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Microsoft® Windows®

Aligning Disk Sectors for Optimal Performance

Abstract

This Technical Report describes how to use the DiskPar or DiskPart utilities to configure Microsoft Windows disk partitions to match the default RAID stripe segment size used in a PS Series storage array.

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V2.0

PS Series Firmware Version 2.0 or later.

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Revision Information

The following table describes the revision history of this Technical Report.

Revision	Date	Change
1.0	October 2005	First release
2.0	October 2006	Added Windows Server 2003 SP1 and DiskPart utility

Introduction

For optimal performance when working with PS Series group volumes accessed by Windows hosts, it is recommended that you configure disk partitions to begin on sector boundaries that are divisible by 64K (that is, evenly divisible by 65536 bytes or 128 sectors), matching the default PS Series storage array RAID stripe segment size. This improves volume and overall group performance, especially in random I/O workloads such as found with Microsoft Exchange and SQL Server.

Windows file systems have an internal structure called the master boot record (MBR). The partition table in the MBR contains the Relative Sectors field which has a default value (63) specifying the offset from the beginning of the disk to the beginning of the first partition, counting by sectors.

For disks that report more than 63 sectors per track, this causes the default starting sector to be the 64th sector. Therefore, when programs transfer data to or from these disks, allocations will begin at a sector other than the starting sector of a RAID stripe, resulting in a misalignment. Ideally, to align with the PS Series array RAID stripe segment size, the default starting sector should be the 129th sector.

Such misalignments can defeat array performance optimizations designed to avoid crossing RAID stripe boundaries within individual I/O requests. Specifically, performance suffers for random I/O loads. Microsoft provides two utilities, DiskPar and DiskPart that allow you to obtain and set partition information.

This Technical Report is divided into two discrete sections. Readers who are running Windows Server 2003 SP1 or later will follow the DiskPart procedure in the first section. Readers using earlier versions of Windows Server will follow the DiskPar procedures in the second section. The difference in these programs is DiskPart aligment is stated in kilobytes, where DiskPar aligment is stated in sectors (512 bytes).

Section 1: DiskPart (Windows Server 2003 SP1 or later)

Follow this procedure to align disk sectors using DiskPart. It assumes that the disk you are aligning is a basic disk with all partitions deleted. Diskpart states alignments in kilobytes.

Warning: If you use the DiskPart command on a partitioned disk, all data on the disk will be lost. To correct disk sector alignment on an in-use partitioned disk, you must back up the volume, stop all applications accessing the volume, and use Disk Manager to delete the partitions. Then, you can repartition the disk. After repartitioning the disk, restore the volume from the backup.

1. Open a command prompt. In the command window, run DiskPart. You should see a DISKPART> command prompt.

2. At the DISKPART> command prompt, type LIST DISK and press Enter. A list of the disks attached to this server appears.

Note: If the disk you want to align is not visible in this list, use the Disk Management snap-in to confirm the drive's existence and availability.

3. At the DISKPART> command prompt, type SELECT DISK X and press Enter. X is the number of the disk you wish to align. A message indicates that DISK X is now selected.

Warning: You are about to align the disk. Unlike DiskPar, DiskPart does not provide a way to view the existing sector alignment. Step 4 will begin the alignment process.

4. At the DISKPART> command prompt, type CREATE PARTITION PRIMARY ALIGN=64 and press Enter. The alignment process begins.

5. At the DISKPART> command prompt, type ASSIGN LETTER=<DRIVE LETTER> and press Enter. For example, to assign drive letter Q, you would type ASSIGN LETTER=Q.

6. Type EXIT to exit the DiskPart utility. The following example shows steps 2 through 6.

```
DISKPART> LIST DISK
  Disk ###   Status        Size      Free      Dyn  Gpt
  --------   ----------   -------   -------   ---  ---
* Disk 0     Online         16 GB   8033 KB
  Disk 1     Online       4095 MB   4095 MB

DISKPART> SELECT DISK 1
Disk 1 is now the selected disk.

DISKPART> CREATE PARTITION PRIMARY ALIGN=64
DiskPart succeeded in creating the specified partition.

DISKPART> ASSIGN LETTER=Q
DiskPart successfully assigned the drive letter or mount point.

DISKPART> EXIT
Leaving DiskPart...
```

7. Format the partition as an NTFS partition.

Section 2: DiskPar (earlier versions)

There are two procedures in this section. The first shows you how to find and install DiskPar. The second uses DiskPar to align the disk sectors.

Note: You will need access to the Windows 2000 Resource Kit companion CD-ROM to install DiskPar.

Installing DiskPar

1. Locate and install the DiskPar utility on the Windows 2000 Resource Kit companion CD-ROM under the ENGLISH/W2KRESKIT directory.

