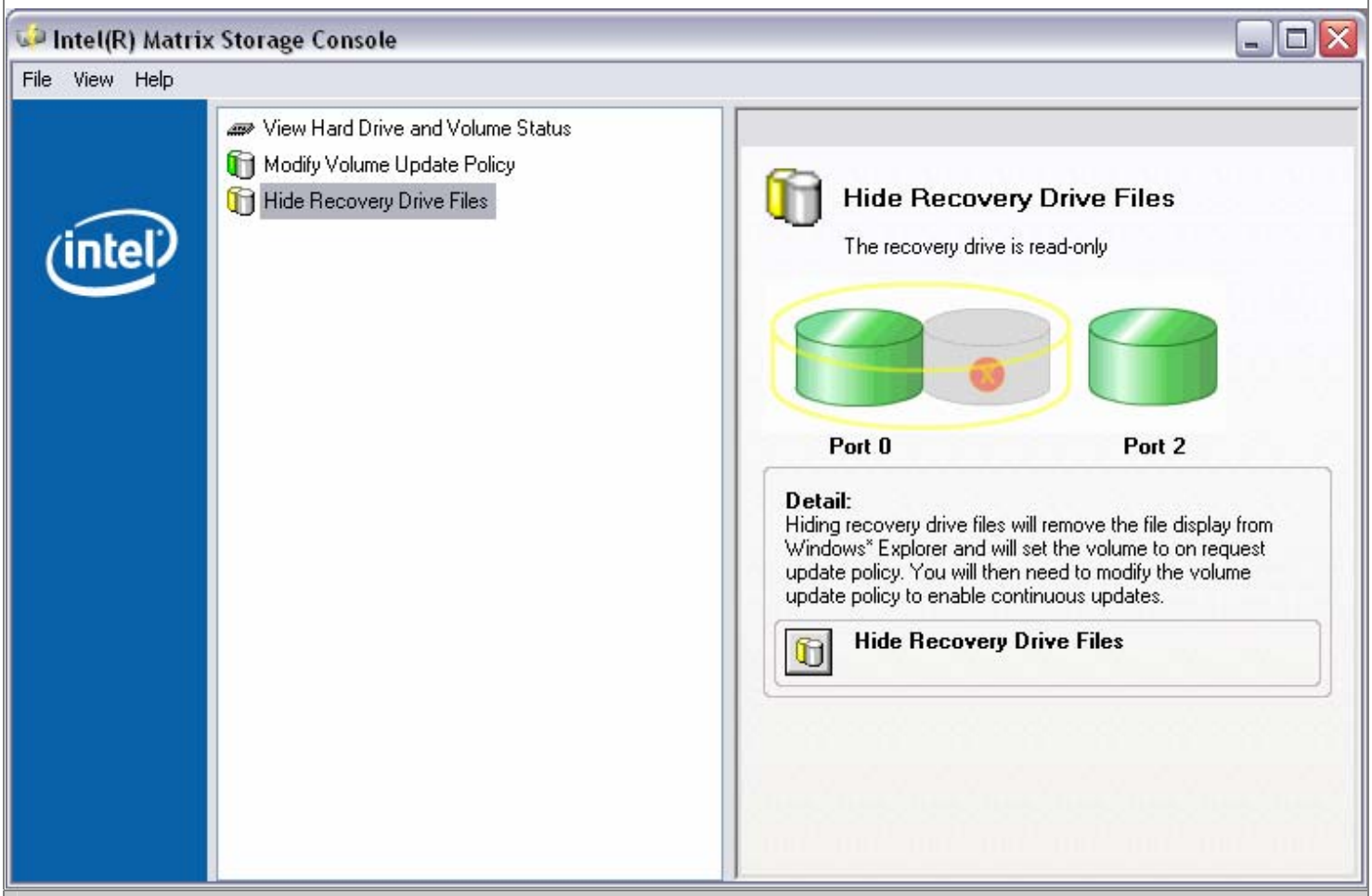
8.8.2 Information dialog



2.1.2 Asset Table – Information dialog

Use Case(s)	Information dialog after accessing recovery drive files
Localization Notes	
System Configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created and Access Recovery Drive Files selected
State	N/A
Purpose	Inform the end-user that he/she needs to open Windows* Explorer to view the recovery drive files.
Action	→ Click ok to make dialog window disappear
Event information	This dialog informs the end-user that: - he/she can view the recovery drive files using Windows* Explorer - the recovery drive is accessed in read-only - he/she needs to open Windows* Explorer to view the files This is a common dialog for this flow regardless of the update policy type prior to accessing the recovery drive files.

8.8.3 Landing screen: Recovery Drive Files accessed

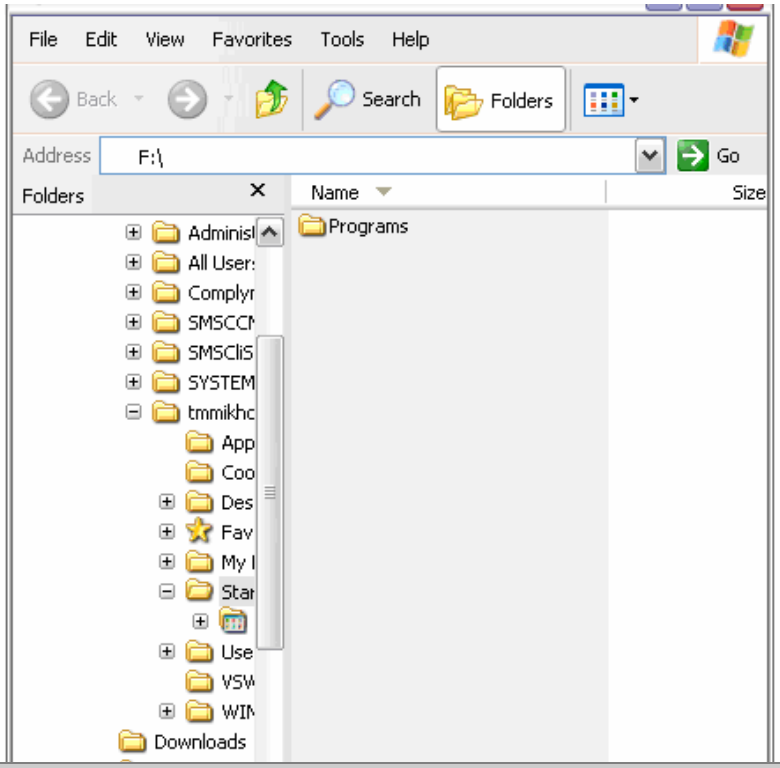


2.1.3 Asset Table – Landing screen: Recovery Drive Files accessed

Use Case(s)	Recovery drive files accessed
Localization Notes	The Detail and Warning text boxes will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created, Access Recovery Drive Files selected
State	Recovery drive in read-only
Purpose	Show dialog after selecting Access Recovery Drive Files
Action 1 Left Pane	→ Hide Recovery Drive Files

Action 2 Right Pane	N/A
Event information	From this dialog, the end-user will be given the option to hide the recovery drive files or modify the recovery drive files. At this stage no updates are allowed as files are viewed in read-only.

