Home Anti-Virus Protection

APRIL - JUNE 2013

Dennis Technology Labs
www.DennisTechnologyLabs.com

This report aims to compare the effectiveness of anti-malware products provided by well-known security companies.

The products were exposed to internet threats that were live during the test period. This exposure was carried out in a realistic way, closely reflecting a customer's experience.

These results reflect what would have happened if a user was using one of the products and visited an infected website.

EXECUTIVE SUMMARY

- **Products tested**
  - AVG Anti-Virus Free 2013
  - Avast! Free Antivirus 8
  - BitDefender Internet Security 2013
  - ESET Smart Security 6
  - Kaspersky Internet Security 2013
  - McAfee Internet Security 2013
  - Microsoft Security Essentials
  - Norton Internet Security 2013
  - Trend Micro Internet Security 2013

- **The effectiveness of free and paid-for anti-malware security suites varies widely. McAfee's paid-for and Microsoft's free product were the least effective.**
  Every product except one was compromised at least once. The most effective were compromised just once or not at all, while the least effective (McAfee Internet Security) was compromised by 18 per cent of the threats. Avast! Free Antivirus 8 was the most effective free anti-malware product while the top three products (from Kaspersky, BitDefender and Symantec) were all paid-for.

- **Blocking malicious sites based on reputation is an effective approach.**
  Those products that prevented users from visiting the malicious sites in the first place gained a significant advantage. If the malware can't download onto the victim's computer then the anti-malware software faces less of an ongoing challenge.

- **Some anti-malware programs are too harsh when evaluating legitimate software**
  Most of the software generated at least one false positive. ESET Smart Security 6 was the least effective, blocking 13 legitimate applications. Microsoft Security Essentials, McAfee Internet Security 2013 and BitDefender Internet Security 2013 were the most effective in this part of the test.

- **Which was the best product?**
  The most accurate programs were BitDefender Internet Security 2013, Kaspersky Internet Security 2013 and Symantec's Norton Internet Security 2013, all of which won our AAA award in this test.

Simon Edwards, Dennis Technology Labs, 5th July 2013

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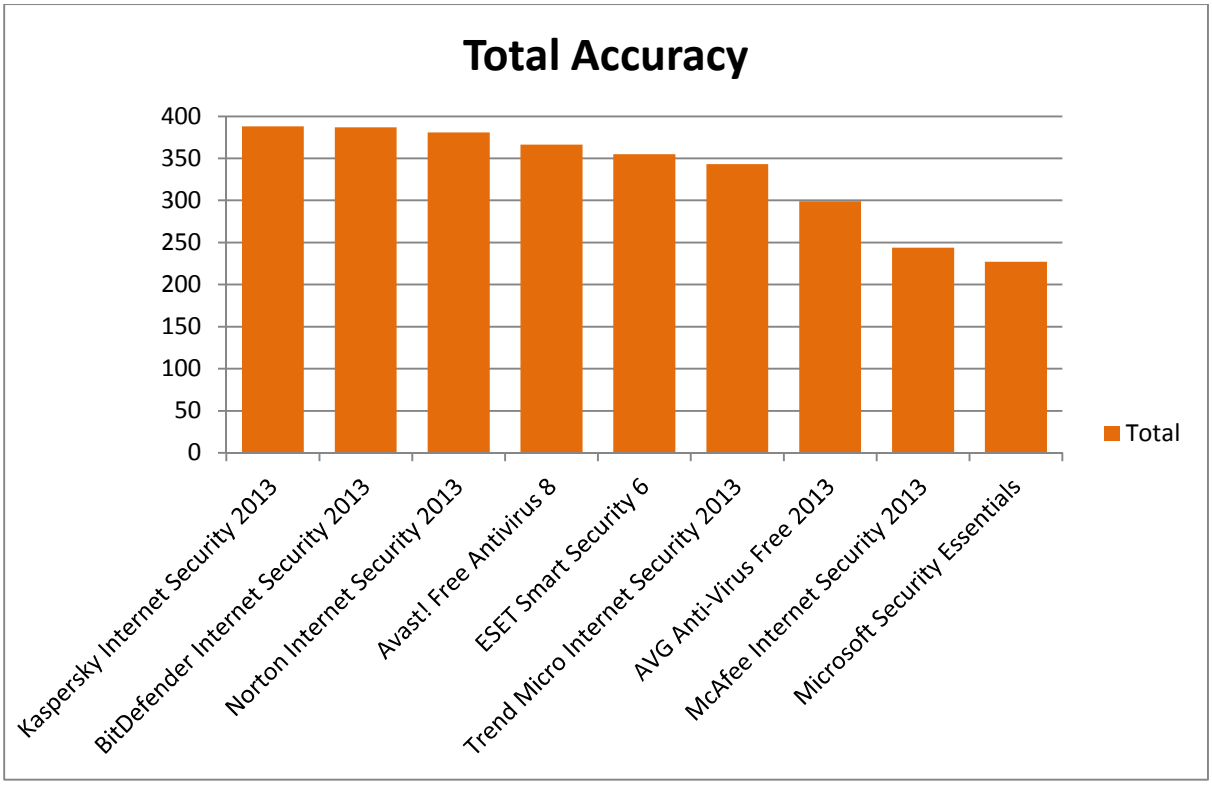
Document version 1.1. Edited 11th July 2013: Microsoft Security Essentials results corrected due to typographical error. One extra neutralization added. 1.2. Edited 18th July 2013: Avast! Free Antivirus version corrected. Changed from seven to eight.

