

Anti-Virus Comparative



Performance Test (AV Products)

Impact of Anti-Virus Software on System Performance

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Table of Contents



1. Introduction	3
2. Tested products	3
3. Test methods	4
4. Notes and comments	5
5. Test cases	7
6. Test results	8
7. Award levels reached in this test	12
8. Copyright and Disclaimer	13



Introduction

We want to make clear that the results in this report are intended only to give an indication of the impact on system performance (mainly by the real-time/on-access components) of the anti-virus products in these specific tests. Users are encouraged to try out the software on their own PC's and see how it performs on their own systems.

Tested products

The following antivirus products were evaluated (with default settings) in this test¹:

avast! Free Antivirus 2014	F-Secure Anti-Virus 2014
AVG Anti-Virus 2014	Kaspersky Anti-Virus 2014
AVIRA Antivirus Premium 2014	Kingsoft Anti-Virus 2013.SP7.5
Baidu Antivirus 4.0.9	Lavasoftware Ad-Aware Free Antivirus 11.1
Bitdefender Antivirus 2014	McAfee AntiVirus Plus 2014
BullGuard Antivirus 14.0	Panda Cloud Antivirus Free 3.0
Emsisoft Anti-Malware 8.1	Qihoo 360 Antivirus 4.9
eScan Anti-Virus 14.0	Sophos Anti-Virus 10.3
ESET NOD32 Antivirus 7.0	ThreatTrack Vipre Anti-Virus 2014
Fortinet FortiClient 5.0.9	Trend Micro Titanium Anti-Virus 2014

Please note that the results in this report apply only to the products/versions listed above (e.g. 64-Bit versions, product version, etc.). Also, keep in mind that different vendors offer different (and differing quantities of) features in their products.

The following activities/tests were performed under an up-to-date Windows 8.1 64-Bit system:

- File copying
- Archiving / Unarchiving
- Encoding / Transcoding
- Installing / Uninstalling applications
- Launching applications
- Downloading files
- PC Mark 8 Professional Testing Suite

¹ We used the latest product versions available at time of testing (May 2014). Additionally, Microsoft Windows Defender integrated in Windows 8.1 has also been evaluated.

Test methods

The tests were performed on an ASUS N56JR-S4056H laptop with an Intel Core i5-4200H CPU (2.8GHz), 8GB of RAM and SATA II hard disks. The performance tests were done on a clean and fully updated Windows 8.1 64-Bit system (English) and then with the installed anti-virus software (with default settings). The tests were done with an active Internet connection to allow for the real-world impact of cloud services/features.

The hard disks were defragmented before starting the various tests, and care was taken to minimize other factors that could influence the measurements and/or comparability of the systems. Optimizing processes/fingerprinting used by the products were also considered – this means that the results represent the impact on a system which has already been operated by the user for a while. The tests were repeated several times (with and without fingerprinting) in order to get mean values and filter out measurement errors. After each run, the workstation was defragmented and rebooted. We simulated various file operations that a computer user would execute: copying² different types of clean files from one place to another, archiving and unarchiving files, encoding and transcoding³ audio and video files, converting DVD files to iPod format, downloading files from the Internet, launching applications, etc. We also used a third-party, industry-recognized performance testing suite (PC Mark 8 Professional) to measure the system impact during real-world product usage. Readers are invited to evaluate the various products themselves, to see how they impact on their systems (due to e.g. software conflicts and/or user preferences, as well as different system configurations that may lead to varying results).

Security products need to load on systems at an early stage to provide security from the very beginning – this load has some impact on the time needed for a system to start up. Measuring boot times accurately is challenging. The most significant issue is to define exactly when the system is fully started, as many operating environments may continue to perform start-up activities for some time after the system appears responsive to the user. It is also important to consider when the protection provided by the security solution being tested is fully active, as this could be a useful measure of boot completion as far as the security solution is concerned. Some security products load their services very late at boot (or even minutes later). Users may notice that some time after the system has loaded, it will become very slow for a little while; thus, it initially looks as though the system has loaded very quickly, but in fact the security product just loads its services belatedly, leaving the system more vulnerable. As we find this misleading, we still do not publish boot times in our reports.

