

auslogics®

White Paper

Auslogics BoostSpeed® 5:
Positive Effects on System Performance

Contents

Research Background.....	3
Purpose of Study.....	5
Disk Cleanup	6
Major Sources of Accumulation of Unneeded Files	6
Testing Environment	7
Test Results	8
Comments on Results	10
Disk Defragmentation.....	11
Auslogics Disk Defrag Defragmentation Techniques and Algorithms.....	11
The Effect of File System Optimization on HDD Performance.....	14
Testing Environment.....	14
Test Results	15
Comments on Results	16
Internet Connection Optimization.....	17
Some of the Basic Internet Connection Settings.....	17
Testing Environment.....	19
Test Results	20
Comments on Results	21

Research Background

It has long been recognized that PC performance decreases with use, becoming slower and more unstable over time. The causes of declining computer performance appear to be wide-ranging:

- The Windows Registry, a database of critical hardware and software instructions, accumulates obsolete shared DLLs, unused drivers and file extension associations as third party software and devices are installed and uninstalled.
- NTFS and FAT file systems are subject to file and free space fragmentation. Fragmentation forces hard drive's read/write heads to make several movements over different areas of the disk when accessing a fragmented file, thus reducing file read speed.
- Unexpected computer restarts and third party software failures, as well as daily computer activity such as web browsing, increase the size of browser cache and lead to the build-up of temporary files, log files, memory dumps and other files that are generally unnecessary for an average user. These files may waste gigabytes of disk space, bloating critical indexes that Windows maintains to organize its files.
- Numerous programs and services set themselves to start automatically on Windows boot, launching unneeded processes that are constantly running in the background and consuming PC's system resources.
- Hidden Windows settings make it hard for an average user to tune operating system for maximum performance.
- Inappropriate network settings are a common cause of slow Internet access speed.

Auslogics BoostSpeed is a computer optimization and maintenance suite that was designed to reverse these types of degradation in PC performance. The program includes 18 tools (*see fig. 1 on p. 4*) that allow users to perform a full system diagnosis and automatically resolve all issues that affect the performance of their PC.

Figure 1. Auslogics BoostSpeed v.5 features.

<p>Disk Cleaner Removes junk files that slow down computers</p>	<p>Disk Defrag Defragments disk drives and optimizes system files placement</p>
<p>Registry Cleaner Repairs thousands of registry errors to increase PC stability</p>	<p>Registry Defrag Compacts the registry eliminating memory-consuming gaps</p>
<p>Startup Manager Allows users to manage programs that start automatically on PC boot</p>	<p>Uninstall Manager Completely uninstalls applications that are no longer needed by the user</p>
<p>Internet Optimizer Tailors the one-size-fits-all settings to a specific Internet connection</p>	<p>Tweak Manager Allows users to tune hundreds of hidden Windows settings</p>
<p>Service Manager Disables unnecessary services that slow down a computer</p>	<p>Task Manager Lists all running processes, services and locked files</p>
<p>Disk Explorer Shows which files take up the most space on a computer</p>	<p>Duplicate File Finder Helps to find and remove duplicate files that waste disk space</p>
<p>Track Eraser Removes the history of computer and Internet usage</p>	<p>File Shredder Erases selected files beyond recovery on a disk or USB stick</p>
<p>Disk Wiper Wipes free space on disks to prevent recovery of sensitive data</p>	<p>File Recovery Recovers accidentally deleted files from disks, USB sticks or cameras</p>
<p>Disk Doctor Finds bad sectors, lost clusters and directory errors, and fixes them</p>	<p>System Information Provides detailed information about installed hardware and software</p>

Purpose of Study

This research was conducted in order to measure the effectiveness of Auslogics BoostSpeed's tools.

Specifically, the study was designed to measure the software's positive impact on system performance by comparing the most common performance factors for computers that have not been maintained and optimized to computers that have undergone a tune-up using the latest version of Auslogics BoostSpeed.

For the purposes of this study, the following cleanup and optimization techniques were implemented using Auslogics BoostSpeed 5.0.3.210:

- Disk cleanup
- Disk defragmentation
- Internet optimization

Disk Cleanup

Disk cleanup is considered to be one of the most important aspects of computer maintenance because unnecessary files tend to accumulate over time and consume valuable system resources.

How Do Unneeded Files Accumulate?

- **Internet browser cache.** HTML files, images and other content of visited web pages that Internet browsers store on a hard drive.
- **Third party applications clutter.** While running, applications create temporary files for current operating needs. These files are supposed to be removed automatically when an operation is terminated. However, temporary files may be left behind by poorly written programs or when a computer was not shut down properly.
- **System clutter.** Like third party applications, Windows operating system creates various temporary files needed for its operation. These files are kept on the hard drive for a certain period of time and don't serve any particular purpose.

