

# Test Report

May 2009

Sponsored by:  
*Diskeeper Corporation*

## **Executive Summary**

### Product Evaluation:

Diskeeper Professional  
Edition vs. Built-in  
Defragmenter of  
Windows Vista

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Intertek NSTL conducted a comparative evaluation of Diskeeper® versus the Built-in Windows Vista™ Defragmenter (Windows Disk Defragmenter). While both products perform defragmentation, they have unique differences in form and function that need to be properly considered and understood for use in a production environment. To achieve that knowledge, there were 2 main objectives for this comparative evaluation:

1. Compare the **effectiveness** of Diskeeper vs. Built-in Windows Vista defragmenter
2. Compare the **performance impact** on the system while running the defragmenters

Intertek NSTL created a heavily fragmented test volume that was restored for each test scenario. We used PCMark® Vantage, a popular third party benchmarking tool for Windows Vista, to measure the performance impact of the defragmenters on the system during defragmentation, and to gauge the performance benefit to the system after defragmentation. The time to boot up the system was also measured after the two products completed defragmentation of the volume.

In order to measure the effectiveness of volume defragmentation on performance, PCMark Vantage scores were obtained prior to, during and then after defragmentation. Benchmarks revealed greater increases in scores during and after Diskeeper defragmentation as compared to the Vista Built-in defragmenter in all tests performed.

## ***Test Environment***

### **Test PC Specifications**

Motherboard: Hewlett-Packard 2820h

CPU: Intel(R) Core(TM) 2 Duo CPU E8400 @ 3.00GHz

Memory: 2GB

Hard Drive: SATA ST3750640AS 700GB

Display Device: Intel(R) Q33 Express Chipset Family

Operating System: Windows Vista Ultimate with Service Pack 1

### **Software Installed on the Test PC**

Futuremark® PCMark Vantage

Microsoft Office® 2007

Diskeeper 2009 Professional Edition (Build 13.0.835)

CreateTestDisk (Provided by Diskeeper to create fragmentation)