² We use around 3GB of data consisting of various file types and sizes (pictures, movies, audio files, various MS Office documents, PDF files, applications/executables, Windows operating system files, archives, etc.).

³ Converting MP3 files to WAV, MP3 to WMA and AVI to MP4

Notes and comments

The on-access/real-time scanner component of anti-virus software runs as a background process to check all files that are accessed, in order to protect the system continuously against malware threats. For example, on-access scanners scan files as soon as they are accessed, while (e.g.) behaviour-blockers add a different layer of protection and monitor what the file does when it is already executed/running. The services and processes that run in the background to do these tasks also require and use system resources. Suite products usually have a higher impact on system performance than anti-virus-only products, as more services/features are included and running in the background.

Security products need to be active deep in the system in order to protect it, e.g. to scan processes and so on that are already active during the system start-up, to identify rootkits and other malware. Those procedures add some extra time and thus a delay in system boot/start up.

If a product takes up too many system resources, users get annoyed and may either disable or uninstall some essential protective features (and thus considerably compromise the security of their system) or may switch to security software that is less resource-hungry. Therefore, it is important not only that anti-virus software provides high detection rates and good protection against malware, but also that it does not degrade system performance or trouble users.

While this report looks at how much impact various anti-virus products have on system performance, it is not always the security software that is principally responsible for a slow system. Other factors also play a role, and if users follow some simple rules, system performance can be improved noticeably. The next sections address some of the other factors that may play a part.

A few common problems observed on some user PCs:

- **Old hardware:** If a PC already runs at a snail's pace because it has ten-year-old hardware, using modern (security) software may make it unusable.
 - If possible, buy a new PC that at least meets the minimum recommended requirements of the software you want to use. Multi-Core processors are preferable.
 - Adding more RAM does not hurt. If you use Windows 7 or Windows 8, you should use a minimum of 4GB of RAM. If you use Windows XP or Vista, switch to Windows 7 or Windows 8 64-Bit.
 - Make sure you have only ONE security program with real-time protection. If your new PC came with a trial security suite, remove this before installing a different protection program.

- **Keep all your software up-to-date:** Using an anti-virus version from e.g. 2012 may not protect you as well as the newer version would, even though you may still be able to update the signatures. Please visit <http://update.microsoft.com> regularly and keep your operating system up-to-date by installing the recommended patches. Any software can have vulnerabilities and bugs, so keep all the software installed on your PC up-to-date: this will not only protect you against many exploits and vulnerabilities, but also give you any other application improvements that have been introduced.

- **Clean up the content of your hard disk:**
 - If your hard disk is almost full, your system performance will suffer accordingly. Leave at least 20% of your disk space free and transfer your movies and other infrequently accessed files to another (external) disk. If money is not an issue, consider buying solid-state drives (SSDs).
 - Uninstall unneeded software. Often, the slowdown that users notice after installing an anti-virus product is due to other software on the PC running in the background (that is, due to software conflicts or heavy file access by other programs, each access requiring anti-virus scanning).
 - Remove unneeded entries/shortcuts from the Start-Up folder in the All Programs menu.
 - If your PC is already messed up by residual files and registry entries left over by hundreds of applications you installed and uninstalled after trying them out, reinstall a clean operating system and install only software you really need (fewer software installations means fewer potential vulnerabilities and conflicts, and so on) and use e.g. an image/backup tool in order to ensure that you do not have to reinstall everything manually in future.

- **Defragment your hard disks regularly:** A fragmented hard disk can have a very big impact on system performance as well as considerably increasing the time needed to boot up the system. Please note that this does not apply to solid-state drives (SSDs).