Auslogics BoostSpeed is supplied with cleanup utility called Disk Cleaner. This tool allows users to scan their computer hard drives for over 70 types of unneeded files among the following categories:

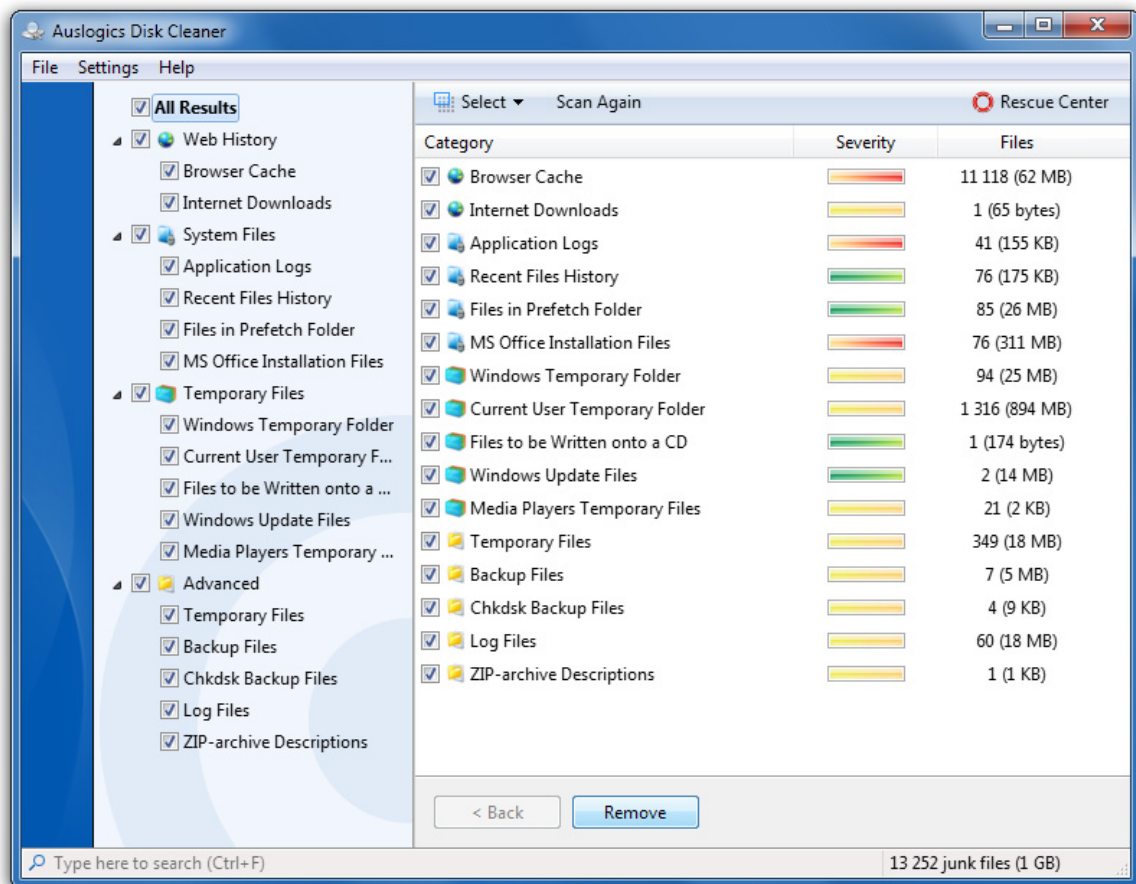
Browser Cache	Performance Logs	Windows Temporary Files
Internet Downloads	Application Logs	Current User Temporary Files
Recycle Bin	Recent Files History	Files to be Written to a CD
Norton Protected Recycle Bin	Files in the Prefetch Folder	Windows Update Files
System Restore Points	MS Office Cache files	Media Players Temp Files
Windows Update Rollbacks	MS Office Installation Files	User-Specifics Folders

Testing Environment

The test was performed on a Windows® 7 X64 Ultimate system with a Core 2 Quad Q9000 (2.0 GHz) CPU, 4GB of RAM, an ATI Mobility Radeon HD 4650 (1024 MB, DDR3) video adapter and a 250GB Fujitsu MJA2250BH G2 hard drive.

The software used to benchmark the effect of disk cleanup was PCMark Vantage.