8.8.4 Windows* Explorer window



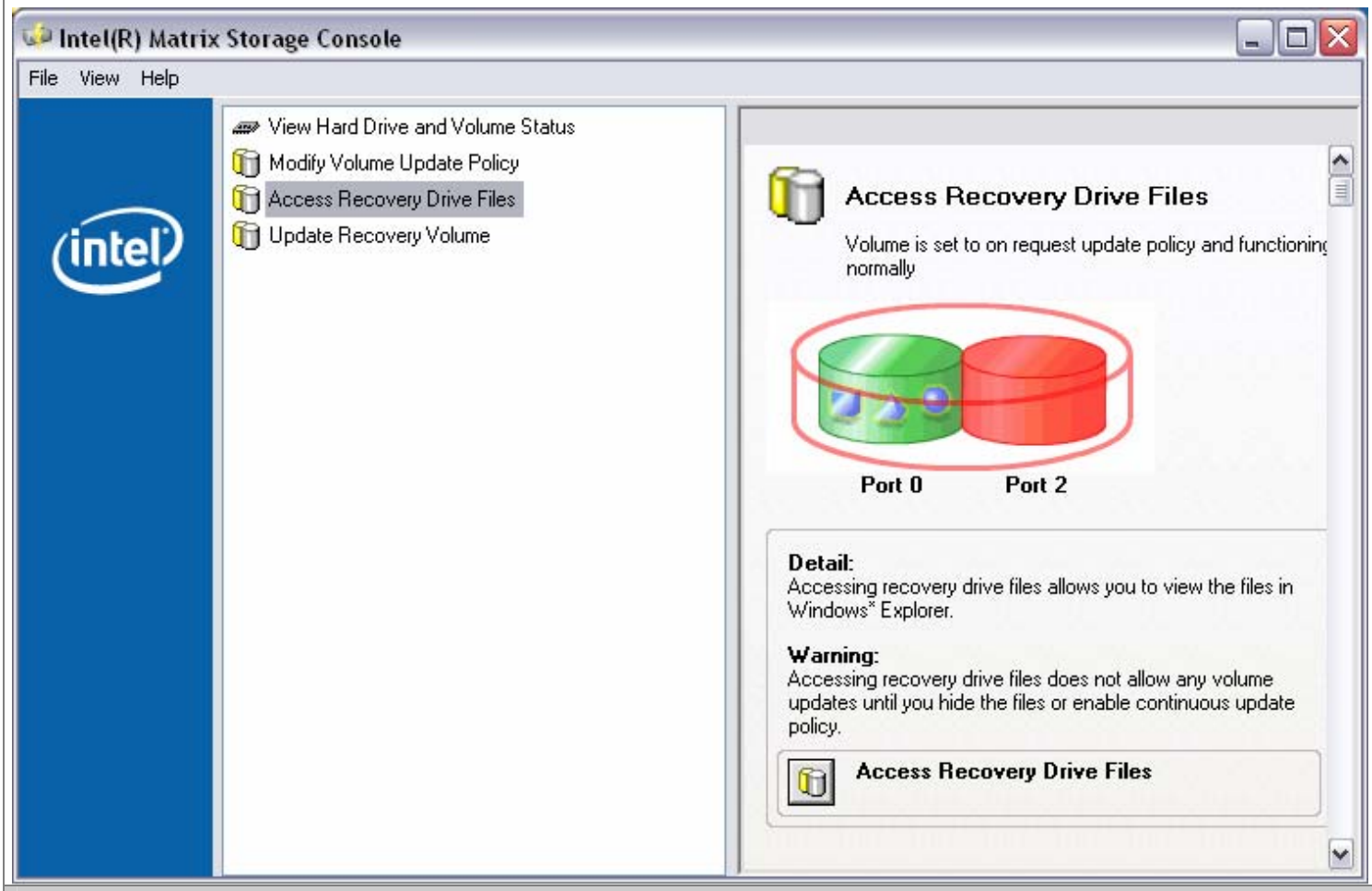
2.1.4 Asset Table – Windows* Explorer window

Use Case(s)	Windows* Explorer window
Localization Notes	
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created, Recovery Drive Files accessed and user opens Windows* Explorer

State	Recovery drive in read-only
Purpose	Show recovery file display using Windows* Explorer after user opens application
Action 1 Left Pane	N/A
Action 2 Right Pane	N/A
Event information	The default focus is placed on the Windows* Explorer window. From this stage of the flow, the end-user has 2 options: → Close or minimize the window → Set focus on the Matrix Storage Console dialog to take the next step.

8.9 Access Recovery Drive Files from On Request Update Policy

8.9.1 Access Recovery Drive Files

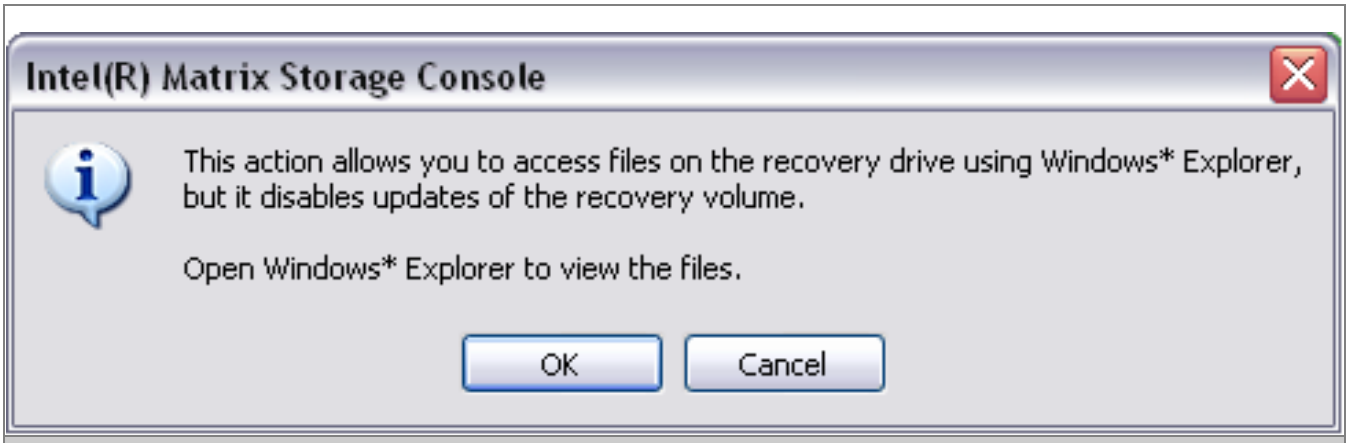


2.2.1 Asset Table – Access Recovery Drive Files

Use Case(s)	Accessing recovery drive files from on request policy
Localization Notes	The Detail and Warning text boxes will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created, continuous updates disabled

State	In on request update policy
Purpose	Access the recovery drive files using Windows* Explorer
Action 1 Left Pane	Access Recovery Drive Files
Action 2 Right Pane	Access Recovery Drive Files
Event information	The only difference between accessing drive files from continuous and on request update policy is the additional option Update Recovery Volume available in the left pane. In this flow, the screens will be identical after selecting Access Recovery Drive Files. The end-user is warned that no updates are allowed as long as the recovery drive files are exposed. To update the volume, he/she will need to hide the recovery drive files.

8.9.2 Information Dialog

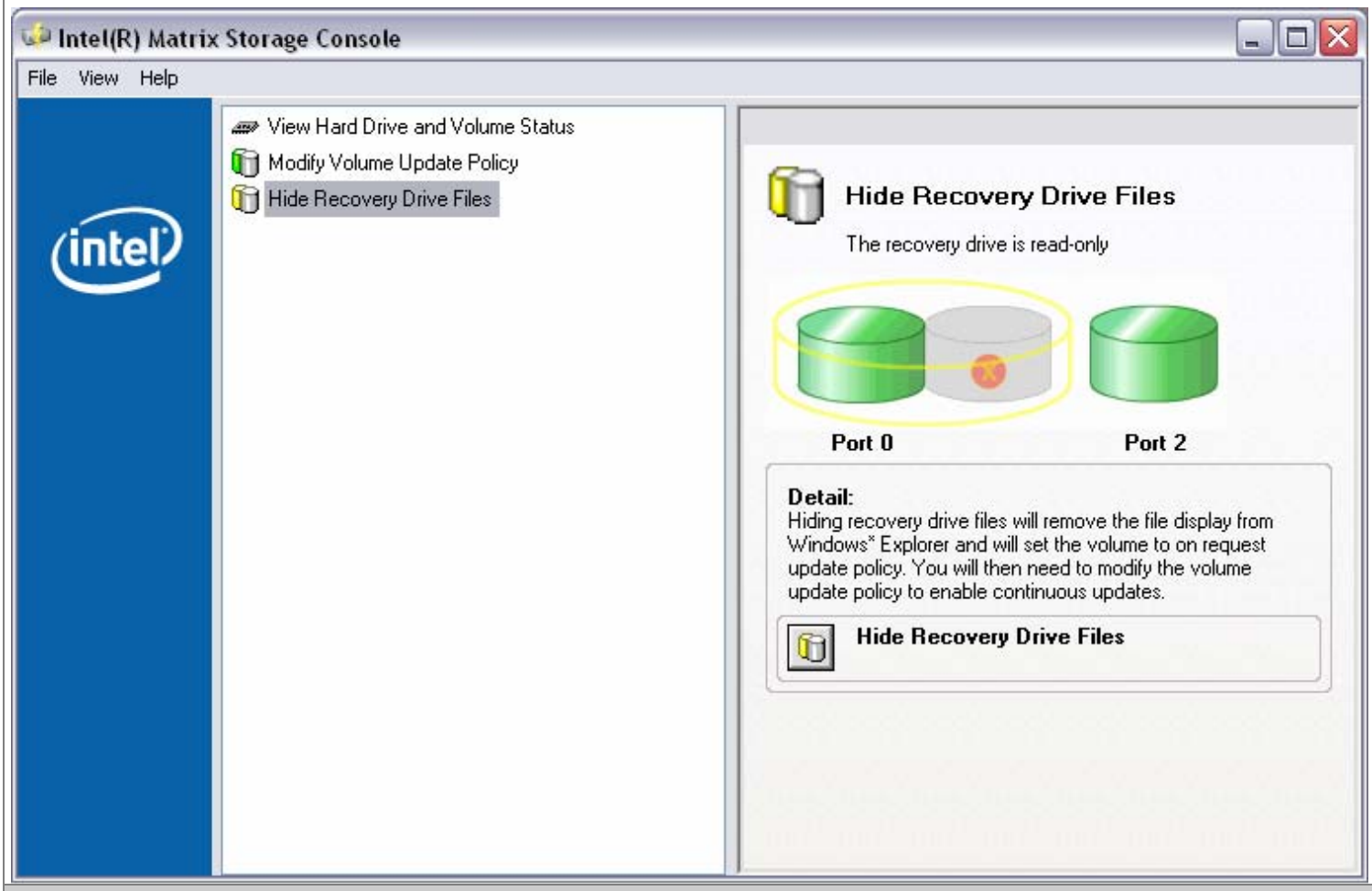


2.2.2 Asset Table – Information dialog

Use Case(s)	Information dialog after accessing recovery drive files
Localization Notes	
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created and Access Recovery Drive Files selected
State	N/A
Purpose	Inform the end-user that he/she needs to open Windows* Explorer to view the recovery drive files.