Acronis® True Image Echo™ Workstation

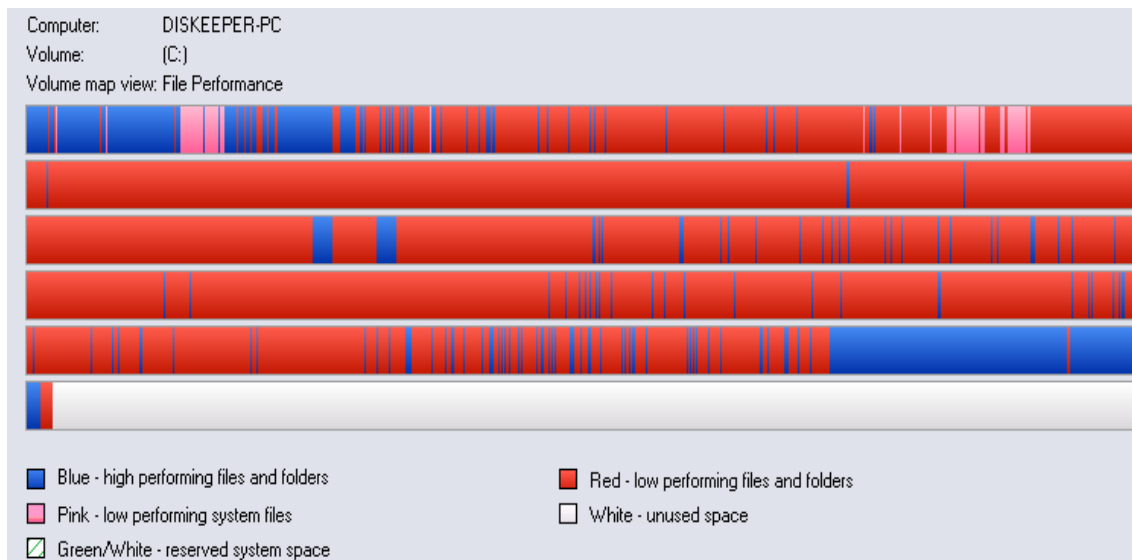
## Test Methodology

The test bed was prepared starting with a clean installation of Windows Vista Ultimate Operating System, service pack 1 and all required drivers on the test PC. A SATA hard drive (700 GB) consisted of 2 partitions C:\ (250 GB) and E:\ (450 GB) drives. Operating System and all other programs like MS Office, PCMark Vantage and Diskeeper were all installed on C:\ drive. C:\ drive was fragmented using a CreateTestDisk utility provided by Diskeeper and was used as the test volume. After fragmenting C:\ drive, the paging file was moved to E:\ and various typical operations like launching several instances of Internet Explorer, opening Word documents etc. were performed to increase the paging file size. To replicate expansion and subsequent fragmentation of the paging file over time the paging file was then moved back to C:\ to generate fragmentation of that file. This process was repeated several times to obtain 805 paging file fragments. Acronis was used to create a base image of the fragmented test volume with paging file fragmentation and was saved to E:\ of the test PC. This clean base image was restored for each test scenario during this comparative evaluation. This fragmented base image was restored for each test scenario during this comparative evaluation.

The Base image was analyzed using both Diskeeper and the Vista Built-in defragmenter. An analysis of the results of the fragmented test volume is reported below:

### Fragmented Test Volume Analysis – Diskeeper

The below image depicts the volume map of the fragmented test volume (base image) prior to any defragmentation.



This fragmented test volume was analyzed using both Diskeeper and the Windows Disk Defragmenter. Full fragmentation analysis reports are located in the appendix.

The base image of the fragmented test volume was loaded before performing any defragmentation tests.

Three iterations of defragmentation were performed on the fragmented test volume using both Diskeeper and the Windows Vista Built-in defragmenter.

