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Antivirus & Internet Security Performance Benchmarking

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REVISION HISTORY

Revision	Revision History	Date
1	Initial version of the document	1/Nov/2007
2	Update after review to correct a number of minor oversights. Removed Trend Micro AV/AS 2007 results as newer 2008 results were available.	20/Nov/2007

REFERENCES

Ref #	Document	Author	Date
1	Measuring Performance in Windows Vista http://www.microsoft.com/whdc/system/sysperf/Vista_perf.mspx	Microsoft	July 13 2007
2	Symantec RFP, Ed 1- 3	**Dora Karali,** Symantec Corporation	8/Aug/2007 - 22/Aug/2007
3	Performance Testing Methodologies 2007 + Symantec test cases	**Global Performance Unit** Symantec Corporation	9/Aug/2007

Executive Summary

System Impact Performance benchmark testing was carried on twenty-four Antivirus and Internet Security products from various vendors between September and November 2007. The current generation of products, available as of October 31 2007, were tested. Measurements were made against five different metrics (6 in the case of some products) on a low range, resource challenged, PC running XPsp2. The performance metrics measured were:

- Boot time
- Scan speed
- UI launch speed
- Memory utilization
- HTTP download speed (Internet Security products only)
- IE launch / browsing speed

No attempt was made to measure the effectiveness of threat detection, as this aspect of the products is covered by other industry benchmarks such as Virus Bulletin and AV-Comparatives.org. This report is solely focused on measuring how responsive the applications are and by how extensively the applications utilize the resources of the machine.

The products were divided into two groups, AntiVirus products (AV) and Internet security products (IS). AV products are defined in this report as products which are primarily focused on detecting and remediating viruses & spyware. IS products typically add additional functions to provide comprehensive internet protection, such phishing detection, firewalls, scanning of web pages and the HTTP data.

Each product was then given a score of 1 to 5 for each metric and then an overall combined score was calculated, to rank the performance of each product relative to the other products.

The following four Antivirus products proved to be the best performing: Norton Antivirus 2008, Avast, AVG Free & Avira AV.

The following two Internet Security products proved to be the best performing: Norton Internet Security 2008 & Zone Alarm IS 7.1.

All of the above mentioned products scored the same 5 star rating.

Products tested

The list of products under test in this report are:

Manufacturer	Product Name	Product Version	Date Tested
Agnitum	Outpost Security Suite Pro	2007	5th Oct
Alwil Software	Avast!	4.7	4th Oct
Avira	Personal Edition Classic	7.06	5th Oct
BitDefender	BitDefender Antivirus	2008	9th Oct
BitDefender	BitDefender Internet Security	2008	9th Oct
Check Point Software	Zonealarm Antivirus	7.0	3rd Oct
Check Point Software	Zonealarm Internet Security Suite	7.0	3rd Oct
F-Secure	F-Secure Anti-Virus 2008	2008	10th Oct
F-Secure	F-Secure Internet Security 2008	2008	10th Oct
G DATA	G DATA AntiVirus	2008	5th Nov
G DATA	G DATA Internet Security	2008	7th Nov
Grisoft	AVG Free	7.5	19th Sept
Kaspersky Lab	Kaspersky Anti-Virus	7.0	12th Sept
Kaspersky Lab	Kaspersky Internet Security	7.0	11th Sept
McAfee	McAfee Total Protection (*)	2008	25th Oct
McAfee	McAfee VirusScan Plus Firewall and AntiSpyware (*)	2008	25th Oct
Panda Security	Panda Antivirus	2008	20th Sept
Panda Security	Panda Internet Security	2008	27th Sept
Symantec	Norton Antivirus	2008	5th Sept
Symantec	Norton Internet Security	2008	6th Sept
Trend Micro	Trend Micro AntiVirus + AntiSpyware	2008	8th Oct
Trend Micro	Trend Micro PC-cillin Internet Security	2008	8th Oct
Webroot Software	Webroot Spysweeper	5.5	19th Sept

(*) McAfee products are “version-less” subscriptions.