Action	→ Click ok to make dialog window disappear
Event information	This dialog informs the end-user that: - he/she can view the recovery drive files using Windows* Explorer - the recovery drive is accessed in read-only - he/she needs to open Windows* Explorer to view the files This is a common dialog for this flow regardless of the update policy type prior to accessing the recovery drive files.

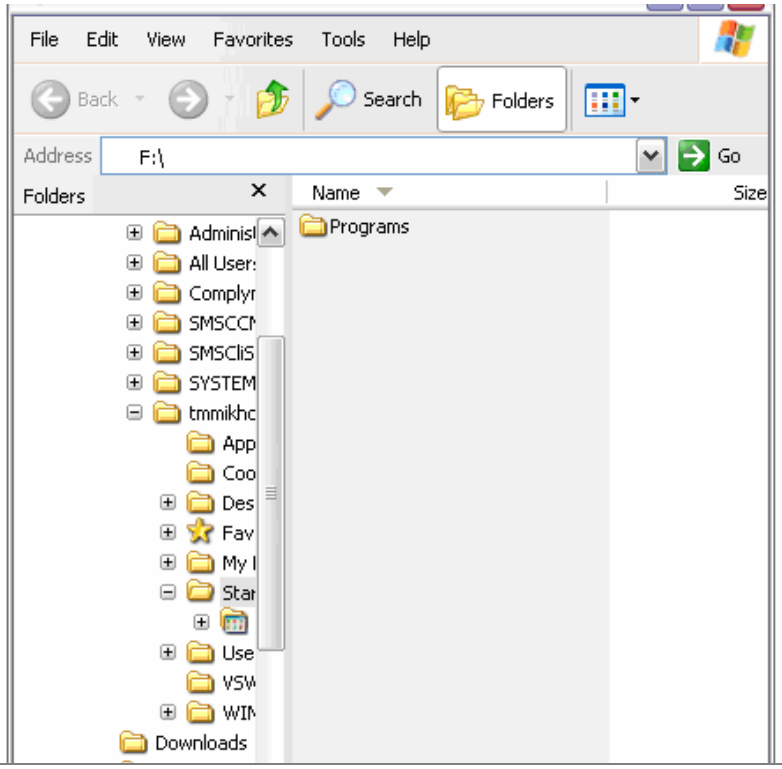
8.9.3 Landing screen: Recovery Drive Files accessed



2.2.3 Asset Table – Landing screen: Recovery Drive Files accessed

Use Case(s)	Recovery drive files accessed
Localization Notes	The Detail and Warning text boxes will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created, Access Recovery Drive Files selected
State	Recovery drive in read-only
Purpose	Show dialog after selecting Access Recovery Drive Files
Action 1 Left Pane	→ Hide Recovery Drive Files
Action 2 Right Pane	N/A
Event information	From this dialog, the end-user will be given the option to hide the recovery drive files or modify the recovery drive files. At this stage no allowed updates are allowed as files are viewed in read-only. Regardless of which update policy state the end-user is accessing the recovery drive files, the same screen will display.

8.9.4 Windows* Explorer window



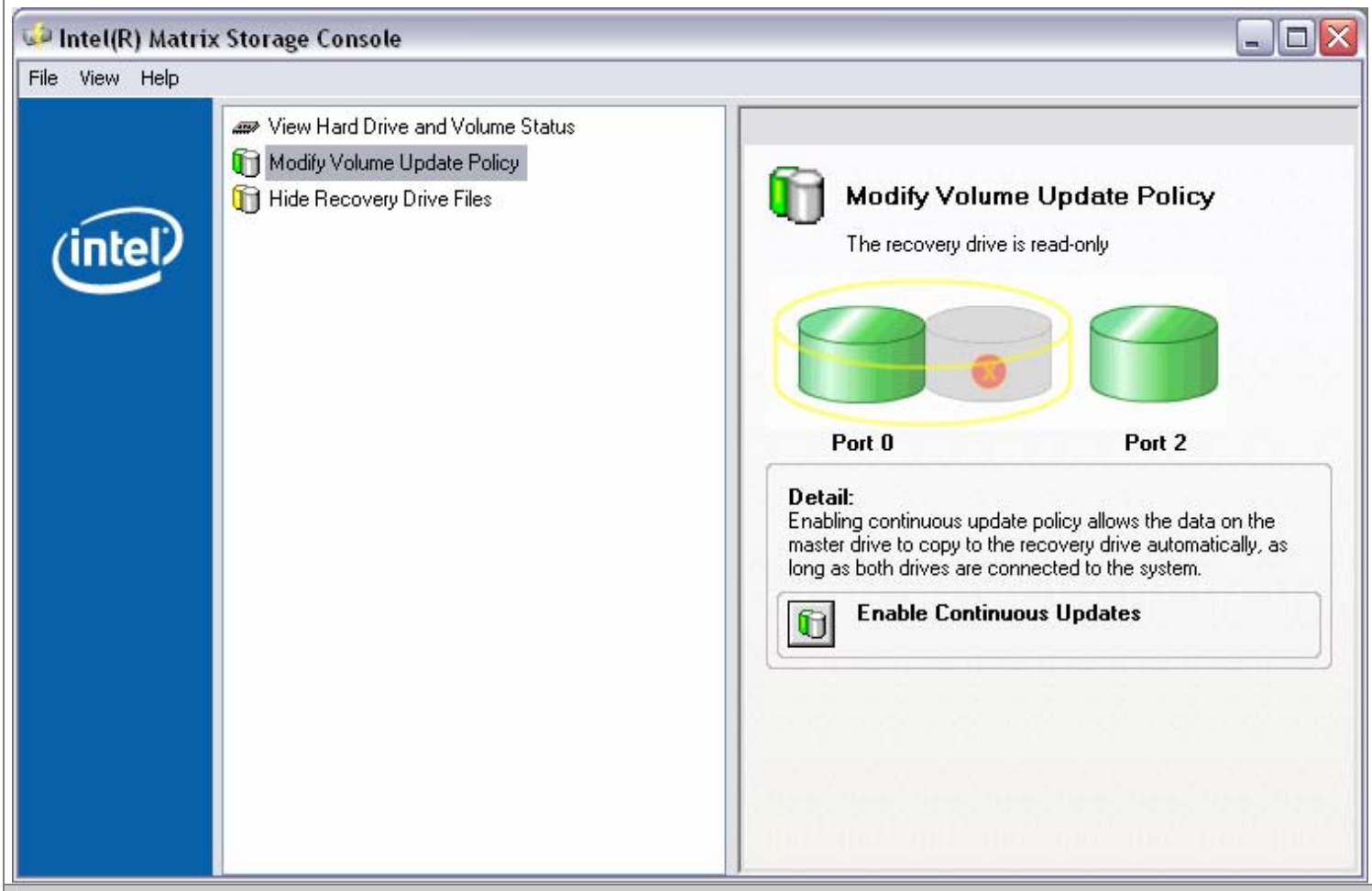
2.2.4 Asset Table – Windows* Explorer window	
Use Case(s)	Windows* Explorer window
Localization Notes	
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created, Recovery Drive Files accessed and end-user o Windows* Explorer
State	Recovery drive in read-only
Purpose	Show recovery file display using Windows* Explorer after user opens application
Action 1 Left Pane	N/A
Action 2 Right Pane	N/A
Event information	The default focus is placed on the Windows* Explorer window. From this stage of the flow, the end-user has 2 options: → Close or minimize the window → Set focus on the Matrix Storage Console dialog to take the next step.