Futuremark's PCMark Vantage benchmark tool was used to measure the impact on the system both during and after defragmentation. PCMark Vantage uses a proprietary scoring system that measures computer performance "across a variety of common tasks such as viewing and editing photos, video, music and other media, gaming, communications, productivity and security<sup>1</sup>." Only Hard Disk Drive specific tests were selected for the benchmark tests. Five iterations of PCMark Vantage HDD Suite tests were run for each scenario below:

- a) On fragmented test volume before defragmentation
- b) During Diskeeper defragmentation
- c) During Built-in Vista defragmentation
- d) After Diskeeper defragmentation
- e) After Built-in Vista defragmentation

Several tests were conducted to measure the impact of defragmenters on the system boot time. The boot time information was measured from Windows Vista event logs by reading event ID 100 at the location specified below:

Event Viewer -> Applications and Services Logs -> Microsoft -> Windows -> Diagnostics-Performance -> Operational

Ten iterations of boot time tests were performed for each scenario below:

1. On fragmented test volume before defragmentation
2. After Diskeeper defragmentation
3. After Built-in Vista defragmentation

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<sup>1</sup> Description taken from: <http://www.futuremark.com/benchmarks/pcmarkvantage/introduction/>

## Test Results

### PCMark Vantage Benchmark Comparison results (Hard Disk Drive Suite)

#### During Defragmentation

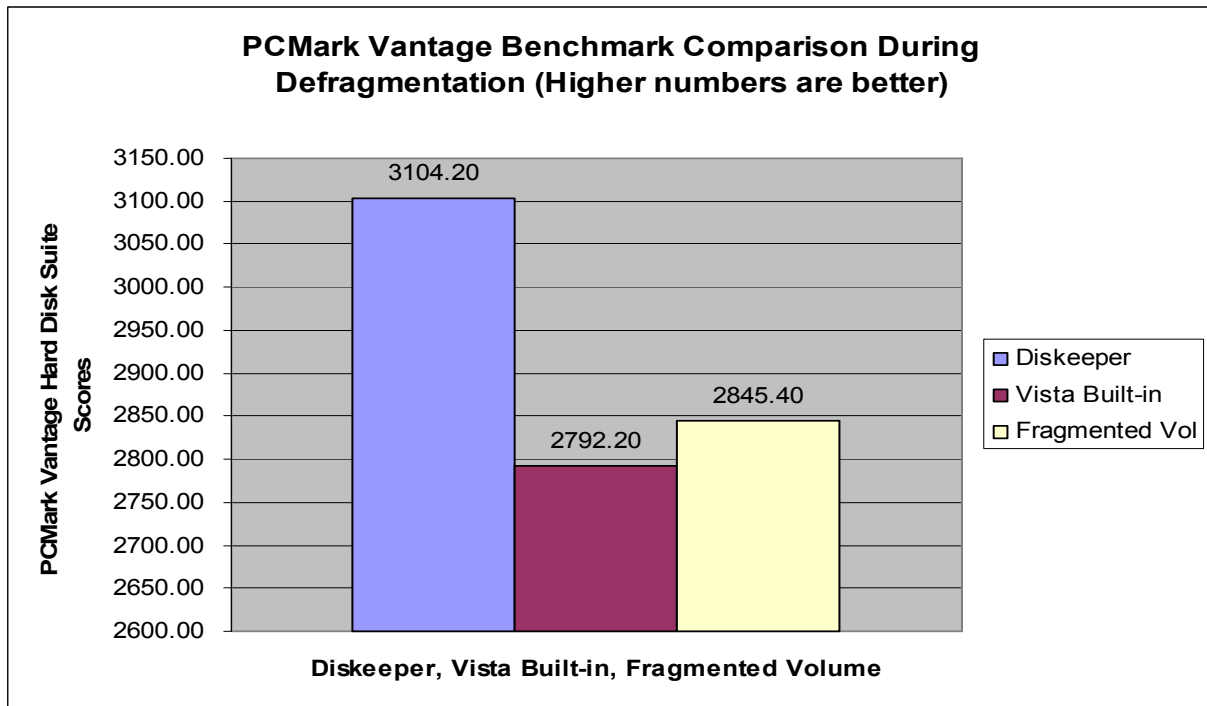
Diskeeper's Automatic Defragmentation mode was enabled after launching the application. In this default mode, Diskeeper uses InvisiTasking® technology to wait for slivers of idle resources to proceed with defragmentation, and exits operation instantly if the system ceases to be idle. The test results prove Diskeeper's claim to defragment without impact to the system.