Metrics – Criteria measured

The metrics used for this report were selected because they provide an indication of the product's performance in a number of key areas which impact on the user experience. They are also objective metrics that can be replicated and re-produced by 3rd parties if required. See Appendix 1 for specific test methodologies.

Benchmark 1 - Boot time

The time taken for the machine to boot was measured. It is typical for protection applications of this genre to be launched at Windows start up. This typically adds some amount of time to the boot time for the machine. Our aim was to measure the additional time added to the boot process as a result of installing these applications. Shorter boot times are better and indicates that the application has less impact on the normal operation of the machine.

Benchmark 2 - Scan speed

All these products have functionality designed to detect viruses and various other forms of malware by scanning files on the system. This test measured the amount of time required to scan a typical set of clean files. The sample set used against all products was 1.2GB worth of data, made up of typical Window's files from the Windows system folder and Office files.

Benchmark 3 – User Interface launch speed

The time taken to start the User Interface of the product was measured. This is one measure of how responsive an application appears to a user. Both the initial launch time and the subsequent launch times, to allow for caching effects, were measured. For simplicity only the more critical initial times are used in this report.

Benchmark 4 - Memory utilization

The amount of RAM used by the product was measured while the machine and product were in an idle state, running in the background. All processes used by the application were identified and the total RAM usage calculated. The less RAM an application uses while resident in the background the better. Idle state measurements were made, as opposed to RAM used while actively scanning, because it is easier to measure the stable idle state and the aim was to see what resources were being used on a permanent basis.

Benchmark 5 - HTTP download speed

These products scan data for malware as it is downloaded from the local network or internet. This test measures what impact the product has on HTTP downloads across a local network. A 100Mbit/sec NIC and switch were used.

Benchmark 6 - IE launch / browsing speed

The time taken to start the user interface of Internet Explorer was measured. This is one measure of how the product impacts on the responsiveness of the system. Both the initial launch time and the subsequent launch times, to allow for caching effects, were measured. For simplicity only the more critical initial times are used in this report.

Test results – Antivirus Products

Percentage rankings

	Boot Time	Scan Time	UI Initial	Memory	IE Initial
Avast	100%	100%	75%	80%	69%
AVG Free	90%	79%	93%	100%	91%
Avira AV	95%	95%	84%	93%	89%
BitDefender AV v11	97%	89%	78%	100%	0%
F-Secure AV 2008	28%	57%	58%	20%	28%
G-Data AV 2008	90%	53%	63%	0%	25%
Kaspersky AV 7	89%	0%	87%	81%	96%
McAfee AV 08	86%	36%	58%	41%	87%
Norton AV 2008	72%	91%	82%	89%	95%
Panda AV 2008	86%	100%	24%	35%	92%
Trend Micro AV/AS 2008	86%	92%	0%	46%	70%
Webroot SS AV/AS 5.5	0%	79%	100%	81%	100%
ZoneAlarm AV 7.1	50%	91%	66%	72%	79%

The percentage of range indicates where the product performed on a single test in comparison to the other products. The range is the difference between the best performing product and the worst performing product. All products were scored against this range. A score of 100% indicates the best performance and a score of 0% indicates the worst performance. Unlike a simple ranking, this method test does not negatively impact products that had similar performance near the top of the range.

Quintiled Star Ranking

	Boot Time	Scan Time	UI Initial	Memory	IE Initial
Avast	★★★★★	★★★★★	★★★★	★★★★★	★★★★
AVG Free	★★★★★	★★★★	★★★★★	★★★★★	★★★★★
Avira AV	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
BitDefender AV v11	★★★★★	★★★★★	★★★★	★★★★★	★
F-Secure AV 2008	★★	★★★	★★★	★★	★★
G-Data AV 2008	★★★★★	★★★	★★★★	★	★★
Kaspersky AV 7	★★★★★	★	★★★★★	★★★★★	★★★★★
McAfee AV 08	★★★★★	★★	★★★	★★★	★★★★★
Norton AV 2008	★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Panda AV 2008	★★★★★	★★★★★	★★	★★	★★★★★
Trend Micro AV/AS 2008	★★★★★	★★★★★	★	★★★	★★★★
Webroot SS AV/AS 5.5	★	★★★★	★★★★★	★★★★★	★★★★★
ZoneAlarm AV 7.1	★★★	★★★★★	★★★★	★★★★	★★★★

The Quintiled Percentage of Range provides a score to each vendor depending on the score of the Percentage of Range (see above). Each range is in 20 point increments starting with 1 (0

to 20%) to 5 (80 to 100%). Once again, this rewards vendors who consistently perform at the top of each category.