8.10 Hide Recovery Drive Files / Modify Volume Update Policy

Two actions will hide the recovery drive files:

- Enable the continuous update policy
- Hide the recovery drive files

8.10.1 Hide Recovery Drive Files / Modify Volume Update Policy

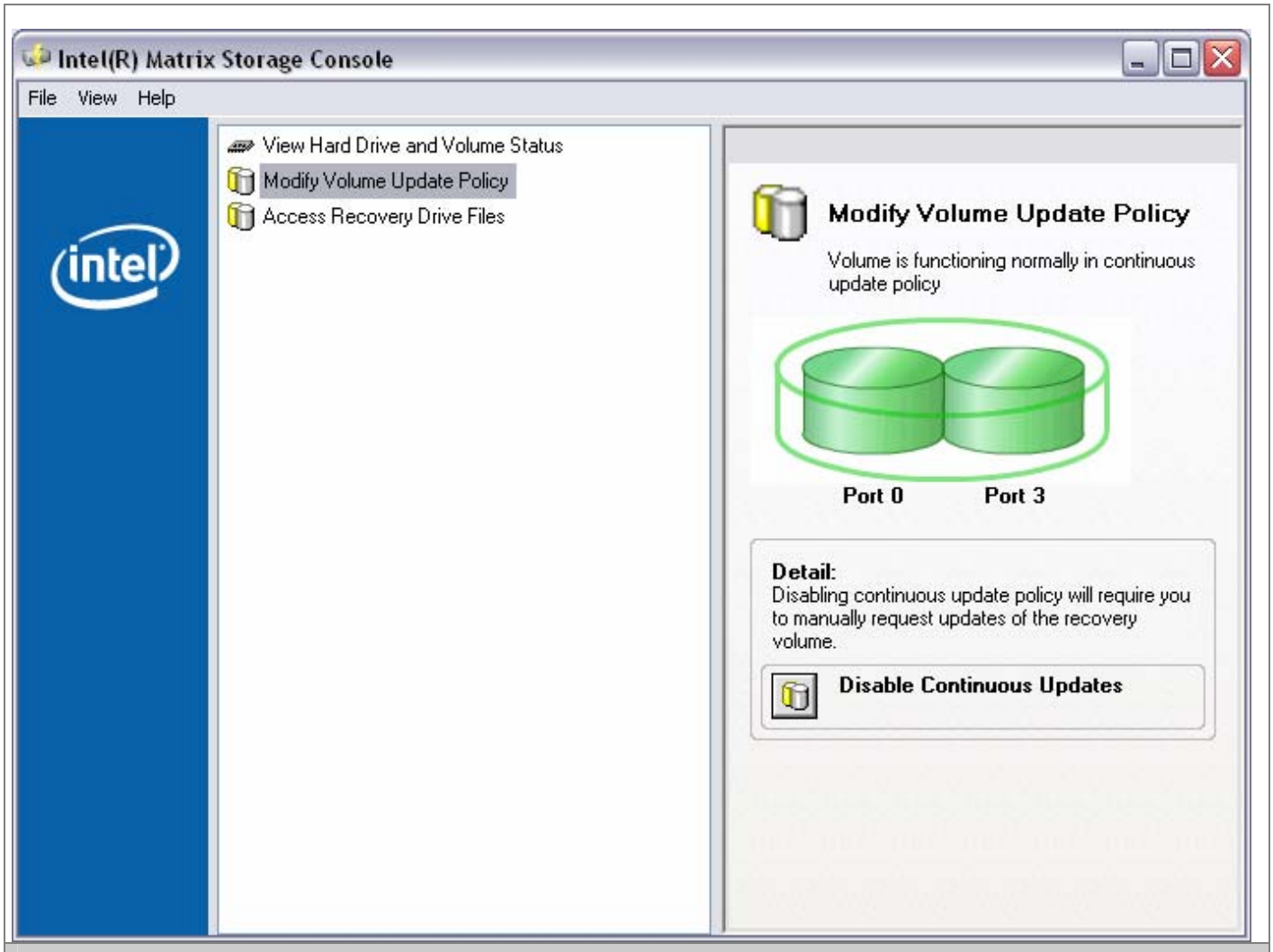


2.3.1 Asset Table – Hide Recovery Drive Files / Modify Volume Update Policy

Use Case(s)	Hide the recovery drive files by enabling continuous updates
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created, recovery drive files accessed
State	Read-only
Purpose	Hide the recovery drive files and enable continuous updates
Action 1 Left Pane	→ Click Modify Volume Update Policy
Action 2 Right Pane	→ Click Enable Continuous Updates

Event information	This action will set the Recovery Volume Policy to Continuous Update and data on the master drive is copied to the recovery drive automatically. The recovery volume updates can only occur if the drive files are hidden and removed from the Windows* Explorer window.

8.10.2 Landing Screen: Continuous Update Policy



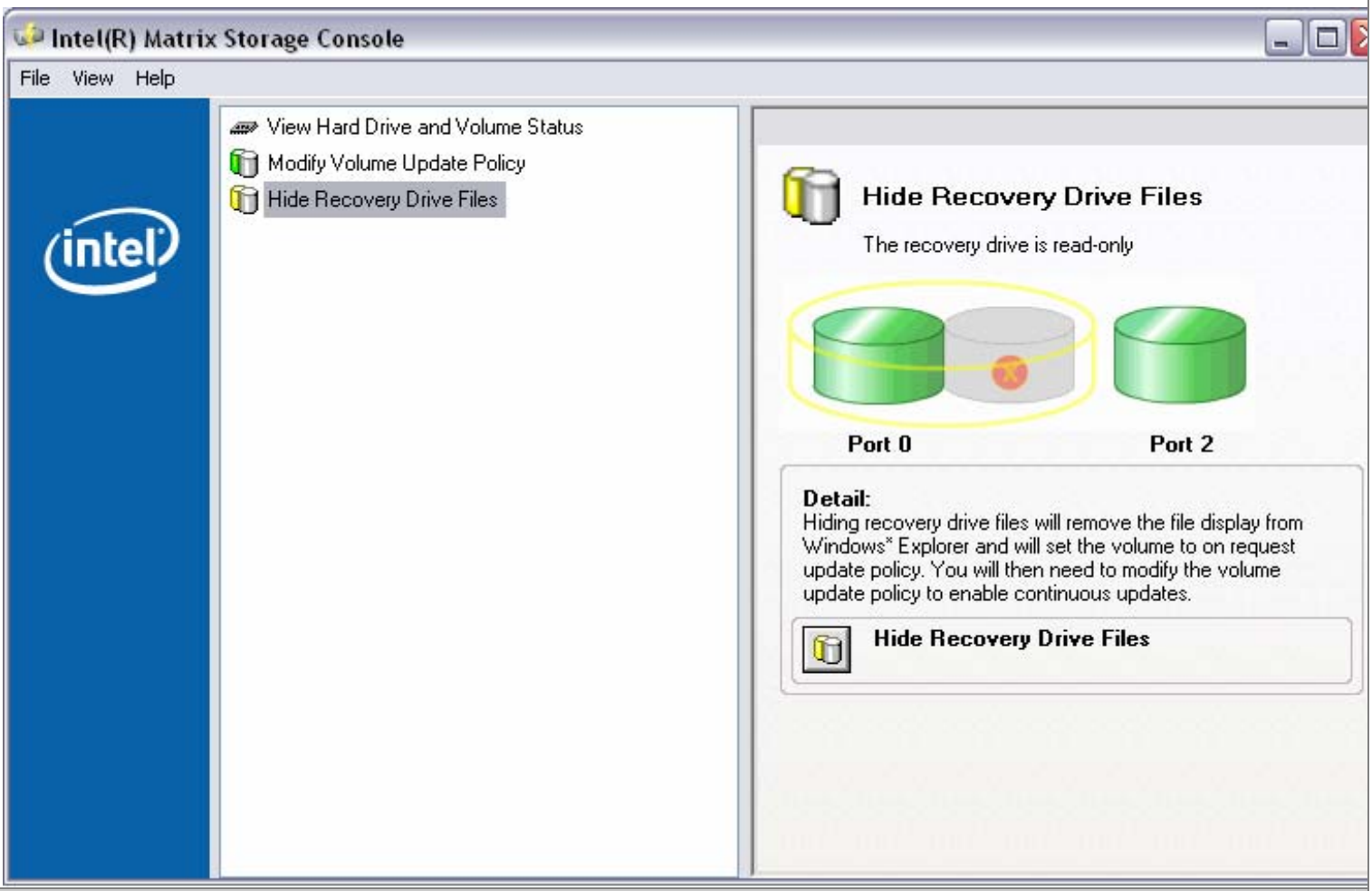
2.3.2 Asset Table – Landing Screen: Continuous Update Policy

Use Case(s)	Continuous Update Policy
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)

Product Conditions	1 Recovery volume created
State	Continuous
Purpose	Show landing screen after enabling continuous updates
Action 1 Left Pane	→ Click Modify Volume Update Policy
Action 2 Right Pane	N/A
Event information	Enabling continuous updates allows data on the master drive to copy automatically to the recovery drive. This action will put the volume in continuous update policy and hide the recovery drive files.