The first iteration of PCMark Vantage was started about 30 minutes after the Automatic Defragmentation was started. Subsequent iterations of PCMark Vantage benchmark scores were obtained every 2 hours with Diskeeper actively running in the background. "Defragment Now" option was chosen on the Vista Built-in defragmenter and same the procedure as above was followed with the PCMark Vantage tests.

The PCMark Vantage HDD Suite test results for 5 iterations on the fragmented test volume, during Diskeeper and Vista Built-in defragmentation have been reported in the table below.

Iteration	Diskeeper	Vista Built-in	Fragmented Vol
1	3088.00	2816.00	2847.00
2	3057.00	2743.00	2892.00
3	3117.00	2798.00	3084.00
4	3161.00	2778.00	2626.00
5	3098.00	2826.00	2778.00
<b>Average</b>	<b>3104.20</b>	<b>2792.20</b>	<b>2845.40</b>

NOTE: The numbers in the table above represents the PCMark Vantage benchmark scores



**While the Vista Built-in defragmenter is running, there is a decrease in the benchmark score.**

As seen from the graph above, the PCMark Vantage HDD test scores are significantly higher while running Diskeeper as compared to that of a fragmented test volume. The graph above shows about a 9% increase over the score acquired on the fragmented test volume.

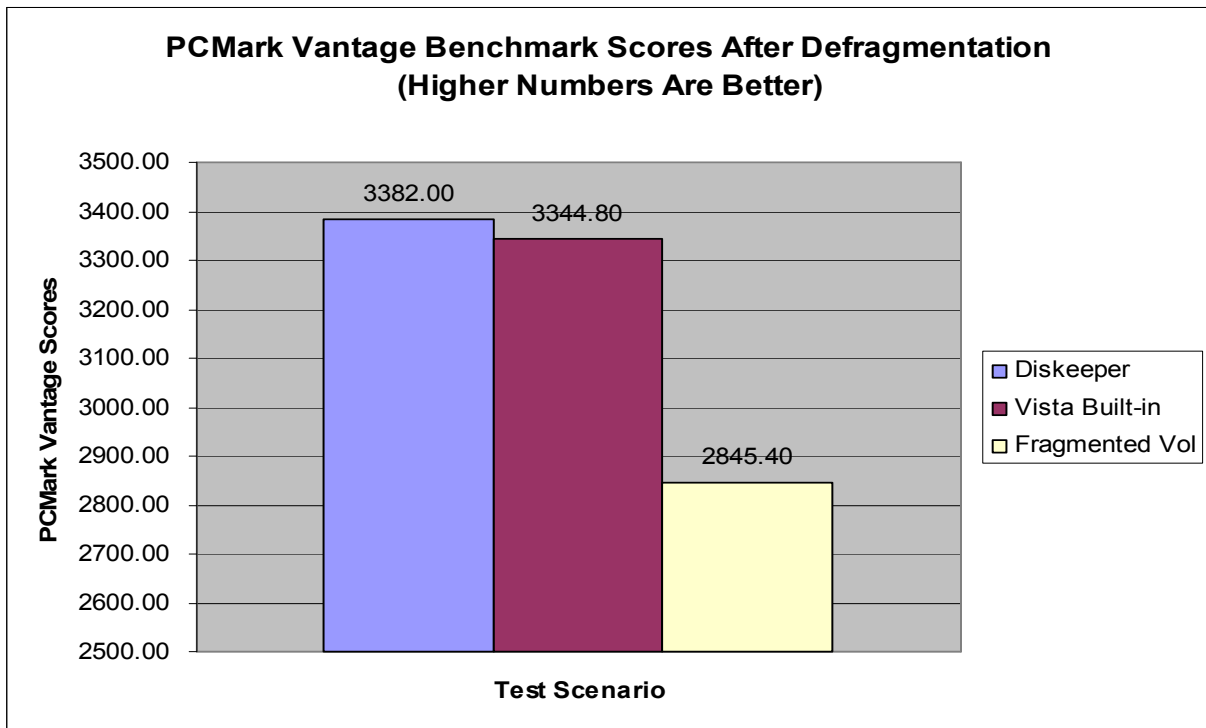
Conversely, while the Vista Built-in defragmenter is running, there is a *decrease* in the benchmark score.