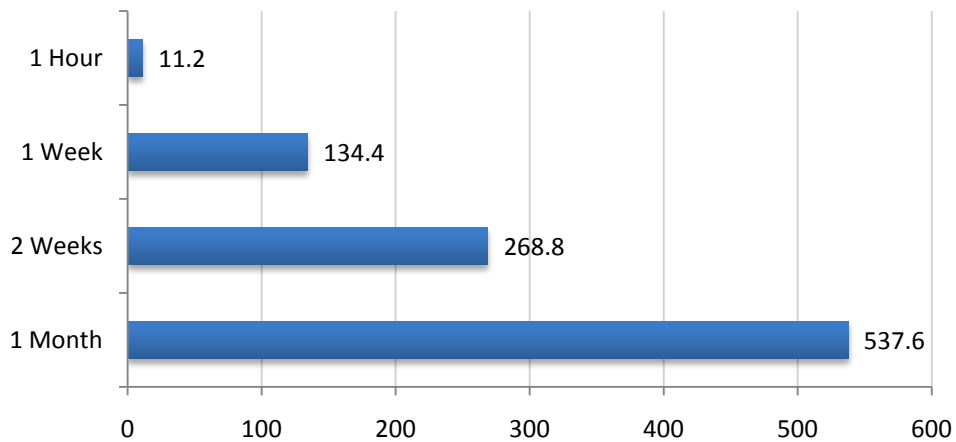
Prior to testing, five most popular web browsers were installed and one hour of moderate Internet use was simulated using each browser. The screenshot below shows the amount of junk files found by Auslogics Disk Cleaner on the tested PC:



Test Results

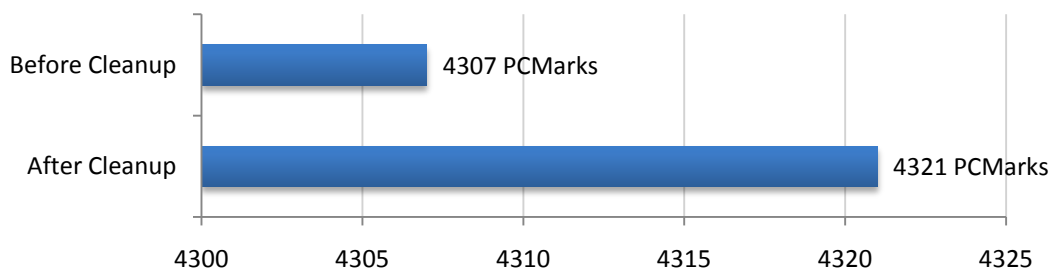
Tests showed that the average amount of browser cache files accumulated during one hour of moderate web surfing is 11.2 MB per one browser. Taking into account that according to Forrester's research report "Consumer Behavior Online: a 2009 Deep Dive" the average time spent online by American users in 2009 was 12 hours a week, the approximate amount of cache files accumulated within a month on an average American user's PC was 537.6 MB:

Avg. Amount of Browsers Cache, MB/per 1 Browser

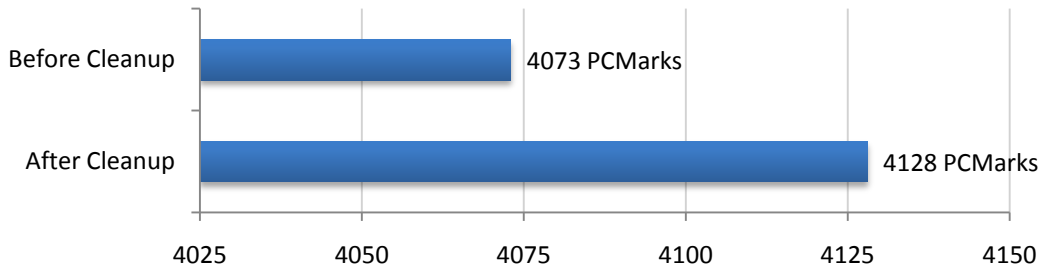


The performance of the tested PC was measured before and after cleanup, benchmarking the most common tasks, such as watching TV and movies, gaming, listening to music and HDD performance:

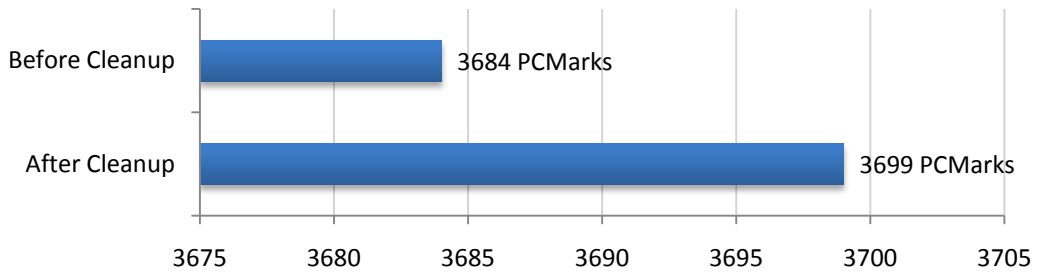
PCMark, Overall Performance



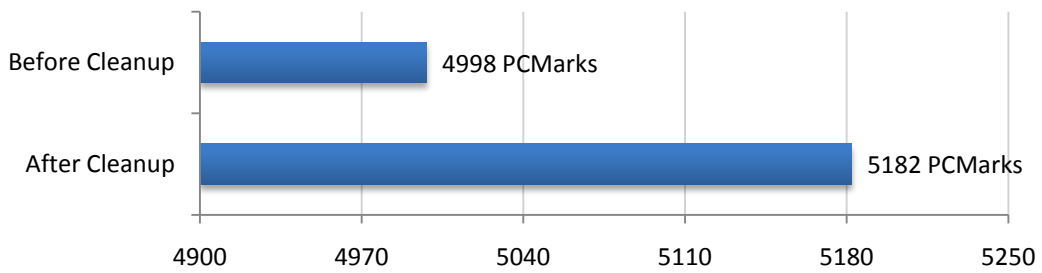
PCMark, TV and Movies



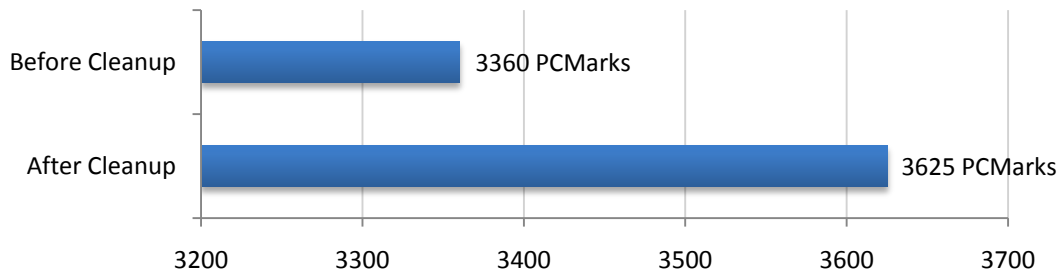
PCMark, Gaming



PCMark, Music



PCMark, HDD



Comments on Results

As seen from the charts, cleaning up disks with Auslogics Disk Cleaner improved the performance of all tested tasks, as well as overall computer performance. In particular:

- TV and Movies - 55 PCMarks improvement
- Gaming - 15 PCMarks improvement
- Music - 184 PCMarks improvement
- HDD - 265 PCMarks improvement
- Overall Performance - 14 PCMarks improvement

Disk Defragmentation

Numerous studies have been shown that hard drive fragmentation can seriously affect computer speed, performance and stability, as well as reduce hard drive life time. This makes file and free space defragmentation one of the most important aspects of computer maintenance. The fact that fragmentation degrades Windows-based computers performance is documented in many official articles and technical notes. The following is just one of them:

"Disk fragmentation. After erasing and writing many files to disk, fragmentation occurs. Fragmentation also occurs when users edit files, such as word documents, as they add and remove content and save updated versions. Fragmentation is normal and happens when pieces of single files are inefficiently distributed across many locations on a disk. The result is an increase in the time it takes to access a file. Running a disk-defragmentation program repairs this problem by rearranging the files so that their entire contents are stored on the disk contiguously."

Source: technet.microsoft.com

Using Auslogics Disk Defrag has been proven to have a positive effect on file access speed, as well as overall hard drive performance.

Auslogics Disk Defrag Defragmentation Techniques and Algorithms

Auslogics Disk Defrag is a FAT32/NTFS defragmentation tool that allows users to defragment files and free space, as well as apply several file system optimization techniques. To make the defragmentation process fast and effective, Disk Defrag is supplied with the following technologies:

Multi-terabyte Volumes Support

Disk Defrag has a powerful engine that allows the program to defragment large disks of several terabytes.

System Files Smart Placement

System files are necessary for the operating system to perform its numerous functions. Commonly used by Windows, system files may be scattered all over the disk and intermixed with regular data files. Disk Defrag defragments them and moves them to the faster part of the disk. Such intelligent way of defragmentation minimizes the time needed for HDD to access system files and thus improves overall computer performance.

Clearing the MFT Reserved Zone

Normally, NTFS file system reserves about 12.5% of the disk volume for the MFT records (a place where information about every file and directory is stored). However, when the rest of the disk space is getting low, the MFT Reserved Zone is used for storing regular files. This may lead to MFT fragmentation.

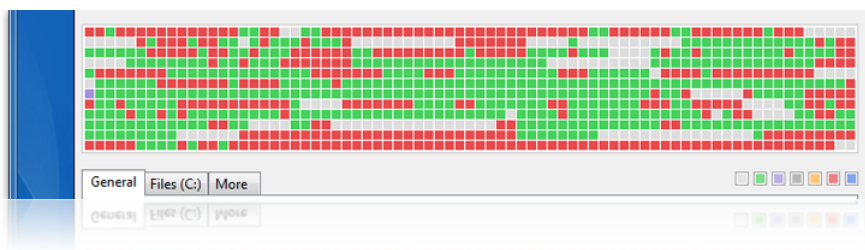
To prevent MFT fragmentation, Disk Defrag moves regular files from the MFT Reserved Zone, allowing NTFS to allocate contiguous space for the MFT records.







Free Space Consolidation

Free space on a disk is often split into many small gaps between files. Windows fills these gaps with newly created or extended files. The more fragmented the free space is, the more fragmented new files will be.