8.11 Hide Recovery Drive Files / On Request Update Policy

8.11.1 Hide Recovery Drive Files / On Request Update Policy

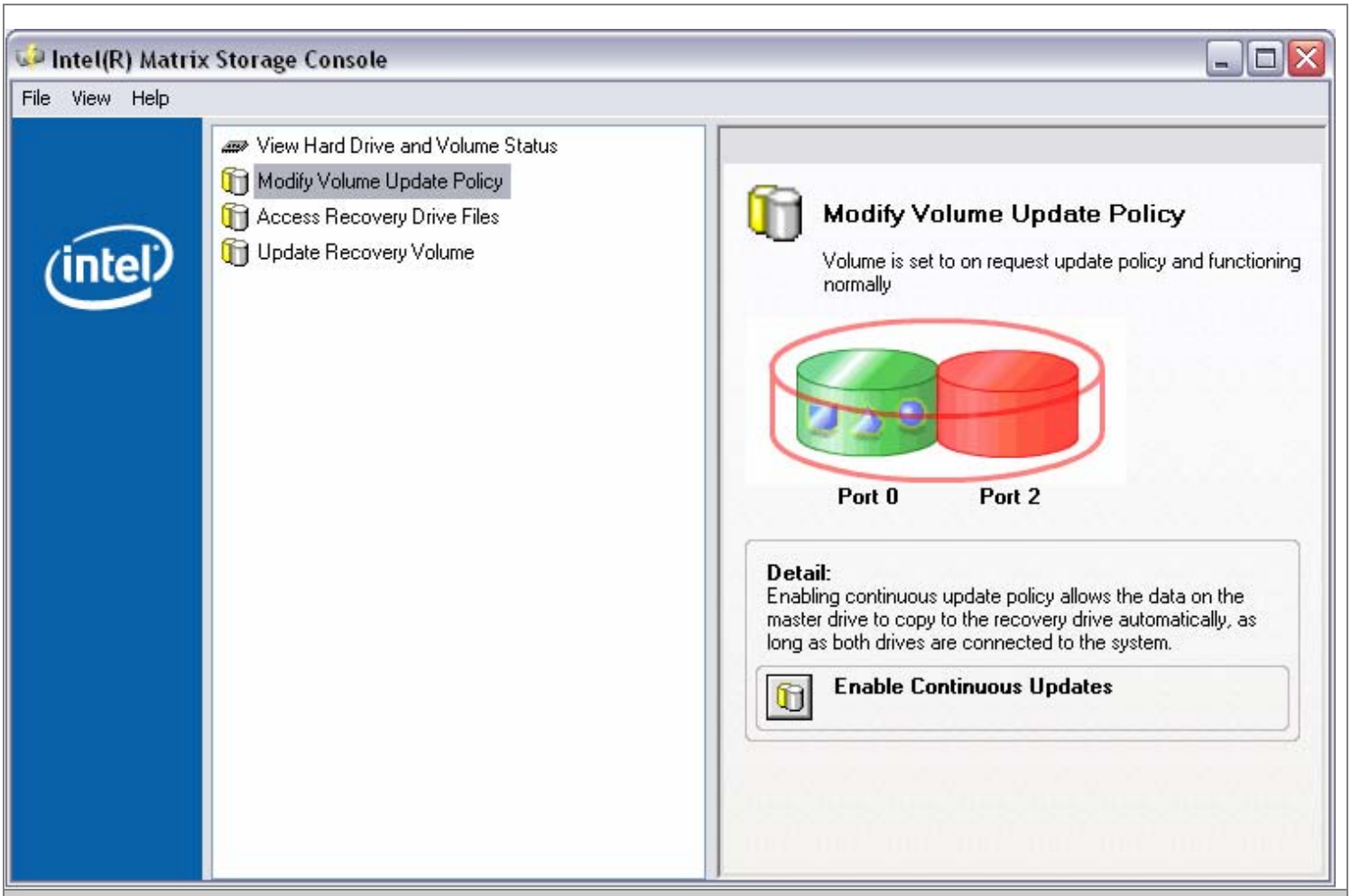


2.4.1 Asset Table – Hide Recovery drive Files

Use Case(s)	Hide Recovery drive Files / On Request Update Policy
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.
System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created, recovery drive files accessed
State	Read-only

Purpose	Hide the recovery drive files and return volume to on request update policy
Action 1 Left Pane	→ Hide Recovery Drive Files
Action 2 Right Pane	→ Hide Recovery Drive Files
Event information	This action will hide the recovery drive files from Windows* Explorer window. The volume returns to on request update policy and automatic updates of the recovery volume are disabled.

8.11.2 Landing screen: On Request Update Policy



2.4.2 Asset Table – Landing Screen: On Request Update Policy

Use Case(s)	On Request Update Policy
Localization Notes	The Detail text box will resize automatically based on the space needed to display localized text accurately. The risk for cut text will be very low.

System configuration	Only 2 Hard Drives connected (system drive and back up drive)
Product Conditions	1 Recovery volume created
State	In On Request Update Policy
Purpose	Show landing screen after hiding recovery drive
Action 1 Left Pane	→ Click Modify Volume Update Policy
Action 2 Right Pane	N/A
Event information	The volume returns to on request update policy and automatic updates of the recovery volume are disabled. The end-user needs to request updates manually by selecting Update Volume. Only changes since the last update process are copied. The recovery volume will remain in On Request Policy until the end-user enables continuous updates.

Note: The Basic mode screen supports the display of only 2 hard drives in the graphical animation.

8.12 Advanced Mode Operations

8.12.1 Changing Continuous Update Policy to On Request Update Policy

To change from Continuous update policy to On Request Update Policy, select the Advanced mode, right-click on the Recovery volume and select Disable Continuous Update.

Follow the below steps to change from On Request Update Policy to Continuous update policy:

1. Right click on the Volume name under Volume and select ‘Disable Continuous Update’.

OR

1. Right-click on the ‘Recovery volume’ and select ‘Modify Volume’.
2. Click ’Next’ on the Modify Recovery Volume Wizard dialog box.
3. On the next screen, select ‘Continuous update’ policy.
4. Select ‘Next’ and then ‘Finish’ to complete the operation.

8.12.2 Accessing Recovery Disk Files through Advanced Mode

Follow the below steps to access the Recovery disk files

Note: Mounting or accessing the Recovery disk will result in displaying the Recovery disk in Windows file explorer. The disk contents will be write protected to preserve data integrity with Master disk.

1. Make sure that the Recovery volume is in On Request Update Policy mode.
2. Then right-click on the Recovery volume name and select 'Access Recovery Drive Files'.
3. Click 'OK' on the information dialog box. The Recovery disk will now be mounted. The files on the Recovery disk can be access using Windows* file explorer.

Follow the below steps to un-mount the Recovery disk

1. In the Advanced mode, right-click on the Recovery volume name.
2. Select 'Hide Recovery Drive Files'.
3. Select 'OK' on the information dialog box.

The recovery disk shall then reappear in Intel® Matrix Storage Manager Console.

? Conditions when Modify option should be available in continuous update mode.

8.12.3 Scenarios of Recovering Data

Scenario 1:

What happens if the Recovery drive that is part of the Intel® Rapid Recover Technology volume fails or gets stolen?

Solution:

When a Recovery drive that is part of a Intel® Rapid Recover Technology volume fails, follow the below steps to set up a new disk as the Recovery drive.

Shut down the system.

Remove the failed Recovery disk and insert a new hard drive. The size of the new drive must be greater than or equal to the Master drive.

Boot to the Master drive and open Intel Matrix Storage Manager.

Open Advanced mode and right click on the new drive and select 'Rebuild to this drive' option. A new Recovery Drive will be created.

Scenario 2:

What happens if the Master Drive fails and/or the user would like to do a reverse synchronization to a new Master Drive?

Solution:

If the Recovery volume was in Continuous update policy when the Master drive crashed, then the system will continue to function off of the Recovery drive.

If the Recovery volume was in Update on Request policy, then a Master drive failure may result in a BSOD.

In either case, follow the below steps to create a new Master drive using the Recovery Drive.