**After Defragmentation**

The PCMark Vantage HDD Suite test results for 5 iterations on fragmented test volume, after Diskeeper defragmentation and Vista Built-in defragmentation have been reported in the table below:

Iteration	Diskeeper	Vista Built-in	Fragmented Vol
1	3376.00	3185.00	2847.00
2	3368.00	3371.00	2892.00
3	3396.00	3432.00	3084.00
4	3387.00	3354.00	2626.00
5	3383.00	3382.00	2778.00
<b>Average</b>	<b>3382.00</b>	<b>3344.80</b>	<b>2845.40</b>

NOTE: The numbers in the table above represents the PCMark Vantage benchmark scores

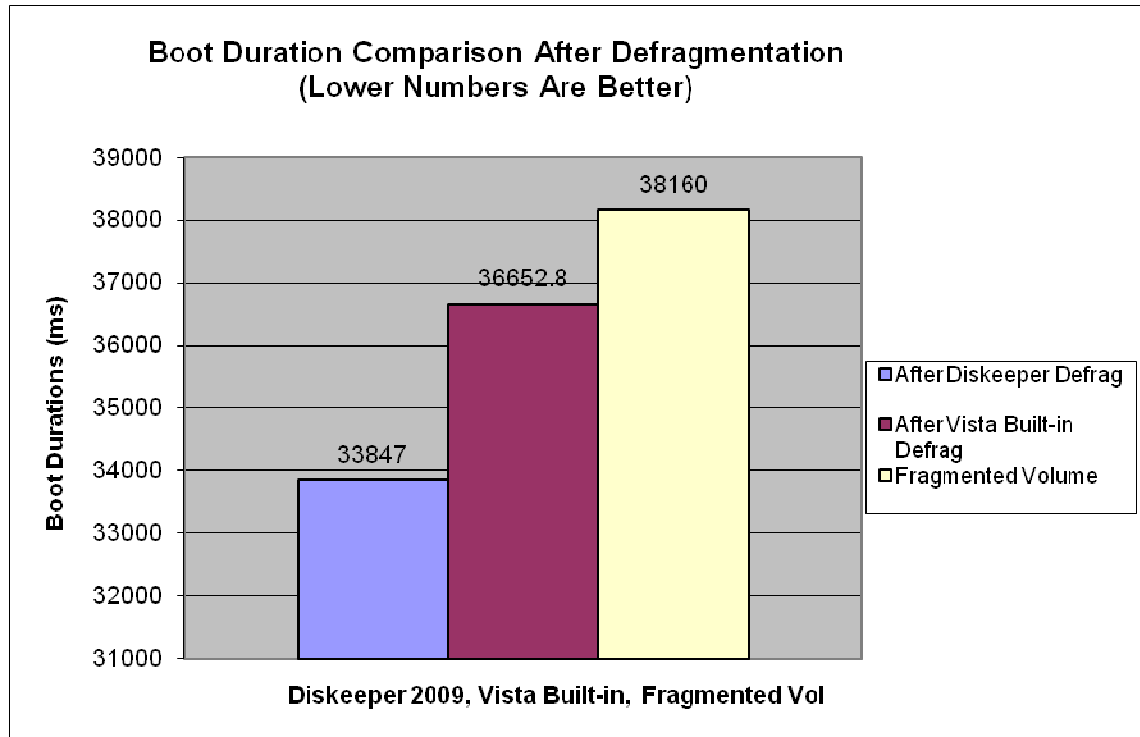


As seen from the graph above, the PC Mark Vantage HDD test scores are much better after defragmentation as compared to that of a fragmented test volume. The graph above reports 18.86% score increase after Diskeeper defragmentation and only a 17.5% score increase after Vista Built-in defragmentation, when compared to that of the fragmented test volume.

#### Boot Duration Comparison AFTER Defragmentation

The table below reports the test results for ten iterations of Boot Time tests:

Iteration	Fragmented Volume (ms)	After Vista Built-in Defrag (ms)	After Diskeeper Defrag (ms)
1	39837	39433	34178
2	36592	36609	34386
3	37141	36403	31182
4	38417	36668	32835
5	38771	36975	32255
6	37284	34653	33463
7	37998	36077	33787
8	38246	36719	37162
9	37927	36369	33862
10	39387	36622	35360
<b>Average</b>	<b>38160</b>	<b>36652.8</b>	<b>33847</b>



A significant improvement of the boot time was observed after Diskkeeper automatic defragmentation with boot time defragmentation enabled. After Diskkeeper defragmentation, the test PC booted 4.13 seconds faster than the test PC with fragmented test volume. The test PC booted 2.8 seconds faster after Windows Vista Built-in defragmentation.

## Defragmentation Results:

### A note about the analysis:

Even though fragmentation reports from both Diskkeeper and the Vista Built-in defragmenter are similar, some discrepancies were found in several aspects of the analysis (Vista reported less fragmentation). Fragmentation numbers obtained from both of the defragmenters has been presented in the two tables below. Detailed analysis data from both defragmenters can be found in the Appendix section of this report.

### Diskkeeper Analysis Before and After Defragmentation:

Diskkeeper	Before	After
Total fragmented Files	47195	2
Total excess fragments	442525	5
Average fragments per file	5.57	1
Files with performance loss	46032	0
Paging file fragments	805	5
Total fragmented directories	30	0
Excess directory fragments	393	0

**Vista Built-in Defragmenter Analysis Before and After Defragmentation:**

Vista Built-in	Before	After
Total fragmented Files	47184	99
Total excess fragments	441695	357
Average fragments per file	5.56	1
Total fragmented directories	30	2
Excess directory fragments	393	6

Both the Diskeeper and Windows Disk Defragmenter (WDD) analysis data presented above is from the same test volume. Total fragmented files reported by both programs is very close, with Vista reporting 11 fewer fragmented files, and 830 less excess fragments. Intertek NSTL used the Diskeeper analysis logs to compare the defragmentation results of the two engines due to the analysis logs from the Diskeeper tool being more complete. Full log results from both analysis tools can be found in the appendix.

**Results**

Defragmentation Results	Before	After Diskeeper Defragmentation	After Built-in Defragmentation
Total fragmented Files	47,195	2	131
Total excess fragments	442,525	5	1,194
Average fragments per file	5.57	1	1.01
Total fragmented directories	30	0	2
Excess directory fragments	393	0	6
Total Page File fragments	805	5	805

As seen from the table above, Diskeeper eliminated significantly more fragments than WDD. Only 2 fragmented files were present after Diskeeper defragmentation, whereas 131 fragmented files were present after WDD completed. Correspondingly, only 5 excess fragments (of those 2 files) remained after Diskeeper versus the 1,194 excess fragments (for the 131 files) still present after WDD defragmentation.

Diskeeper eliminated all fragmented directories during defragmentation where as WDD left 2 fragmented directories and 6 excess directory fragments.