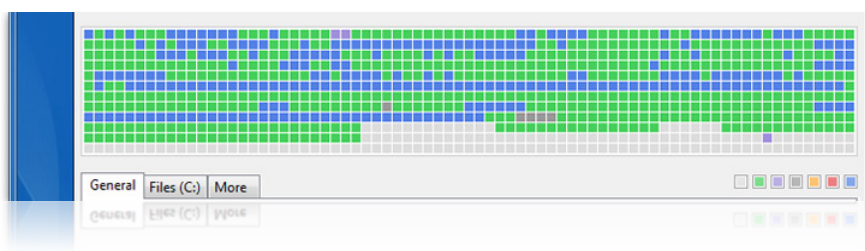
Disk Defrag merges free space into a large contiguous block during the optimization process. This technology effectively prevents file fragmentation.

Before disk optimization



-  Free space
-  Non-fragmented
-  Fragmented
-  Defragmented
-  MFT
-  Unmovable files

After running Disk Defrag in the Defrag & Optimize mode



Simultaneous Defragmentation of Disks

This option allows users to defragment multiple disks at once instead of one by one. This greatly reduces defragmentation time.

Single File Defragmentation

Disk Defrag allows users to defragment a single file or several files instead of defragmenting an entire drive. This option is useful when certain files need to be defragmented to speed up an application and there is no need to defragment the entire hard drive.

Removing Temporary Files

This option allows Disk Defrag to clear current user and Windows temporary folders before starting defragmentation. Temporary files can take up hundreds of megabytes of disk space. Deleting them will speed up defragmentation.

Skipping Large File Fragments

For faster defragmentation results, Disk Defrag allows users to ignore files with fragments larger than user-specified size. Since reading large file fragments takes much longer than head positioning, their defragmentation is unnecessary.

Volume Shadow Copy Service (VSS) Compatible Mode

Disk Defrag is supplied with special defragmentation engines that are optimized for VSS-enabled volumes. Defragmenting in VSS-compatible mode allows the program to minimize the growth of the VSS storage area caused by file movement and reduce the chance of overwriting previous VSS snapshots.

Auto-defragmentation Mode

Auto-defragmentation mode enables Disk Defrag to defragment disks when the system is idle. Since the program is very compact and requires few system resources, it will not interrupt user activity while defragmenting hard drives in the background.

The Effect of File System Optimization on HDD Performance

When the file system receives a command for reading a fragmented file, it has to split a single input/output request packet (IRP) into multiple associated request packets that read scattered fragments of the file. This process decreases file read speed. This test was designed to measure the effect of file system optimization on hard drive performance.

Testing Environment

For the purpose of this study, a 20GB NTFS logical drive was tested using the following benchmarking software:

- HD Tune Pro
- PassMark
- Crystal Disk Mark

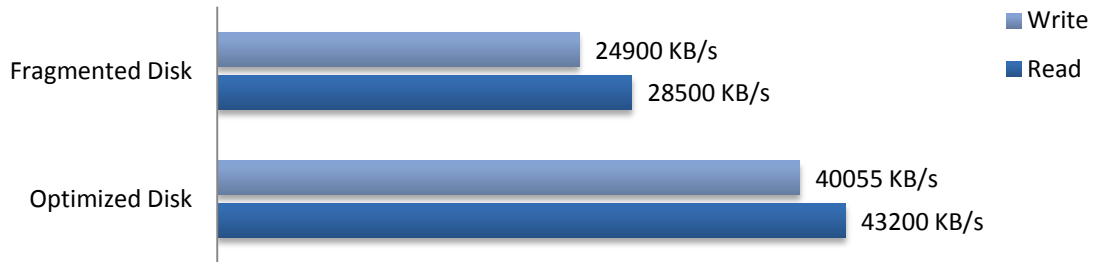
The test was performed on a Windows® 7 X64 Ultimate system with a Core 2 Quad Q9000 (2.0 GHz) CPU, 4GB of RAM, an ATI Mobility Radeon HD 4650 (1024 MB, DDR3) video adapter and a 250GB Fujitsu MJA2250BH G2 hard drive.

Prior to testing, DiskFragmenter had been run and 249 fragments (ca. 11.9 GB) had been created. Then two folders containing smaller fragmented files were copied to the tested drive - web browser cache (ca. 3.57 GB) and a folder containing documents, videos, music, compressed files (ca. 2.7 GB). Free space on the disk made up 7% (1.4 GB) of the total disk space.