1. Shut down the system.
2. Remove the old Master disk and connect a new Hard Disk Drive to be designated as the new Master disk. **Note:** The size of the new Master drive should be less than or equal to the Recovery disk.
3. Power on the system. It will automatically boot from the Recovery drive. After the operating system is running, select the Intel® Matrix Storage Console from the Start Menu or click the Intel® Matrix Storage Manager tray icon. From the View menu, select 'Advanced Mode' to display a detailed view of the Intel Matrix Storage Console.
4. Under 'Non-RAID Hard Drives', right-click on the new hard drive and select 'Rebuild to this Hard Drive' to begin the recovery process.
5. To view the recovery progress, right-click on the recovery volume and select 'Show Recovery Progress'. A tray icon message will pop up when the migration is complete and the volume's 'Status' will display 'Continuous Update' or 'Needs Update' depending on which update policy the recovery volume was set to before the original master drive was removed.

Scenario 3:

What is the expected behavior if a power failure occurs (and no battery supply available) in the middle of migration for each of the below?

- Creating a recovery volume (migration)
- Updating a recovery volume (Copy some files from Master drive to Recovery drive)
- Verifying a recovery a volume
- Verify and Repair a recovery volume
- Recovering a recovery volume (copy from a Recovery drive to a Master Drive

Solution:

In each case, upon the next reboot, the migration, or Verifying a Recovery Volume, or Verify and Repair a Recovery Volume or Recovering a Recovery Volume operation would continue normally starting from where it had been interrupted by the power failure.

In the case where the Recovery volume was getting updated or was being recovered, if it were a fast synchronization, then if writes had been in progress while the power was lost, then it would result in a dirty shutdown. As a result, the fast synchronization would degenerate to a slow synchronization or a complete update.

Note: If the system is running is on battery, the volume will not synchronize if it is in continuous update policy. If the volume is in Update on Request policy, then the synchronization will be successful.

Additional comments: need to call out that an on update volume should first be updated before the recovery disk is valid.

Scenario 4:

One a system with configured with Intel Raid Recover Technology, a user would like to revert the Master Drive Data to a Previous State.

Solution:

If the recovery volume is set to the on request update policy, you can revert master drive data to the state it was in at the end of the last volume update process. This is especially useful when a virus is detected on the master drive or guests use your system.

1. Restart the system. During the system startup, press Ctrl-I to enter the user interface of the Intel® Matrix Storage Manager option ROM.
2. In the 'MAIN MENU' select 'Recovery Volume Options'.
3. In the 'Recovery Volume Options' menu, select 'Enable Only Recovery Disk' to boot from the recovery drive.
4. Exit the option ROM and start up Windows*.
5. After the operating system is running, select the Intel® Matrix Storage Console from the Start Menu or click the Intel Matrix Storage Manager tray icon.
6. From the View menu, select 'Advanced Mode' to display a detailed view of the Intel Matrix Storage Console.
7. Right-click on the recovery volume in the device pane and select 'Recover Data to Master' to begin the recovery process.
8. To view the recovery progress, right-click on the recovery volume and select 'Show Recovery Progress'. A tray icon message will pop up when the migration is complete and the volume's 'Status' will display 'Needs Update'. Any data changes will now be written to the master drive.

8.12.4 Intel® Rapid Recover Technology States

The below table provides details on the various states of a Recovery volume as shown in the RAID Option OROM and the Intel Matrix Storage Console.

State	IMSM Console "Status" Text	OROM Status Text
Recovery Volume pair	Continuous Update	Updated
Broken Recovery Volume		
Access Recovery disk files	Recovery Drive Read-Only	NeedsUpdate
Updating	Volume Update in Progress: x% Complete	Updating
Normal	Needs Update	NeedsUpdate
Normal (When recovery drive unplugged.)	Recovery Drive Missing	RcDrvMissing
Invalid Partner		
Degraded		
Access Recovery disk files	Master Drive Read-Only	NeedsUpdate
Updating	Recovery in Progress: x% Complete	Updating
Normal	Master Drive Failed	NeedsUpdate
Normal (When Master drive unplugged)	Master Drive Missing	MrDrvMissing

Table: Intel Rapid Recover Technology States

9 System Running off Recovery Drive

The “System Running off Recovery Drive in Basic Mode” flow is an existing feature in the current UI but is documented here for the sole purpose of providing Validation and Localization with the flow of expected behavior for test pass preparation.

9.1 Drive Offline or Missing

System Configuration	2 hard drives: recovery drive connected, master drive offline or missing
Product Condition	Recovery volume created with recovery drive normal and master drive offline or missing

- Access UI OROM – Note that the master drive is designated as an offline disk or master drive missing
- Select option 4 Recovery Volume Options

Then Select Option 2 Enable Only Recovery Disk.

10 Pre-Installation of the Intel® Matrix Storage Manager Driver

The Intel Matrix Storage Manager driver must be installed before installing Windows XP on a RAID volume or when in AHCI mode. The Intel Matrix Storage Manager driver must be installed before installing Windows Vista on a RAID volume or when in AHCI mode Intel Matrix Storage Manager AHCI driver can be installed over Vista's native AHCI driver.

10.1 Pre-Installation Using the "F6" Method

1. When you start installing Windows XP and older operating systems, you may encounter a message stating, "Setup could not determine the type of one or more mass storage devices installed in your system". If this is the case, then you are already in the right place and are ready to supply the driver. If this is not the case, then press F6 when prompted at the beginning of Windows setup.

2. Press the 'S' key to select 'Specify Additional Device".

3. You should be prompted to insert a floppy disk containing the manufacturer-supplied driver into the A: drive. This disk should contain the driver which includes: **Note**: For Windows Vista you can use Floppy, CD/DVD or USB.

   - Driver binary (iastor.sys),
   - INF files (iastor.inf and iaAhci.inf),
   - cat files (iaStor.cat and iaAhci.cat) and
   - TxtSetup OEM file (txtsetup.oem).

These should be in the root directory of the floppy. See Section 7.3 for instructions on making a driver installation disk.

For Windows Vista:

1. During the Operating system installation, after selecting the location to install Vista click on 'Load Driver' button to install a third party SCSI or RAID driver.

2. When prompted, insert the floppy disk or media (Floppy, CD/DVD Or USB) you created in step 3 and press Enter.

3. You should be shown a list of available RAID / SCSI Adapters.

4. Select the appropriate Intel RAID controller and press ENTER.

5. The next screen should confirm that you have selected the Intel® RAID controller. Press ENTER again to continue.

6. You have successfully installed the Intel® Matrix Storage Manager driver, and Windows setup should continue.

7. Leave the disk in the floppy drive until the system reboots itself. Windows setup will need to copy the files from the floppy again after the RAID volume is formatted, and Windows setup starts copying files.

10.2 Unattended Installations of Microsoft Windows XP

To install the driver as outlined in the Microsoft document, "Deployment Guide Automating Windows NT* Setup" use the TXTSETUP.OEM file included in this package and insert the lines below into the UNATTEND.TXT file. This method is also available for Microsoft Windows XP operating system. For Windows XP, extract the iaStor.inf, iaAhci.inf, iaStor.sys, iaStor.cat, iaAhci.cat, and Txtsetup.oem files.

For Microsoft Windows XP, insert the following text into the UNATTEND.TXT file:

For system in RAID mode:

```
[MassStorageDrivers]

“Intel® 82801IR/IO  SATA RAID Controller (ICH9R/IO)” = OEM

[OEMBootFiles]

iaStor.inf

iaStor.sys

iaStor.cat

Txtsetup.oem
```

For systems in AHCI Mode:

```
[MassStorageDrivers]

“Intel® 82801IR/IO  SATA AHCI Controller (ICH9R/IO)” = OEM

[OEMBootFiles]

iaAhci.inf

iaStor.sys

iaAhci.cat

 Txtsetup.oem
```

10.3 Creating a Floppy Disk containing the Intel Matrix Storage Manager Driver

This procedure should be used to create a floppy disk containing the Intel Matrix Storage Manager driver for use in installing the driver using the “F6 method”.

10.3.1 Method 1 – Using Install applications

1. On a system running Microsoft Windows, download the Intel Matrix Storage Manager package or obtain it from your Intel representative. The package contains the following files:
   - iata_enu.exe (English only executable)
   - iata_enu.zip (English only zip package)
   - iata_cd.exe (Multi-language executable)
   - iata_cd.zip (Multi-language zip package)
2. For convenience copy the above files into the C:\ drive.
3. Insert a blank, formatted floppy disk into the A: drive.
4. Unpack the iata_enu.zip or iata_cd.zip files. The setup.exe will be located in path “..\iATA_ENU\Disk1” for English version.
5. Choose the language in which you want the driver to be supported and execute the commands described below. From Windows command prompt, type the following commands:
6. Using Setup.exe – English version:
   a. `C:\>setup.exe -a -p c:\IAAdriver`
7. Using iata_enu.exe - English version (Alternate Method):
   a. `C:\>iata_enu.exe -a -a -p c:\IAAdriver`
8. Using iata_cd - Multi-language version:
   a. `C:\>iata_cd.exe -a -a -p c:\IAAdriver`

   **Where `C:\IAAdriver` is an already existing folder on the c: drive
9. After this is done, copy the driver binary files, INF files and the txtsetup.oem file from the local directory `C:\IAAdriver\Driver` to the root directory of the floppy.