Overall star score - Antivirus Products

The Quintile Scores above are averaged and then rounded to create the overall "Star Score" (below)

	Overall Star Score
Avast	★★★★★
AVG Free	★★★★★
Avira AV	★★★★★
BitDefender AV v11	★★★★
F-Secure AV 2008	★★
G-Data AV 2008	★★★
Kaspersky AV 7	★★★★
McAfee AV 08	★★★★
Norton AV 2008	★★★★★
Panda AV 2008	★★★★
Trend Micro AV/AS 2008	★★★★
Webroot SS AV/AS 5.5	★★★★
ZoneAlarm AV 7.1	★★★★

Four Anti-virus products had high enough performance across the five test metrics to average 5 stars, Avast, AVG Free, Avira AV and Norton AV 2008.

Test results – Internet Security Products

Percentage rankings

	Boot Time	Scan Time	UI Initial	Memory	HTTP Download	IE Initial
Agnitum Outpost Security Suite 2007	47%	60%	100%	48%	76%	18%
BitDefender Total Security 2008	90%	87%	75%	100%	0%	11%
F-Secure IS 2008	27%	18%	57%	47%	58%	37%
G-Data IS 2008	94%	41%	57%	42%	63%	0%
Kaspersky IS 7	100%	0%	86%	92%	31%	100%
McAfee TP 08	90%	17%	57%	58%	50%	63%
Norton IS 2008	87%	91%	92%	95%	99%	38%
Panda IS 2008	0%	100%	0%	0%	96%	99%
Trend Micro IS 2008	76%	92%	11%	67%	100%	80%
ZoneAlarm IS 7.1	64%	92%	72%	83%	77%	84%

See the corresponding Antivirus test above for details about how the percentage values were derived from the raw results.

Quintiled star ranking

	Boot Time	Scan Time	UI Initial	Memory	HTTP Download	IE Initial
Agnitum Outpost Security Suite 2007	★★★	★★★	★★★★★	★★★	★★★★	★
BitDefender Total Security 2008	★★★★★	★★★★★	★★★★	★★★★★	★	★
F-Secure IS 2008	★★	★	★★★	★★★	★★★	★★
G-Data IS 2008	★★★★★	★★★	★★★	★★★	★★★★	★
Kaspersky IS 7	★★★★★	★	★★★★★	★★★★★	★★	★★★★★
McAfee TP 08	★★★★★	★	★★★	★★★	★★★	★★★★
Norton IS 2008	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★	★★
Panda IS 2008	★	★★★★★	★	★	★★★★★	★★★★★
Trend Micro IS 2008	★★★★	★★★★★	★	★★★★	★★★★★	★★★★★
ZoneAlarm IS 7.1	★★★★	★★★★★	★★★★	★★★★★	★★★★	★★★★★

See the corresponding Antivirus test above for details about how the star values were derived from the raw results.

Overall star score - Internet Security Products

	Overall Star Score
Agnitum Outpost Security Suite 2007	★★★
BitDefender Total Security 2008	★★★★
F-Secure IS 2008	★★
G-Data IS 2008	★★★
Kaspersky IS 7	★★★★
McAfee TP 08	★★★
Norton IS 2008	★★★★★
Panda IS 2008	★★★
Trend Micro IS 2008	★★★★
ZoneAlarm IS 7.1	★★★★★

Only two Internet Security products had high enough performance across the six test metrics to average 5 stars, ZoneAlarm IS 7.1 and Norton IS 2008.

What this report doesn't cover

This report focused on performance measurements such as execution speed and resource usage. No attempt was made to measure the effectiveness of threat detection, as this aspect of the products is covered by other industry benchmarks such as Virus Bulletin &, AV-Comparatives.org.