- **Fingerprinting/Optimization:** most anti-virus products use various technologies to decrease their impact on system performance. Fingerprinting is such a technology, where already scanned files do not get rescanned again for a while (or more rarely) or are whitelisted. This increases the speed considerably (especially after a longer period of PC usage), but also adds some potential risk, as not all files are scanned anymore. It is up to the user to decide what to do. We suggest regularly performing a full-system scan (to be sure that all files are at least currently found to be clean, and to further optimize the fingerprinting).

- **Be patient:** a delay of a few additional seconds due to security software is not necessarily a big deal. However, if even with the suggestions above the performance of your PC still annoys you, you should consider trying out another anti-virus product. If you only notice a slow-down after using the anti-virus for a long time, there are probably other factors behind the slowdown. Never reduce your security by disabling essential protection features, just in the hope of gaining a slightly faster PC!

Test cases

File copying

Some anti-virus products ignore some types of files by design/default (e.g. based on their file extensions), or use fingerprinting technologies, which may skip already scanned files in order to increase the speed (see comments on page 6). We copied a set of various common file types from one physical hard disk to another physical hard disk.

Archiving and unarchiving

Archives are commonly used for file storage, and the impact of anti-virus software on the time taken to create new archives or to unarchive files from existing archives may be of interest for most users. We archived a set of different file types that are commonly found on home and office workstations. The results already consider the fingerprinting/optimization technologies of the anti-virus products, as most users usually make archives of files they have on their disk.

Encoding/transcoding

Music files are often stored and converted on home systems, and converting such files takes system resources. Because of this, many home users may be interested to know if their anti-virus product imposes a slowdown while converting multimedia files from one format to another. We encoded and transcoded some multimedia files with FFmpeg and HandBrakeCLI.

Installing/uninstalling applications

We installed several popular applications with the silent install mode, then uninstalled them and measured how long it took. We did not consider fingerprinting, because usually an application is installed only once.

Launching applications

Microsoft Office and PDF files are very common. We opened and then later closed some large document files in Microsoft Office and some large PDF files in Adobe Acrobat Reader. The time taken for the viewer or editor application to launch, and afterwards to close, was measured. Although we list the results for the first opening and the subsequent openings, we consider the subsequent openings more important, as normally this operation is done several times by users, and optimization of the anti-virus products take place, minimizing their impact on the systems.

Downloading files

Large files are downloaded from a local server with a GUI-less browser that allows sending HTTP requests in the background. Additionally, the content of several popular websites are fetched via wget, also from a local server.

Test results

These specific test results show the impact on system performance that anti-virus products have, compared to the other tested anti-virus products. The reported data just gives an indication and is not necessarily applicable in all circumstances, as too many factors can play an additional part.

As we noticed that delivering percentages can easily be misinterpreted by users (as well as misused by marketing departments or the press), and percentages would need adjustments when other hardware specifications are being used, we grouped the percentage results by clustering them. The impact within those categories does not statistically differ, also considering error measurements. The testers defined the categories by consulting statistical methods like hierarchical clustering, and taking into consideration what would be noticed from the user's perspective, or compared to the impact of the other security products. As the single performance results (page 9) are built using clusters, if some products are faster/slower than others this is reflected in the results. We give the mean values (the percentages refer to a system without a security product) of the clusters as an indication only:

	slow	mediocre	fast	very fast
File copying (first run)	-	-	The mean value of this cluster is over +50%	The mean value of this cluster is under +50%
File copying (subsequent runs)	-	-	The mean value of this cluster is over +40%	The mean value of this cluster is under +40%
Archiving/unarchiving	-	-	The mean value of this cluster is over +20%	The mean value of this cluster is under +20%
Installing/uninstalling	-	The mean value of this cluster is over +70%	The mean value of this cluster is under +70%	The mean value of this cluster is under +50%
Encoding/transcoding	-	-	-	The mean value of this cluster is under 3%
Open Office documents (on first run)	-	The mean value of this cluster is over +40%	The mean value of this cluster is under +40%	The mean value of this cluster is under +25%
Open Office documents (on subsequent runs)	-	-	The mean value of this cluster is over +10%	The mean value of this cluster is under +10%
Open PDF (on first run)	-	-	The mean value of this cluster is over +30%	The mean value of this cluster is under +30%
Open PDF (on subsequent runs)	-	-	The mean value of this cluster is over +10%	The mean value of this cluster is under +10%
Downloading files	-	-	The mean value of this cluster is over +50%	The mean value of this cluster is under +50%