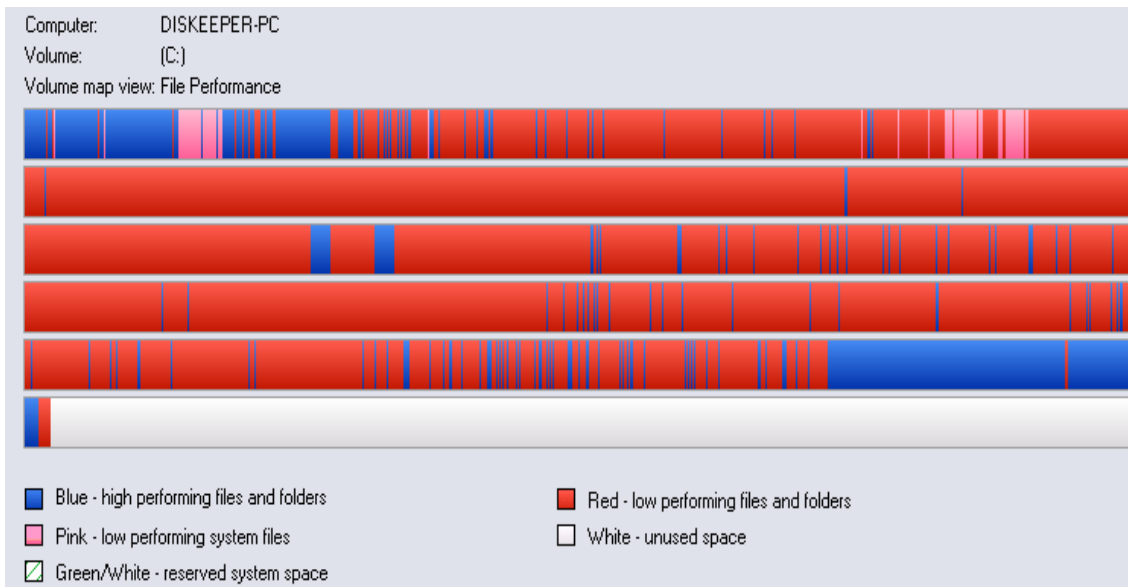
After performing Diskeeper's proprietary Boot-Time defragmentation, all but 5 paging file fragments were present out of the initial 805. WDD does not support page file defragmentation and the report confirmed that 805 paging file fragments remained after WDD completed defragmentation.

The test data clearly shows that Diskeeper's advanced features and capabilities result in more thorough defragmentation of data and system files. While the Windows Disk Defragmenter left significant fragmentation behind, Diskeeper was able to clean up all but a few excess fragments.

**Test data clearly shows that Diskeeper's advanced features and capabilities result in more thorough defragmentation of data and system files.**

The screenshots below depict the volume map before and after defragmentation.

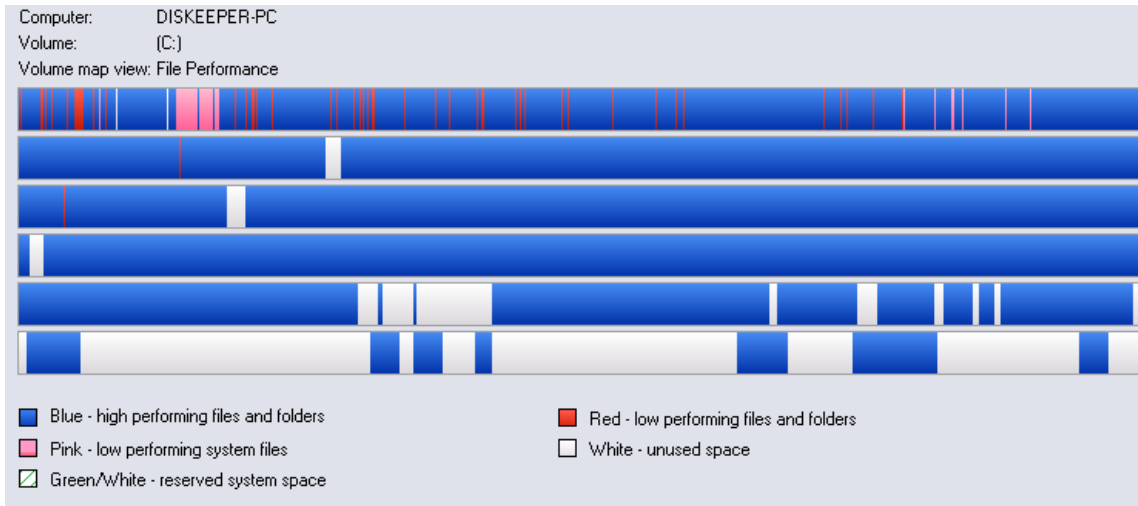
### Volume Map of Fragmented Test Volume



### Volume Map after Diskeeper Defragmentation



## Volume Map after Vista Built-in Defragmentation



NOTE: Vista does not provide a graphical representation of the analysis. Diskeeper was installed after completing Vista Built-in defragmentation to obtain the volume map above.