The metrics used for this report cover a number of key performance areas and are metrics that can be replicated & re-produced by 3rd parties if required.

However there are a number of areas that this report doesn't attempt to cover. These include,

- CPU usage during local file scanning
- Impact on multitasking foreground tasks while scanning is in progress in the background
- RAM usage during scanning
- Impact on shutdown & hibernation times
- Installation & Un-installation times
- Out of the box virus signature update times
- Impact on E-mail receive and send times
- Speed of the products UI when performing common tasks
- Impact on system stability
- Testing on high end hardware running Vista.
- Testing on 64bit operating systems with 64bit hardware.
- Some products such as NOD32 were omitted, whose new 2008 software release was not available by our deadline for this report.

Some of these items are subjective and / or not easily measured, others such as signature update times are likely to change from one week to the next.

Some testing was performed on Vista, but at the time of writing, one product failed to install cleanly under Vista when tested (G-Data IS 2008) and another explicitly stated that it did not support Vista (Agnitum Outpost Security Suite 2007). The incomplete set of Vista measurements, not included in this report, show results that were for the most part broadly in line with the XP results.

It might be of interest to re-visit this list during any future tests with a view to adding additional metrics.

Disclaimer & Disclosure

This report only covers products that were available up until available as at October 31 2007.

Disclaimer of Liability

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Disclosure

Symantec Corporation funded the production of this initial version of the report and supplied some of the test scripts used for the tests (See appendix 1 'test methods' below).

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Download link

An electronic copy of this report can be found here,
http://www.passmark.com/ftp/Antivirus-Performance-Testing-Ed1.pdf

Appendix 1 - Test method – How we tested

Common methodology

Norton Ghost was used to create images of the O/S and these clean images were restored before the test of each product.

Image creation steps

1. Install and Activate Windows
2. Download and Install Windows Updates
3. Disable Automatic Updates
4. Turn off windows security notifications
5. Disable windows defender automatic scans to avoid unexpected background activity
6. If testing on Vista, close and disable "start at run", Vista sidebar to avoid some background activity
7. Disable windows firewall
8. For XP install .NET 2.0 as this is required by Ghost (and probably by several of the products under test).
9. Install Ghost
10. Disable ghost taskbar icon from auto startup in msconfig
11. Disable windows defender from startup in msconfig
12. Optimize bootup with ProcessIdleTasks (repeated several times)
13. If testing on Vista, disable Vista admin prompts to allow for better test automation
14. Reboot and tell msconfig not to start again.
15. Create image using Ghost

Benchmark 1 - Boot time

The machines were rebooted in a cyclic manner. Averages of 15 boot times were taken for each product on each machine. The start of the boot process was taken to be the end of the BIOS initialization and the end of the boot process was taken to be when the CPU was idle for 5 continuous seconds.

Windows has various functions to optimize the boot process. So it is important to force optimization of the system before starting the test (with ProcessIdleTasks) and delete the Windows pre-fetch folder.

Benchmark 2 - Scan speed

The time it took for each product to scan a set of sample files. The sample used was identical in all cases and contained a mixture of system files and Office files. In total there were 6159 files whose combined size was 982MB. Most of these files come from the Windows system folders. As the file types can influence the scan speed, the breakdown of the main file types, file numbers and total sizes of the files in the sample set is given here.

.dll	2589	490MB	.mof	43	6MB	.py	20	<1MB
.exe	695	102MB	.ax	39	4MB	.msc	18	1MB
.sys	332	23MB	.xls	38	3MB	.vbs	18	1MB
.gif	302	1MB	.ime	35	5MB	.xml	18	1MB
.doc	281	64MB	.drv	31	1MB	.rtf	16	62MB
.wmf	185	2MB	.txt	31	1MB	.ocx	16	4MB
.png	149	2MB	.chm	30	6MB	.tsp	14	1MB
.html	126	1MB	.cpl	29	4MB	.com	14	<1MB
.nls	80	6MB	.mfl	29	3MB	.xsl	14	<1MB
.jpg	70	1MB	.inf	26	2MB	.h	13	<1MB
.ini	59	2MB	.hlp	22	3MB	.vsd	12	2MB
.ico	58	<1MB	.imd	20	18MB	.scr	12	2MB

.aw	12	2MB	.lex	9	10MB	.wav	7	5MB
.js	12	1MB	.ppt	9	4MB			
.zip	11	25MB	.acm	9	1MB			

For each product 5 samples were taken with the machine rebooted before each sample to clear any caching effects.