10.3.2 Method 2: Using F6 application

On system running Windows, download the application f6flpy32.exe for 32-bit operating system or f6flpy64.exe for 64-bit operating system to your local drive.

1. Double click on the application. A dialog box prompting you to 'Insert floppy to write' will show-up.
2. Insert a blank floppy into floppy drive and click "OK" to proceed.
3. The application will perform the following tasks
   - Formatting of the disk
   - Writing data into the disk
   - Verification of the validity of data in the disk.
4. After the task is done, the "About Self-Extractor for WinImage" will be displayed. Click "OK" to exit.
5. Now your floppy disk will have the valid Intel Matrix Storage Manager Driver which can be used for F6 method.

11 Determining Software Component versions

11.1 Determining the version of the RAID driver

There are two ways to do this. The first is to use the Intel Matrix Storage Console. It reports the current version of the driver installed. The second is to locate the driver (iaStor.sys) itself and view its properties.

11.1.1 Using Intel Matrix Storage Console

1. Run the Intel Matrix Storage Console from the following Start Menu path:
2. Start→All Programs→Intel® Matrix Storage Manager→Intel Matrix Storage Console
3. Select 'System Report' from the View menu. 'System Report' will be displayed.
4. Choose Intel® RAID Technology tab. Look for a parameter labeled "Driver Version". It should have a number in the following format: 8.0.0.xxxx
5. This is the current version of the user interface utility installed on your system. The 8.0.0 portion is the product release number; the xxxx portion is the build number.

11.1.2 Using Intel Matrix Storage Manager File Properties

1. Locate the file "iaStor.sys" within the following path:

   <System Root>\Windows\System32\Drivers
2. Right Click on "iaStor.sys" and select Properties
3. Select the "Version" tab
4. At the top of this tab, there should be a parameter called "File version". Next to it is the version of the driver currently installed on your system. It should have the same format and version as the one you obtained using the Intel Matrix Storage Console

11.2 Determining the Version of the Option ROM

There are two way to determine the version of the Intel Matrix Storage Manager option ROM integrated into the system BIOS. Use the following procedure to determine the version.

11.2.1 Using the Intel Matrix Storage Console

1. Follow the procedure illustrated in section 11.1.1
2. Look for the parameter RAID Option ROM.

11.2.2 Using the Intel Matrix Storage Manager Option ROM User Interface

1. Early in system boot-up, during post, or when you see the “Intel® RAID for Serial ATA” status screen output, type CTRL-I. This will open the Option ROM user interface.
2. The following banner will be displayed:
3. Intel® Matrix Storage Manager option ROM v8.0.0.xxxx ICH8M
4. V8.0.0.xxxx is the version of the Option ROM currently installed on your system. The 8.0.0 portion is the product release number; the xxxx portion is the build number.

12 Uninstallation

Uninstalling the RAID driver could potentially cause an end-user to lose access to important data within a RAID volume. This is because the driver can only provide functionality for the ICH9 I/O controller. Therefore, Intel does not provide a way to permanently remove the driver from the system. However, disabling the SATA RAID Controller causes the operating system to not use the RAID driver.

The uninstallation application that is included with the Intel Matrix Storage Manager software can remove all components except the RAID driver (i.e. it removes the UI application, Start Menu links, Control Panel Applet, etc.).

Use the following procedures to remove the Intel Matrix Storage Manager software or to disable the SATA RAID controller:

12.1 Uninstalling the Intel Matrix Storage Manager Software (except the RAID Driver)

1. Run the Uninstall program from the following start menu link:

2. Start→All Programs→Intel® Matrix Storage Manager→Uninstall

3. The first dialog box that appears gives you the option of un-installing all components of the Intel Matrix Storage Manager software except the RAID driver. Click OK to do so.

4. The next dialog box is a confirmation that you would like to un-install all components of the software except the RAID driver. Click Yes to confirm.

5. All components of the software will be un-installed except the RAID driver. You should no longer see any Start menu links to the UI application or a control panel applet for Intel Matrix Storage Manager. However, the RAID configuration should still function normally.

12.2 Disabling the RAID Driver by Disabling the RAID Controller

1. Enter System BIOS Setup and disable RAID Mode. This setting may be different for each motherboard manufacturer. Consult your manufacturer's user manual if necessary. When done, exit Setup.

2. Reboot the system. You should no longer see the RAID Option ROM status screen during boot, and you should no longer see the ICH9 I/O controller in Device Manager.

3. At this point, Windows will no longer be using the RAID driver and you will not have Intel RAID functionality. All data contained in existing RAID volumes will no

longer be accessible. To re-enable Intel RAID functionality, re-enter System BIOS Setup and re-enable RAID mode.

Uninstall Note: End-users can use this same procedure to disable the SATA RAID Controller if necessary. In fact, the uninstall program used in section 9.1 of this document will display a text file with a similar procedure. Run the Uninstall Program, click Cancel when presented with the first dialog box, then click Yes at the second dialog box to read the text document containing the procedure.

13 Registry Customizations

After installation of the Intel Matrix Storage Manager, the registry will contain keys to allow customization of several features. The registry key used to customize the Intel Matrix Storage Manager is at the following path:

HKEY_LOCAL_MACHINE/SOFTWARE/Intel/Intel Matrix Storage Manager

13.1 Tray Icon Configuration

This value configures the tray icon balloons for the following behaviors:

"RAIDNotificationIcon"=

Value	Description
0x0 - Disabled	The tray icon will not be shown. The user will not receive notifications using balloons or dialogs.
0x1 – No SMART	The tray icon only shows notification for RAID volume status changes and hard drive failures. SMART event notifications are not shown.
0x2 – Default	The tray icon only appears when a balloon is presented or there is a migration or rebuild occurring. The mode shows all events.
0x3 – Persistent Tray Icon	The tray icon will be shown in the system tray at all times. No other functionality is affected.

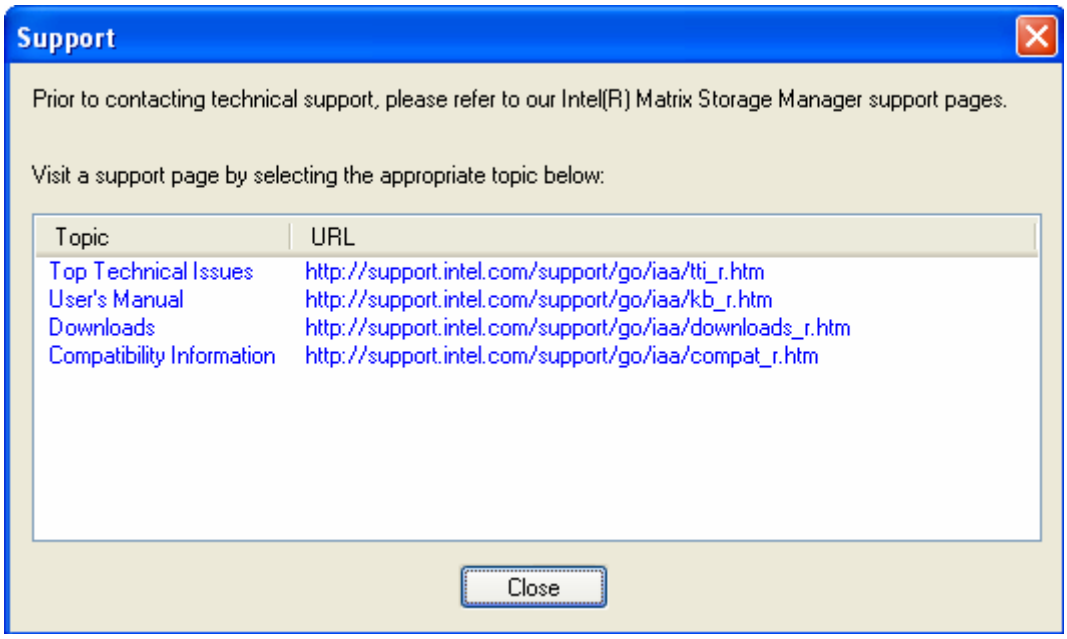
13.2 User Notification Dialogs

"RAIDNotificationDialogs"=

0x0 – Disabled	This mode does not present any dialogs.
0x2 – Enabled All	This mode presents dialogs for all events

13.3 Customize Support URLs in Intel Matrix Storage Console

The Intel Matrix Storage Console Help Menu, Submenu Support when selected will display a pop-up window with the support URLs as shown in the figure below:



These URLs can be changed to be OEM-specific by following the procedure listed below:

Method 1: Manual Registry

1. Run Regedit.exe from command prompt.

2. Select “HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Matrix Storage Console” key.
3. Add STRING values in the following form:

ResourceN	REG_SZ	myurl
ResourceNURL	REG_SZ	http://www.myurl.com

Where N is any value from 0-49.