2. In the ENGLISH/W2KRESKIT directory, click on setup.exe to run the Windows installer.

3. After accepting the end-user license agreement and entering your user information, select a Custom installation.

4. Select the Performance Tools option and install the entire feature.
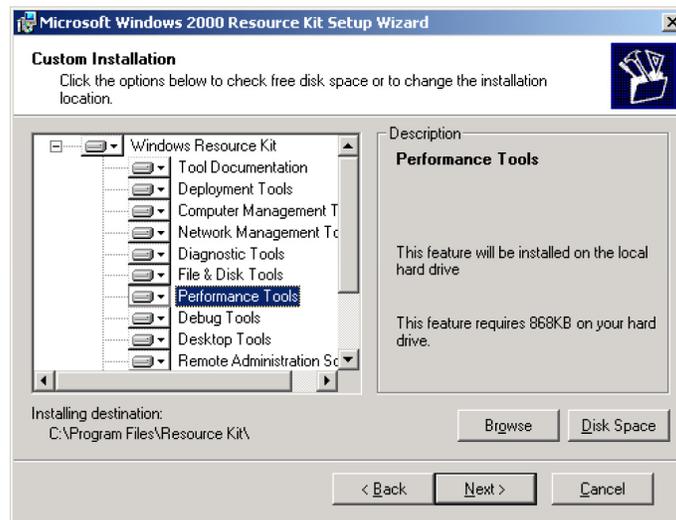
Figure 1: Install Performance Tools to install DiskPar.

After installation, DiskPar appears in the Performance Tools directory as the Disk Alignment Tool.

You can run DiskPar by double-clicking the Disk Alignment Tool icon or by entering DiskPar from a DOS command line.
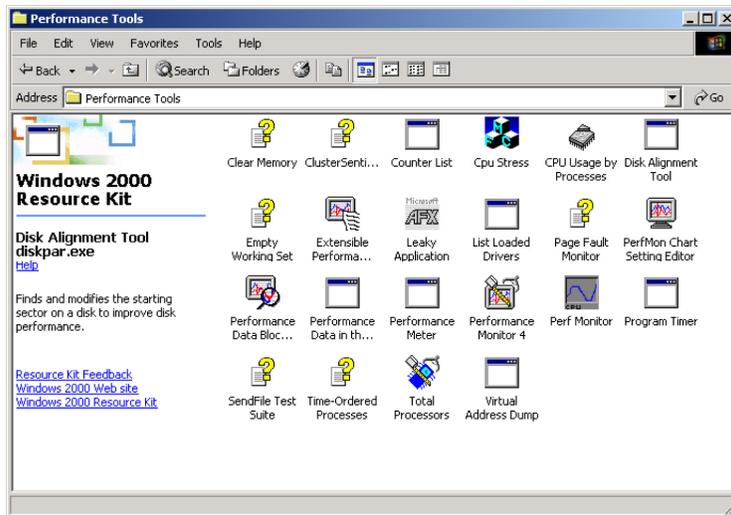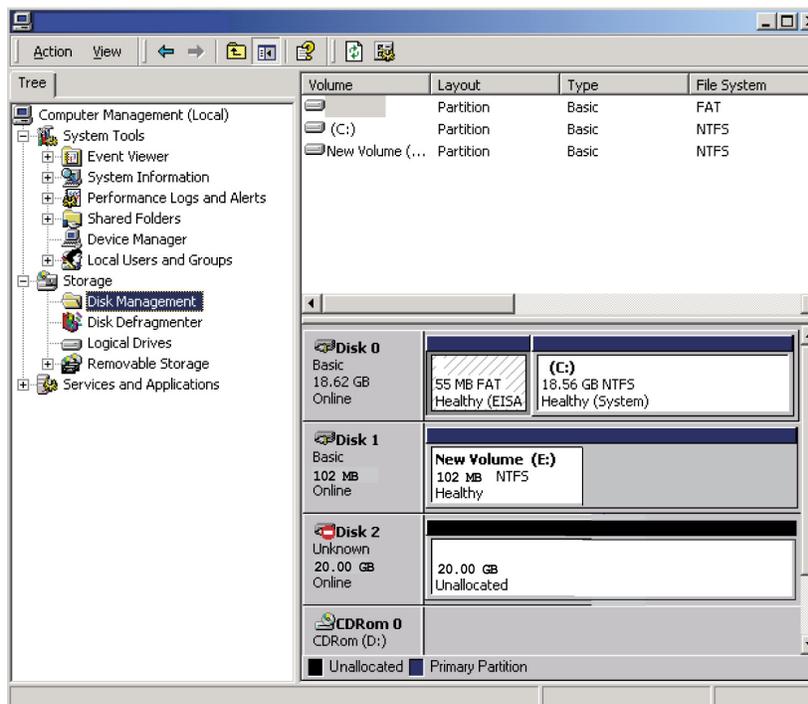
Figure 2: DiskPar appears as the Disk Alignment Tool.