Where possible, PerfScan++ was used to automate the testing process. Additionally, if possible the scan was run without launching the product's UI. When it was not possible to use PerfScan the samples were taken manually with a stop watch.

Benchmark 3 - UI launch speed

The launch speed of the product's user interface was tested using AppTimer. Each product was tested for 5 sets of 3 launches, with a reboot before each set. When compiling the results the first of each set was separated out so that there was a set of values for the initial launch after reboot and a set for subsequent launches.

In some cases AppTimer did not correctly record the time taken for UI launch. For instance, some applications would open their window and look like they were ready, but then continued to be unresponsive. Where this was noticeable the measurement was taken manually with a stop watch.

Benchmark 4 - Memory utilization

The Perflog++ utility was used to record process memory usage on the system at boot, and then every minute for another fifteen minutes after. This was done only once per product and resulted in a total of 16 samples. However the first sample taken at boot was never counted.

Because this recorded the memory usage of all processes, the products processes needed to be identified before the results could be processed. For this a program called Sysinternals Process Explorer was used to create a more detailed record of all the processes, with information such as company name included. This was run immediately after Perflog finished.

Benchmark 5 - HTTP download speed

For this test PerfBench was used to download a set of files from a server running Windows Vista Ultimate and IIS 7. The client machine and the server were placed on an isolated network segment and PerfBench would download the file set 15 times consecutively. Before the first test both the server and client were rebooted (but not in between subsequent samples).

The file set used was a partial copy of CNN.com. The total size of the sample retrieved was 24,313,141 bytes and the total number of files was 422. Files from the CNN web site were selected as being a typical set of HTML files.

Benchmark 6 - IE launch / browsing speed

The launch speed of Internet Explorer interface was tested using AppTimer. This test was practically identical to the UI launch test. Each product was tested for 5 sets of 3 launches, with a reboot before each set. When compiling the results the first of each set was separated out so that there was a set of values for the initial launch after reboot and a set for subsequent launches.

Appendix 2 - Test environment

System under test

AMD 1600+ CPU, ASUS A7V Motherboard, 512MB of RAM, 80GB Hard drive, 100Mbit/sec Ethernet.
Windows XP Service Pack 2.

A low range system was selected for testing as it was expected that the impact of the applications under test would be more pronounced on older hardware.

Appendix 3 - Raw results

Boot time

Product	Seconds
AV Products	
Webroot Spysweeper AV/AS 5.5	159.71
F-Secure AV 2008	143.91
ZoneAlarm AV 7.1	131.09
Norton AV 2008	118.60
Panda AV 2008	111.20
McAfee AV 08	110.88
Trend Micro AV/AS 2008	110.65
Kaspersky AV 7	108.95
G-Data AV 2008	108.89
AVG Free	108.65
Avira AV	105.90
BitDefender AV v11	104.91
Avast	102.99
Average result	117.41

IS Products	
Panda IS 2008	176.78
F-Secure IS 2008	158.02
Agnitum Outpost Security Suite 2007	144.38
ZoneAlarm IS 7.1	132.62
Trend Micro IS 2008	124.32
Norton IS 2008	116.67
BitDefender Total Security 2008	114.34
McAfee TP 08	114.23
G-Data IS 2008	111.65
Kaspersky IS 7	107.35
Average result	130.04

Scan time

Product	Seconds
AV Products	
Kaspersky AV 7	1005.1
McAfee AV 08	702.2
G-Data AV 2008	562.8
F-Secure AV 2008	529.6
AVG Free	344.1
Webroot Spysweeper AV/AS 5.5	343.0
BitDefender AV v11	263.6

ZoneAlarm AV 7.1	242.8
Norton AV 2008	242.7
Trend Micro AV/AS 2008	231.2
Avira AV	207.0
Avast	169.6
Panda AV 2008	168.4
Average result	385.55