## Conclusion

Intertek NSTL’s objective was to perform a comparative evaluation of Diskeeper 2009 and the Vista Built-in defragmenter. Intertek NSTL examined both the “effectiveness” and the “performance impact” of both defragmenters. Using PCMark Vantage benchmark scores during active defragmentation and post defragmentation revealed an 18.86% score increase after Diskeeper defragmentation.

After running the respective programs, our results reveal that Diskeeper provided a greater increase in boot up performance, trimming 4.13 from the time to boot. Very few files were left fragmented after Diskeeper defragmentation as compared to the fragmented files present after Vista Built-in defragmentation. Also, Diskeeper’s Boot-Time defragmentation, which is not available in the built-in defragmenter, was effective in removing 800 out of 805 paging file fragments.

The PCMark Vantage results also revealed that the benchmark scores on a system actively running Diskeeper in “Automatic Defragmentation” mode were about 9% higher than the fragmented test volume, indicating that Diskeeper’s defragmentation process was able to optimize the volume quickly and quietly in the background.

**The test results  
 “reveal an 18.86%  
 score increase after  
 Diskeeper  
 defragmentation”**

## Appendix

Three iterations of defragmentation were performed on the fragmented test volume using both Diskeeper and Vista Built-in defragmenters. The results of all 3 iterations were mostly identical. One set of results have been reported below.

### Diskeeper Professional Edition:

This defragmented test volume was analyzed using both Diskeeper and Vista Built-In defragmenters and the analysis log files have been reported below:

#### Diskeeper Analysis File (Before Defragmentation)

```

-----START-----
Volume Files
Volume size                = 244 GB
Cluster size               = 4 KB
Used space                  = 193 GB
Free space                  = 51,408 MB
Percent free space         = 20 %
Fragmentation percentage
Volume fragmentation       = 71 %
Data fragmentation         = 89 %
Directory fragmentation
Total directories          = 11,536
Fragmented directories     = 30
Excess directory fragments = 393
File fragmentation
Total files                 = 96,780
Average file size          = 2,098 KB
Total fragmented files     = 47,195
Total excess fragments     = 442,525
Average fragments per file = 5.57
Files with performance loss = 46,032
Paging file fragmentation
Paging/Swap file size     = 2,320 MB
Total fragments            = 805
Master File Table (MFT) fragmentation
Total MFT size             = 106 MB
MFT records In Use        = 108,591
Percent MFT in use        = 99 %
Total MFT fragments       = 4
-----END-----

```

**Windows Vista Built-in Analysis File (Before Defragmentation)**

-----START-----

Analysis report for volume C:

Volume size	= 244 GB
Cluster size	= 4 KB
Used space	= 194 GB
Free space	= 50.21 GB
Percent free space	= 20 %

File fragmentation

Percent file fragmentation	= 86 %
Total movable files	= 108,256
Average file size	= 2 MB
Total fragmented files	= 47,184
Total excess fragments	= 441,695
Average fragments per file	= 5.56
Total unmovable files	= 54

Free space fragmentation

Free space	= 50.21 GB
Total free space extent	= 24,405
Average free space per extent	= 2 MB
Largest free space extent	= 38.84 GB

Folder fragmentation

Total folders	= 11,528
Fragmented folders	= 30
Excess folder fragments	= 393

Master File Table (MFT) fragmentation

Total MFT size	= 106 MB
MFT record count	= 108,581
Percent MFT in use	= 99
Total MFT fragments	= 5

Note: On NTFS volumes, file fragments larger than 64MB are not included in the fragmentation statistics  
You should defragment this volume.