Overview of single AV-C performance scores

Vendor	File copying		Archiving/ unarchiving	Installing/ uninstalling applications	Encoding/ transcoding	Launching applications				Downloading files
	On first run	On subsequent runs				Open Office documents		Open PDF		
						On first run	On subsequent runs	On first run	On subsequent runs	
Avast										
AVG										
AVIRA										
Baidu										
Bitdefender										
BullGuard										
Emsisoft										
eScan										
ESET										
Fortinet										
F-Secure										
Kaspersky Lab										
Kingsoft										
Lavasoft										
McAfee										
Microsoft										
Panda										
Qihoo										
Sophos										
Trend Micro										
Vipre										

Key: slow mediocre fast very fast



PC Mark Tests

In order to provide an industry-recognized performance test, we used the PC Mark 8 v2.0.228 Professional Edition⁴ testing suite. Users using PC Mark 8 benchmark⁵ should take care to minimize all external factors that could affect the testing suite, and strictly follow at least the suggestions documented inside the PC Mark manual, in order to get consistent and valid/useful results. Furthermore, the tests should be repeated several times to verify them. For more information about the various consumer scenarios tests included in PC Mark, please read the whitepaper on their website⁶.

“Without AV”⁷ is tested on a baseline⁸ system, which scores 100 points in the PC Mark 8 Home benchmark.

	PC Mark 8 points
<i>without AV</i>	100
ESET	99.0
Avast	98.8
Baidu	
Bitdefender	
F-Secure	
Kaspersky Lab	
Sophos	98.5
Avira	
Fortinet	98.3
Emsisoft	
Qihoo	98.1
ThreatTrack Vipre	
AVG	97.7
Panda	
Trend Micro	
Kingsoft	97.3
Lavasoft	96.7
McAfee	96.3
BullGuard	95.9
eScan	94.4

⁴ For more information, see <http://www.futuremark.com/benchmarks/pcmark8>

⁵ PCMark® is a registered trademark of Futuremark Corporation.

⁶ <http://www.futuremark.com/downloads/pcmark8-technical-guide.pdf> (PDF)

⁷ The PC Mark score with active Windows Defender would be 97,7.

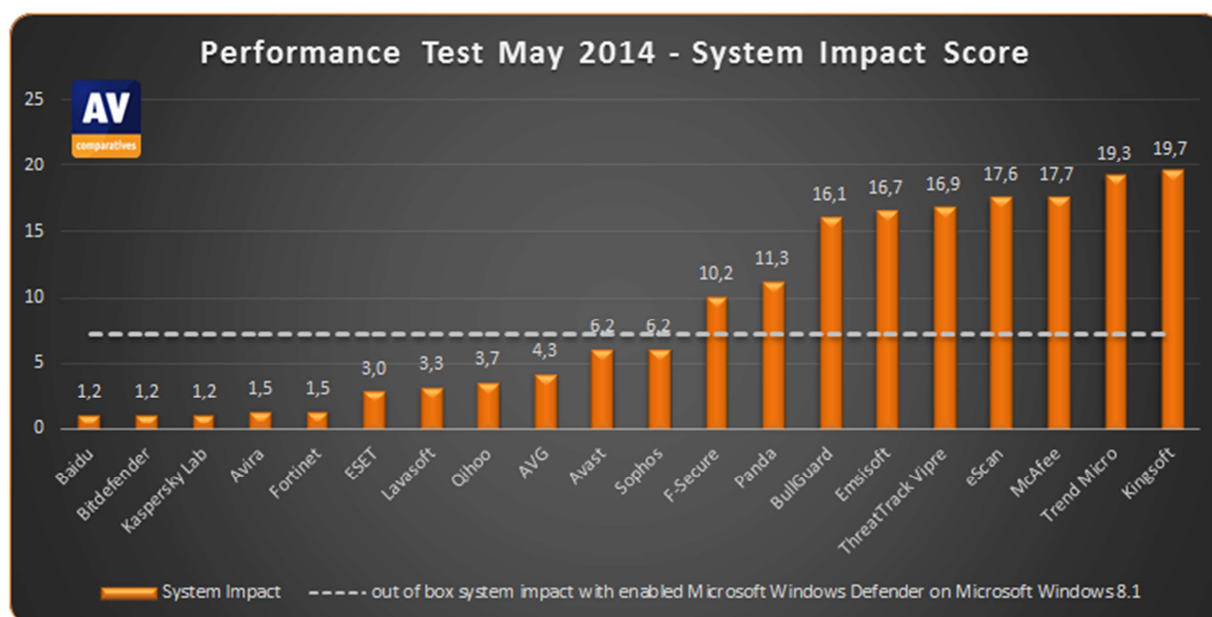
⁸ Baseline system: Intel Core i5-4200H machine with 8GB RAM