IS Products	
Kaspersky IS 7	825.7
McAfee TP 08	714.6
F-Secure IS 2008	713.4
G-Data IS 2008	566.0
Agnitum Outpost Security Suite 2007 for XP	444.4
BitDefender Total Security 2008	269.4
Norton IS 2008	242.8
ZoneAlarm IS 7.1	238.0
Trend Micro IS 2008	237.2
Panda IS 2008	188.0
Average result	443.95

User Interface Launch (Initial)

Product	Milliseconds
AV Products	
Trend Micro AV/AS 2008	5600.00
Panda AV 2008	4330.00
F-Secure AV 2008	2514.00
McAfee AV 08	2514.00
G-Data AV 2008	2268.0
ZoneAlarm AV 7.1	2085.00
Avast	1611.20
BitDefender AV v11	1459.80
Norton AV 2008	1229.75
Avira AV	1128.80
Kaspersky AV 7	1008.50
AVG Free	691.20
Webroot Spysweeper AV/AS 5.5	301.80
Average result	2057.08

IS Products	
Panda IS 2008	6346.00
Trend Micro IS 2008	5688.00
F-Secure IS 2008	3012.50
McAfee TP 08	3012.50
G-Data IS 2008	3012.00

ZoneAlarm IS 7.1	2111.00
BitDefender Total Security 2008	1915.75
Kaspersky IS 7	1306.80
Norton IS 2008	919.00
Agnitum Outpost Security Suite 2007 for XP	463.00
Average result	2778.66

Memory Usage

Product	MB Used
AV Products	
G-Data AV 2008	71.5
F-Secure AV 2008	57.5
Panda AV 2008	47.6
McAfee AV 08	43.5
Trend Micro AV/AS 2008	39.9
ZoneAlarm AV 7.1	22.1
Avast	16.2
Kaspersky AV 7	15.7
Webroot Spysweeper AV/AS 5.5	15.5
Norton AV 2008	10.1
Avira AV	7.7
BitDefender AV v11	2.9
AVG Free	2.8
Average result	27.15

IS Products	
Panda IS 2008	153.7
G-Data IS 2008	90.4
F-Secure IS 2008	82.6
Agnitum Outpost Security Suite 2007 for XP	82.3
McAfee TP 08	66.7
Trend Micro IS 2008	53.9
ZoneAlarm IS 7.1	28.9
Kaspersky IS 7	16.2
Norton IS 2008	11.2
BitDefender Total Security 2008	3.6
Average result	58.95

HTTP Download times

Product	Seconds
IS Products	
BitDefender Total Security 2008	90.7
Kaspersky IS 7	67.4

McAfee TP 08	53.3
F-Secure IS 2008	47.7
G-Data IS 2008	43.8
Agnitum Outpost Security Suite 2007 for XP	33.8
ZoneAlarm IS 7.1	33.4
Panda IS 2008	19.1
Norton IS 2008	17.3
Trend Micro IS 2008	16.3
Average result	42.28

IE Launch Initial

Product	Milliseconds
AV Products	
BitDefender AV v11	3646.8
G-Data AV 2008	2953.0
F-Secure AV 2008	2875.3
Avast	1722.0
Trend Micro AV/AS 2008	1690.8
ZoneAlarm AV 7.1	1442.8
McAfee AV 08	1228.0
Avira AV	1188.4
AVG Free	1108.4
Panda AV 2008	1094.6
Norton AV 2008	997.2
Kaspersky AV 7	976.5
Webroot Spysweeper AV/AS 5.5	871.6
Average result	1676.57
IS Products	
G-Data IS 2008	2981.3
BitDefender Total Security 2008	2780.2
Agnitum Outpost Security Suite 2007 for XP	2646.6
F-Secure IS 2008	2288.0
Norton IS 2008	2267.2
McAfee TP 08	1803.5
Trend Micro IS 2008	1474.8
ZoneAlarm IS 7.1	1404.8
Panda IS 2008	1119.8
Kaspersky IS 7	1099.8
Average result	1986.6