-----END-----

**Diskeeper Analysis File (After Diskeeper Defragmentation)**

-----START-----

Volume Files

Volume size	= 244 GB
Cluster size	= 4 KB
Used space	= 192 GB
Free space	= 53,196 MB
Percent free space	= 21 %

Fragmentation percentage

Volume fragmentation	= 0 %
Data fragmentation	= 0 %

Directory fragmentation

Total directories	= 11,540
Fragmented directories	= 0
Excess directory fragments	= 0

File fragmentation

Total files	= 96,814
Average file size	= 2,078 KB
Total fragmented files	= 2
Total excess fragments	= 5
Average fragments per file	= 1.00
Files with performance loss	= 0

Paging file fragmentation

Paging/Swap file size	= 2,320 MB
Total fragments	= 5

Master File Table (MFT) fragmentation

Total MFT size	= 106 MB
MFT records In Use	= 108,748
Percent MFT in use	= 99 %
Total MFT fragments	= 2

-----END-----

**Windows Vista Built-in Analysis File (After Diskeeper Defragmentation)**

-----START-----

Windows Disk Defragmenter

Analysis report for volume C:

Volume size	= 244 GB
Cluster size	= 4 KB
Used space	= 192 GB
Free space	= 51.96 GB
Percent free space	= 21 %

## File fragmentation

Percent file fragmentation	= 0 %
Total movable files	= 108,303
Average file size	= 2 MB
Total fragmented files	= 1
Total excess fragments	= 1
Average fragments per file	= 1.00
Total unmovable files	= 56

## Free space fragmentation

Free space	= 51.96 GB
Total free space extent	= 44
Average free space per extent	= 1.18 GB
Largest free space extent	= 51.69 GB

## Folder fragmentation

Total folders	= 11,533
Fragmented folders	= 1
Excess folder fragments	= 0

## Master File Table (MFT) fragmentation

Total MFT size	= 106 MB
MFT record count	= 108,749
Percent MFT in use	= 99
Total MFT fragments	= 3

Note: On NTFS volumes, file fragments larger than 64MB are not included in the fragmentation statistics

You do not need to defragment this volume.

-----END-----

**Windows Vista Built-in Defragmenter:**

This defragmented test volume was analyzed using both Diskeeper and Vista Built-In defragmenters and the analysis log files have been reported below:

**Diskeeper Analysis File (After WDD Defragmentation)**

```
-----START-----
Volume Files
  Volume size                = 244 GB
  Cluster size               = 4 KB
  Used space                  = 192 GB
  Free space                  = 52,487 MB
  Percent free space         = 20 %
Fragmentation percentage
  Volume fragmentation       = 13 %
  Data fragmentation         = 16 %
Directory fragmentation
  Total directories          = 11,538
  Fragmented directories     = 2
  Excess directory fragments = 6
File fragmentation
  Total files                 = 96,803
  Average file size          = 2,086 KB
  Total fragmented files     = 131
  Total excess fragments     = 1,194
  Average fragments per file = 1.01
  Files with performance loss = 57
Paging file fragmentation
  Paging/Swap file size      = 2,320 MB
  Total fragments            = 805

Master File Table (MFT) fragmentation
  Total MFT size             = 106 MB
  MFT records In Use         = 109,007
  Percent MFT in use         = 99 %
  Total MFT fragments        = 4
-----END-----
```

**Windows Vista Built-in Analysis File (After WDD Defragmentation)**

-----START-----

Windows Disk Defragmenter

Copyright (c) 2006 Microsoft Corp.

Analysis report for volume C:

Volume size	= 244 GB
Cluster size	= 4 KB
Used space	= 193 GB
Free space	= 51.07 GB
Percent free space	= 20 %

## File fragmentation

Percent file fragmentation	= 0 %
Total movable files	= 108,304
Average file size	= 2 MB
Total fragmented files	= 99
Total excess fragments	= 357
Average fragments per file	= 1.00
Total unmovable files	= 55

## Free space fragmentation

Free space	= 51.07 GB
Total free space extent	= 7,403
Average free space per extent	= 7 MB
Largest free space extent	= 10.61 GB

## Folder fragmentation

Total folders	= 11,531
Fragmented folders	= 2
Excess folder fragments	= 6

## Master File Table (MFT) fragmentation

Total MFT size	= 107 MB
MFT record count	= 109,021
Percent MFT in use	= 99
Total MFT fragments	= 5

Note: On NTFS volumes, file fragments larger than 64MB are not included in the fragmentation statistics

You do not need to defragment this volume.

-----END-----

## About Intertek NSTL

Intertek NSTL is the leading independent information technology testing organization for the computer and mobile technology industries, dedicated to providing high quality services to hardware developers, software publishers, network operators, and government agencies. Intertek NSTL has extensive experience developing and conducting objective tests to assess new and existing products for compatibility, performance, and usability, and functionality.

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