Summarized results

Users should weight the various subtests according to their needs. We applied a scoring system in order to sum up the various results.

For “file copying”, we took the mean values, as well as for “launching applications” (on subsequent runs). As in previous performance reports, “very fast” gets 15 points, “fast” gets 10 points, “mediocre” gets 5 points and “slow” gets zero points. This leads to the following results:





	AV-C Score	PC Mark Score	TOTAL	Impact Score
Baidu, Bitdefender, Kaspersky Lab	90	98.8	188.8	1.2
Avira, Fortinet	90	98.5	188.5	1.5
ESET	88	99.0	187.0	3.0
Lavasoft	90	96.7	186.7	3.3
Qihoo	88	98.3	186.3	3.7
AVG	88	97.7	185.7	4.3
Avast, Sophos	85	98.8	183.8	6.2
F-Secure	81	98.8	179.8	10.2
Panda	81	97.7	178.7	11.3
BullGuard	78	95.9	173.9	16.1
Emsisoft	75	98.3	173.3	16.7
ThreatTrack Vipre	75	98.1	173.1	16.9
eScan	78	94.4	172.4	17.6
McAfee	76	96.3	172.3	17.7
Trend Micro	73	97.7	170.7	19.3
Kingsoft	73	97.3	170.3	19.7



The out-of-box system impact score with enabled Windows Defender on Microsoft Windows 8.1 is 7,3.

Award levels reached in this test

The following award levels are for the results reached in this performance test report⁹. Please note that the performance test only tells you how much impact an anti-virus product may have on a system compared to other anti-virus products (please read the note on page 8); it does not tell anything about the effectiveness of the protection a product provides, so please have also a look at the results of recent [Real-World Protection](#) and [File Detection](#) tests on our website.

AWARDS	PRODUCTS ¹⁰
	<ul style="list-style-type: none"> ✓ Baidu ✓ Bitdefender ✓ Kaspersky Lab ✓ Avira ✓ Fortinet ✓ ESET ✓ Lavasoft ✓ Qihoo ✓ AVG ✓ Avast ✓ Sophos
	<ul style="list-style-type: none"> ✓ F-Secure ✓ Panda
	<ul style="list-style-type: none"> ✓ BullGuard ✓ Emsisoft ✓ ThreatTrack Vipre ✓ eScan ✓ McAfee ✓ Trend Micro ✓ Kingsoft
	<p style="text-align: center;">-</p>

The above awards have been given based on our assessment of the overall impact results with default settings under Windows 8.1 64-Bit.

⁹ Microsoft Windows Defender was tested out-of-competition and is therefore not included in the awards page.

¹⁰ We suggest considering products with the same award to be as light as the other products with same award.

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