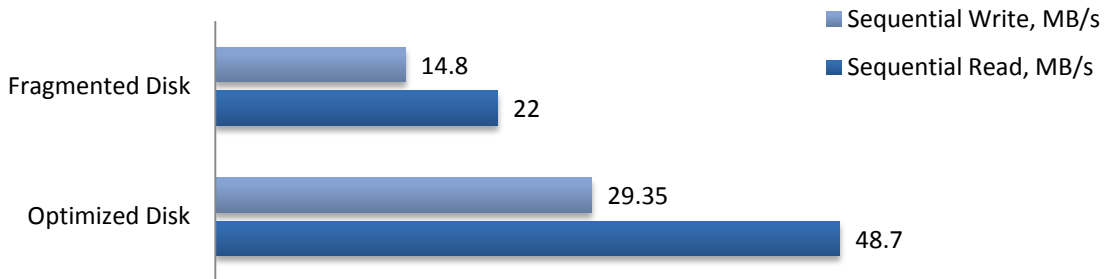
The tests have been run on a fragmented disk and after performing disk optimization with Auslogics Disk Defrag. After each test the computer was rebooted.

Test Results

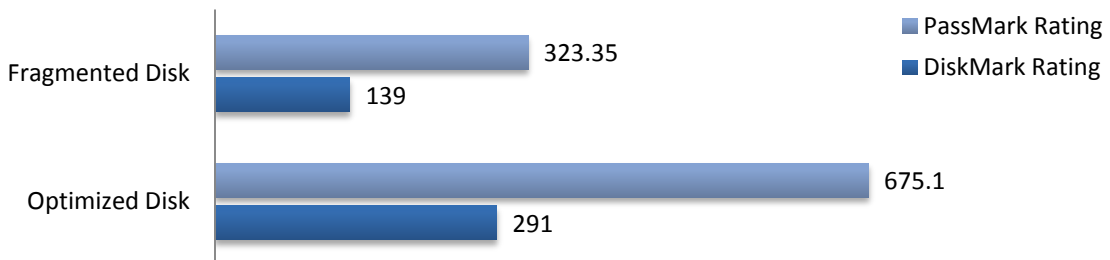
HD Tune Pro, Max Read/Write



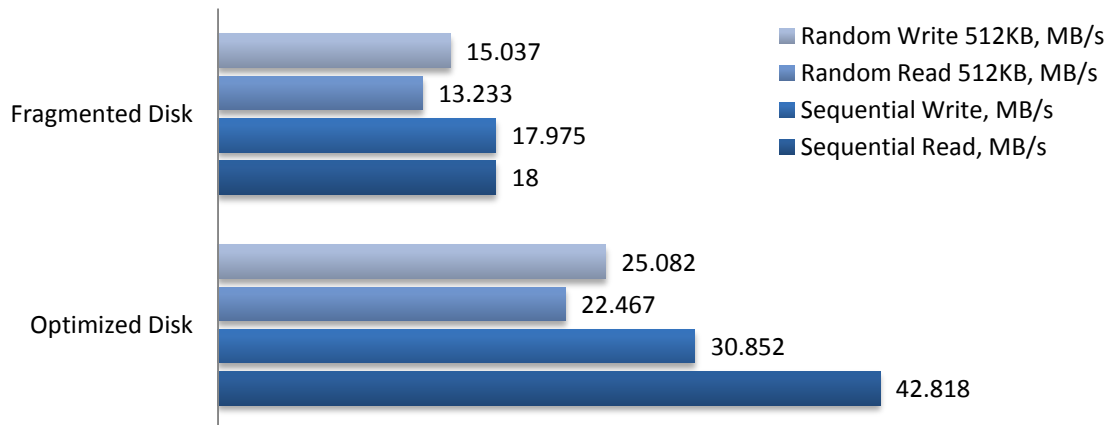
PassMark Performance Test



PassMark Performance Test



Crystal Disk Mark



Comments on Results

File fragmentation is capable of affecting both sequential and random read/write performance of a disk.

- PassMark and Crystal Disk Mark tests showed 120-137% improvement of sequential read performance and 71-98% improvement of sequential write performance after optimizing the disk with Auslogics Disk Defrag.
- At the same time, random write and read speed improvement was 66%-69% according to Crystal Disk Mark test.
- Cumulative PassMark Performance test showed approximately 100% improvement of overall disk performance.
- According to HD Tune Pro test, maximum write speed improvement reached 60% and maximum read speed improvement - 51%

Internet Connection Optimization

Windows settings related to Internet connection have a significant impact on web browsing speed. Most of the PCs come from manufacturers with a preset of connection settings that are often not optimized for the particular connection type. This is the common issue that can greatly limit connection throughput, download/upload speed and web page load time.

Auslogics BoostSpeed has an inbuilt Internet optimization tool that automatically tweaks Windows and third-party web browser settings specifically for the type of Internet connection used on a particular computer. The program tests numerous connection parameters like MTU and Latency in real time to find the best possible configuration for the connection.

Some of the Basic Internet Connection Settings

Maximum Transmission Unit (MTU)

MTU is the maximum size of a single message (transmission unit) that can be transferred in one physical frame on the network. Depending on the network type, MTU can range from 68 to 1500 bytes. For instance, Ethernet has MTU of 1500 bytes, PPPoE - 1492 bytes, dial-up connections often use 576 bytes.