After creating a PS Series group and connecting to the volume's iSCSI target from the host, ensure proper disk alignment, using DiskPar.

Checking Disk Sector Alignment with DiskPar

To check the current disk sector alignment:

1. Run Disk Manager to identify the disk containing the PS Series group volume.

Figure 3: Disk Manager Window showing Disk 1.

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2. Determine whether the disk has the correct starting offset.

   From a DOS command prompt, enter the `diskpar -i` *n* command, where *n* specifies the disk number. In the following example *n* is 1:

```
> diskpar -i 1
----Drive 1 Geometry Information ----
Cylinders = 1306
TracksPerCylinder = 255
SectorsPerTrack = 63
BytesPerSector = 512
DiskSize = 10742215680 (Bytes) = 10244 (MB)

---- Drive Partition 0 Information ----
StartingOffset = 32256
PartitionLength = 10733958144
HiddenSectors = 63
PartitionNumber = 1
PartitionType = 7
End of partition information. Total existing partitions: 1
```

   In the previous example, the StartingOffset is 32256 bytes, which is not evenly divisible by 65536. Therefore, track level misalignment can occur on this disk.

Aligning Disks Using DiskPar

Follow this procedure to correct the sector alignment (if necessary).

Warning: If you run the `diskpar -s` *n* command on a partitioned disk, all data on the disk is lost. To correct disk sector alignment on an in-use partitioned disk, you must back up the volume, stop all applications accessing the volume, and use Disk Manager to delete the partitions. Then, you can repartition the disk. After repartitioning the disk, restore the volume from the backup.

1. From a DOS command prompt, enter the `diskpar -s` *n* command where *n* specifies the disk number. In the following example, the disk number is 2.

2. When prompted, enter the new starting offset in sectors (typically, 128). Also, specify a partition length (typically, the default).

```
> diskpar -s 2
Set partition can only be done on a raw device.
You can use Disk Manager to delete all existing partitions.
Are you sure drive 2 is a raw device without any partition? (Y/N) y

----Drive 2 Geometry Information ----
Cylinders = 2612
TracksPerCylinder = 255
SectorsPerTrack = 63
BytesPerSector = 512
DiskSize = 21484431360 (Bytes) = 20489 (MB)

We are going to set the new disk partition.
All data on this drive will be lost. Continue (Y/N)? y

Please specify starting offset (in sectors): 128
Please specify partition length (in MB) (Max = 20489): 20489
```

```
Done setting partition.
---- New Partition Information ----
StartingOffset = 65536
PartitionLength = 21484273664
HiddenSectors = 128
PartitionNumber = 1
PartitionType = 7

You should now use Disk Manager to format this partition.
```

As shown in this example, the StartingOffset is evenly divisible by 65536, ensuring a correct disk sector alignment.

Note: You *must* enter a value for the partition length. If you do not enter a value, `diskpar` waits for a value without displaying a prompt.

3. Format the partition using Disk Manager.

You may need to restart Disk Manager to see the partition change.

Additional Resources

For more information, consult the following resources:

- Master boot record. See *Disk Concepts and Troubleshooting* at the following location:

  http://www.microsoft.com/resources/documentation/Windows/2000/server/reskit/en-us/Default.asp?url=/resources/documentation/Windows/2000/server/reskit/en-us/prork/pree_exa_oori.asp

- `diskpar.exe` and help on `diskpar.exe`. See the Microsoft Windows 2000 Resource Kit Help.

- Disk performance. See articles on *Examining and Tuning Disk Performance*:

  http://www.microsoft.com/windows2000/techinfo/reskit/en-us/default.asp?url=/windows2000/techinfo/reskit/en-us/prork/pree_exa_oori.asp

Documentation and Customer Support

Visit the EqualLogic Customer Support website, where you can download the latest documentation and firmware. You can also view FAQs, the Knowledge Base, and Technical Reports and submit a service request.

EqualLogic PS Series storage array documentation includes the following:

- *Release Notes*. Provides the latest information about PS Series storage arrays and groups.

- *QuickStart*. Describes how to set up the hardware and start using a PS Series storage array.

- *Group Administration*. Describes how to use the Group Manager GUI to manage a PS Series group. This manual provides comprehensive information about product concepts and procedures.

- *CLI Reference*. Describes how to use the Group Manager command line interface to manage a group and individual arrays.

- *Hardware Maintenance*. Provides information on maintaining the PS Series storage array hardware.

To access the Customer Support website, from the EqualLogic website (`www.equallogic.com`), click `Support` and log in to a support account. If you do not have an account, create one by clicking the link under the login prompt.
To contact customer support, send e-mail to `supportnp@equallogic.com`. If the issue is urgent, call 1-877-887-7337 to speak with a member of the customer support team.