Method 2: Using SetupCfg.reg

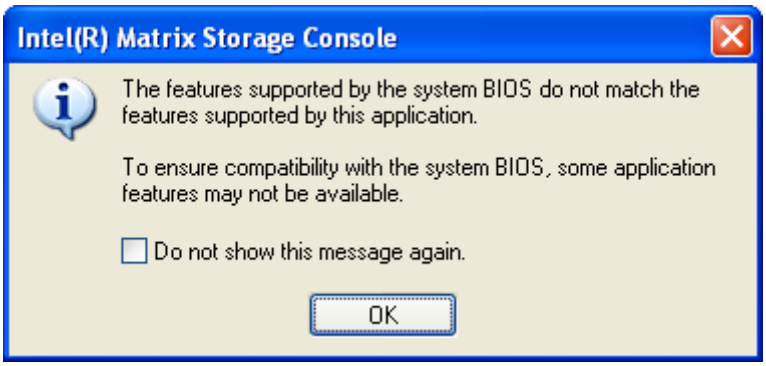
Edit the setcfg.reg file and append the following lines:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Matrix Storage Console]
"Resource0URL"="http://www.xxx.com"
"Resource0"="Test xxx"
"Resource1"="Test yyy"
"Resource1URL"="http://www.yyy.com"
```

"Resource3"="Test zzz"
"Resource3URL"="http://www.zzz.com"
"Resource4"="Test aaa"
"Resource4URL"="http://www.aaa.com"

13.4 Disable the pop-up Window with BIOS incompatibility Warning

When a window warning is displayed in Intel Matrix Storage Console, as shown in the figure below, follow the procedure given below if you intend to suppress the warning.



Method 1:

Check the “Do not show this message again” box.

Method 2: Registry entry

1. Run `regedit.exe` from the command prompt.
2. Select “HKEY_LOCAL_MACHINE\Software\Intel\Intel Matrix Storage Console” key.
3. Add a new string “PlugInRAID.pin_CompatibilityMsg” with value to enable or disable:
   - "PlugInRAID.pin_CompatibilityMsg"=dword:00000000
   - dword:00000000 – Disable
   - dword:00000001 - Enable
4. Exit the Regedit application.
5. Open Intel® Matrix Storage Console from Start menu.
6. Confirm the above window is not displayed.

13.5 Native Command Queuing Settings

Native Command Queuing (NCQ) is enabled by default on both mobile and desktop platforms.

NCQ can be enabled or disabled using the below registry key.

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaStor\Parameters\SATA

"NCQEnable"=dword:00000000; Native Command Queuing (1=Enabled)

13.6 Honoring Operating System's Flush Requests

Honoring OS flush commands can be enabled or disabled using the below registry key.

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaStor\Parameters]

"EnableFlush"=dword:00000001 ; 1=Enabled, 0=Disabled (default)

14 Enabling Link Power Management with Intel® Matrix Storage Manager

Intel® Matrix Storage Manager implements the Link power management (LPM) feature described by the Serial ATA specification to overcome the power demand of a high-speed serial interface, SATA and providing the capability of SATA at the minimum power cost. LPM, when used in conjunction with a SATA hard drive that supports this feature, enables lower power consumption. LPM was initially enabled on mobile platforms starting ICH6M with Intel® Matrix Storage Manager. Starting with ICH9R this feature has also been enabled on desktop platforms with Intel® Matrix Storage Manager 8.0 release. LPM is enabled by default on mobile platforms when Intel® Matrix Storage Manager is installed on the system. On platforms with ICH9R controller hub, LPM is disabled. OEM's who wish to enable LPM on their platforms follow the instructions to enable mentioned in section14.1.

14.1 Instructions to enable LPM

After system is setup with OS and Intel® Matrix Storage Manager installed, follow the below instructions to enable LPM.

1. Go to **Start->Run**
2. Type in **RegEdit** and hit the Enter Key.
3. Go to the below mentioned location to configure the registry keys for LPM

NOTE: OEM's need to configure the LPM settings by port. Ports are numbered starting with zero (please refer the Intel® Matrix Storage Manager PRD for the number of ports supported on each of the platforms)

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\iaStor\Parameters\Port0
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\iaStor\Parameters\Port1
…
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\iaStor\Parameters\Port5

4. Now add the following registry keys under the registry location mentioned in step3, if they are not available (Registry keys can be added by using automated scripts, .reg files, executable utilities, etc). If you find the below registry keys already available, please make sure the default values are as mentioned below. **

"**LPM**"=dword: 00000001 {dword: 00000000->Disable; dword: 00000001->Enable}
"**LPMSTATE**"=dword: 00000000 {dword: 00000000->Partial; dword: 00000001->Slumber}
"**LPMDSTATE**"=dword: 00000001 {dword: 00000000->Partial; dword: 00000001->Slumber}
"**DIPM**"=dword: 00000001 {dword: 00000000->Disable; dword: 00000001->Enable}

NOTE: The following issues might occur when LPM is enabled on desktop platforms with Intel® Matrix storage manager installed.

- Unable to install OS
- Performance degradation
- Timeout errors reported by iastor in Microsoft* Event Viewer*

These issues are most likely caused by one or more of the attached Serial ATA devices that do not comply with the Serial ATA LPM device specification
Please refer the below article for more details.
http://support.intel.com/support/chipsets/imsm/sb/CS-025783.htm

***Warning:** If you edit the registry incorrectly, you can cause serious problems that may require you to reinstall your operating system. Intel does not guarantee that problems that are caused by editing the Registry incorrectly can be resolved.*

15 Glossary

Term	Definition
ATA	Advanced Technology Attachment
BIOS	Basic Input/Output System
BOM	Bill Of Materials
CD	Compact Disc
Chipset	Term used to define a collection of integrated components required to make a PC function.
Hard drives	Physical hard drives attached to a RAID controller
DOS	Disk Operating System
GB	Giga-byte
HDD	Hard Drive
I/O	Input/Output
ICH	I/O Controller Hub
ICH9	Intel® 82801IR/DO SATA RAID Controller
IDE	Integrated Drive Electronics
INF	Information file (.inf) used by Microsoft operating systems that support the Plug & Play feature. When installing a driver, this file provides the OS needed information about driver filenames, driver components, and supported hardware.
Intel® Option ROM (OROM)	Standard Plug and Play option ROM that provides a pre-operating system user interface for the Intel RAID implementation.
MB	Mega-byte
Migration	Term used to describe the movement of data from one configuration or usage model to another.
OEM	Original Equipment Manufacturer
Option ROM	A code module built into the System BIOS that provides extended support for a particular piece of hardware. For this product, the Option ROM provides boot support for RAID 0/1/5/10 volumes, and provides a user interface for configuring and managing RAID 0/1/5/10 volumes.
OS	Operating System
PATA	Parallel ATA
PCI	Peripheral Components Interconnect
PFW	Package for the Web
PIO	Programmed Input Output
PnP	Plug and Play

Term	Definition
Port 0..3	Term used to describe the point at which a SATA drive is physically connected to the SATA Controller. Port n is the nth of the four available ports in ICH9 systems, where n=0..3
RAID	Redundant Array of Independent Disks
RAID 0	A RAID level where data is striped across multiple physical hard drives (aka striping)
RAID 1	A RAID level where data is mirrored between hard drives to provide data redundancy (aka mirroring)
RAID 5	A RAID level where data and parity are stripped across the hard drives to provide good read/write performance and data redundancy. The parity is stripped in a rotating sequence (aka Stripping and rotating parity).
RAID 10	A RAID level where information is striped across a two disk array for system performance. Each of the drives in the array has a mirror for fault tolerance. (aka Stripping and mirroring)
RAID volume	A block of capacity allocated from a RAID Array and arranged into a RAID topology. Operating Systems typically interpret a RAID volume as a physical hard drive.
RAM	Random Access Memory. Usually refers to the system's main memory
ROM	Read Only Memory
SATA	Serial ATA
SCSI	Small Computer System Interface
SP#	Service Pack (number)
Strip	Grouping of data on a single physical hard drive within a RAID volume
Stripe	The sum of all strips in a horizontal axis across physical hard drives within a RAID volume
UI	User Interface