Each transmission unit consists of TCP/IP headers and actual data:

MTU = TCP/IP headers + actual data

Standard TCP/IP headers take up 40 bytes. It is logical to assume that if we set the MTU too low, this results in inefficient use of bandwidth. For instance, if we set the MTU to 80 bytes, only 50% of each transmission unit would be actual data and the rest - TCP/IP headers.

On the other hand, if MTU is too large, throughput performance will be reduced. For example, if a message (transmission unit) is passed from a network with a high MTU to one with a low MTU, it will be fragmented in order to fit the network with the smaller MTU.

To establish the optimal MTU for a particular network connection, Auslogics BoostSpeed is testing bandwidth of several routes, determining the MTU for each of them. MTU of the route with the lowest bandwidth will be set as a default MTU for the current network connection. This allows the program to establish a default MTU as large as possible while avoiding fragmentation for most transmitted units.

RWIN (Receive Window)

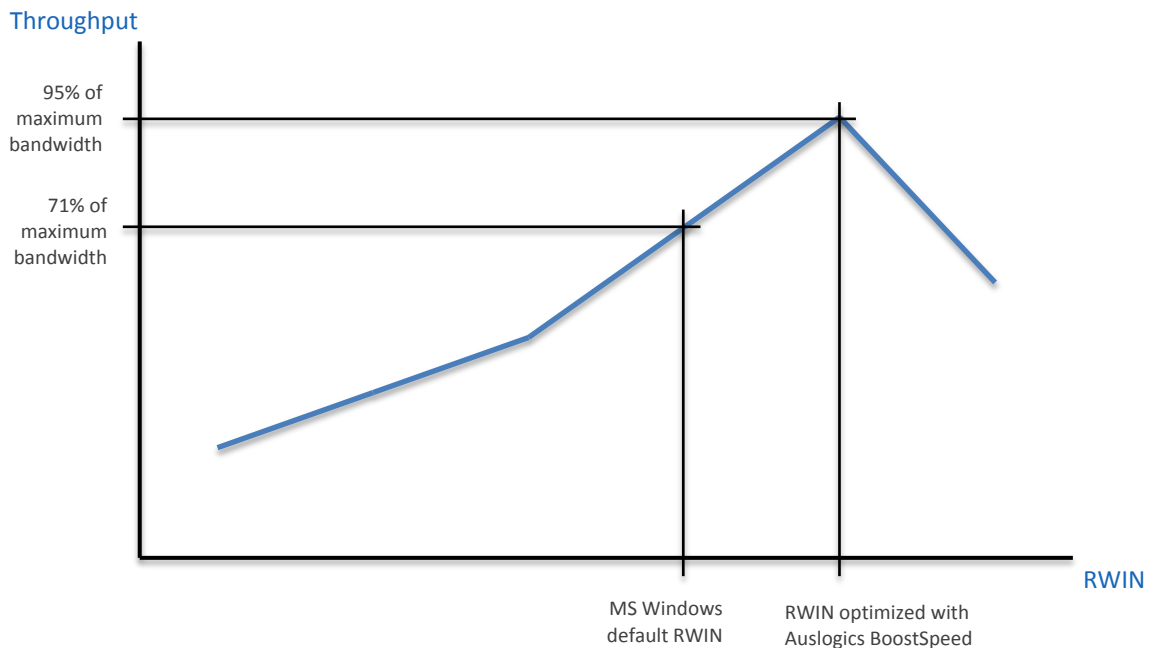
Throughput limitation caused by Receive Window size can be calculated as follows:

Throughput = $RWIN/RTT$, where

RWIN - the TCP Receive Window size - controls how much data can be sent at one time from the sender to the recipient.

RTT - the round-trip time for the path - the length of time it takes for a signal to be sent plus the length of time it takes for an acknowledgment of that signal to be received. The RTT is also referred to as the ping time.

Often a default TCP Receive Window size adjusted by MS Windows OS limits throughput, especially of a high speed connection such as Gigabit Ethernet. While optimizing the Receive Window size, Auslogics BoostSpeed automatically determines the speed and latency of the current Internet connection. Knowing that, the program changes the default RWIN to the best suitable for the connection, assuring that there is no throughput limitation caused by improper Receive Window size.



Number of simultaneous connections to a web server

When loading a web page, most of the browsers only make two simultaneous connections to a web server by default: one to download the text of the page (html file) and another to fetch the images. But one connection can load only one image at a time. This means that if there are many images on a page, it may take a lot of time to load them even on a fast connection.

Auslogics BoostSpeed increases the number of concurrent connections by tweaking appropriate settings of a particular web browser. This allows a browser to download more web page components at the same time, noticeably increasing browsing speed.

Testing Environment

This study was aimed to measure performance improvement of Internet connection on a computer that has been optimized with Auslogics BoostSpeed.

The test was performed on a 64-bit Windows® 7 system with a Core 2 Quad Q9000 (2.0 GHz) CPU, 4GB of RAM, and a 500GB HDD.

Type of Internet connection used during tests - 3G broadband

During the study the following characteristics were tested:

- download speed
- web page loading time

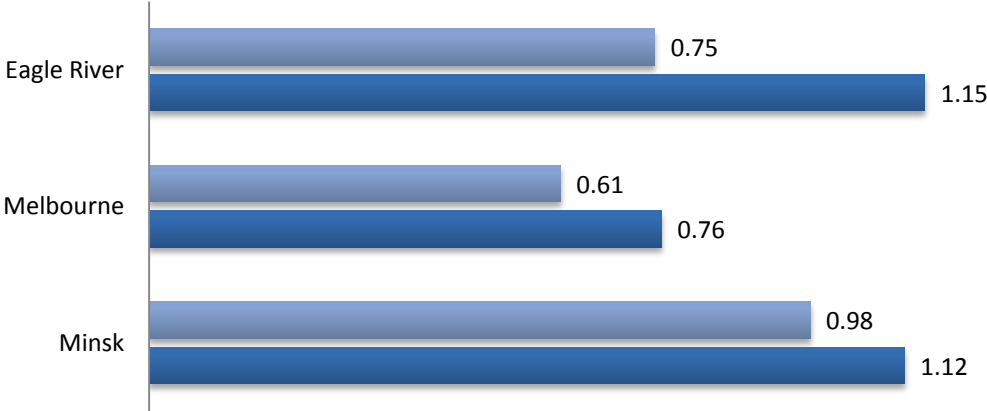
The download speed was measured using the speedtest.net online service. Taking into account that the connection speed may vary from host to host (depending on the path that the ISP takes to the host, as well as servers capacity and network congestion), three servers located on different continents were randomly chosen: Melbourne, Minsk and Eagle River. The tests were run several times for each server and the average download speed was calculated before and after running the optimization.

Web page loading time test was conducted using the [HTTP Analyzer v6](#). For the purpose of the test, the time required for the most popular web browsers to load the www.msn.com web page was measured. The tests were run several times for each browser, calculating the average page loading time before and after optimization.

Test Results

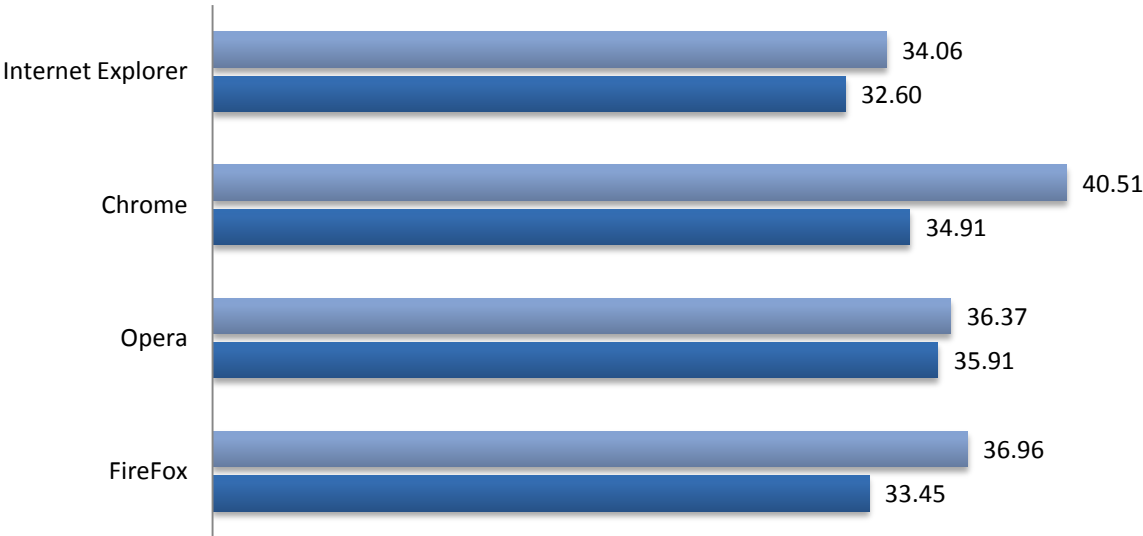
Download Speed (Mbits/sec)

■ Before Optimization ■ After Optimization



Page Load Time (sec)

■ Before Optimization ■ After Optimization



Comments on Results

- The study showed a 14%-53% increase in download speed (depending on the server location), after Internet connection settings on the tested PC were optimized with Auslogics BoostSpeed. This means, for instance, that downloading a 1GB file from the server located in Eagle River city would take up approximately 3 hours before optimization and only 2 hours after optimization.
- Web page load time decreased by 3%-26%, depending on the Internet browser. This result might be even more impressive when opening heavy pages that contain lots of images and complicated graphics.