1. Total Accuracy Ratings

The total accuracy ratings provide a way to judge how effectively the security programs work by looking at a single graph.

Anti-malware software should not just detect threats. It should allow legitimate software to run unhindered as well.

The results below take into account how accurately the programs treated threats and handled legitimate software.



The total accuracy ratings take into account successes and failures with both malware and legitimate applications.

We ran two distinct tests: one that measured how the products handled internet threats and one that measured how they handled legitimate programs.

The ideal product would block all threats and allow all legitimate applications.

When a product fails to protect the system against a threat it is compromised. When it warns against, or even blocks, legitimate software then it generates a 'false positive' result.

Products gain points for stopping threats successfully and for allowing users to install and run legitimate software. Products lose points for failing to stop threats and when they handle legitimate files incorrectly.

Each product then receives a final rating based on its performance in each of the 'threat' and 'legitimate software' tests.

These results show a combined accuracy rating, taking into account each product's performance with both threats and non-malicious software.

There is a maximum possible score of 400 and a minimum of -1,000.

See *5. False Positives* on page 9 for detailed results and an explanation on how the false positive ratings are calculated.

TOTAL ACCURACY RATINGS

Product	Total Accuracy Rating	Percentage	Award
Kaspersky Internet Security 2013	388	97%	AAA
BitDefender Internet Security 2013	386.8	97%	AAA
Norton Internet Security 2013	381	95%	AAA
Avast! Free Antivirus 8	366.25	92%	AA
ESET Smart Security 6	354.95	89%	A
Trend Micro Internet Security 2013	343	86%	A
AVG Anti-Virus Free 2013	299	75%	C
McAfee Internet Security 2013	243.9	61%	-
Microsoft Security Essentials	227	57%	-

Awards

The following products win Dennis Technology Labs awards:

DENNIS AAA TECHNOLOGY LABS	Kaspersky Internet Security 2013 BitDefender Internet Security 2013 Norton Internet Security 2013
DENNIS AA TECHNOLOGY LABS	Avast! Free Antivirus 8
DENNIS A TECHNOLOGY LABS	ESET Smart Security 6 Trend Micro Internet Security 2013
DENNIS C TECHNOLOGY LABS	AVG Anti-Virus Free 2013

2. Protection Ratings

The following results show how each product was scored for its accuracy in handling malware only. They do not take into account false positives.

- **Neutralize (+1)**

If the product terminated a running threat the result was a neutralization. The product protected the system and was awarded one point.

- **Neutralize, complete remediation (+2)**

The product was awarded a bonus point if, in addition to stopping the malware, it removed all hazardous traces of the attack.

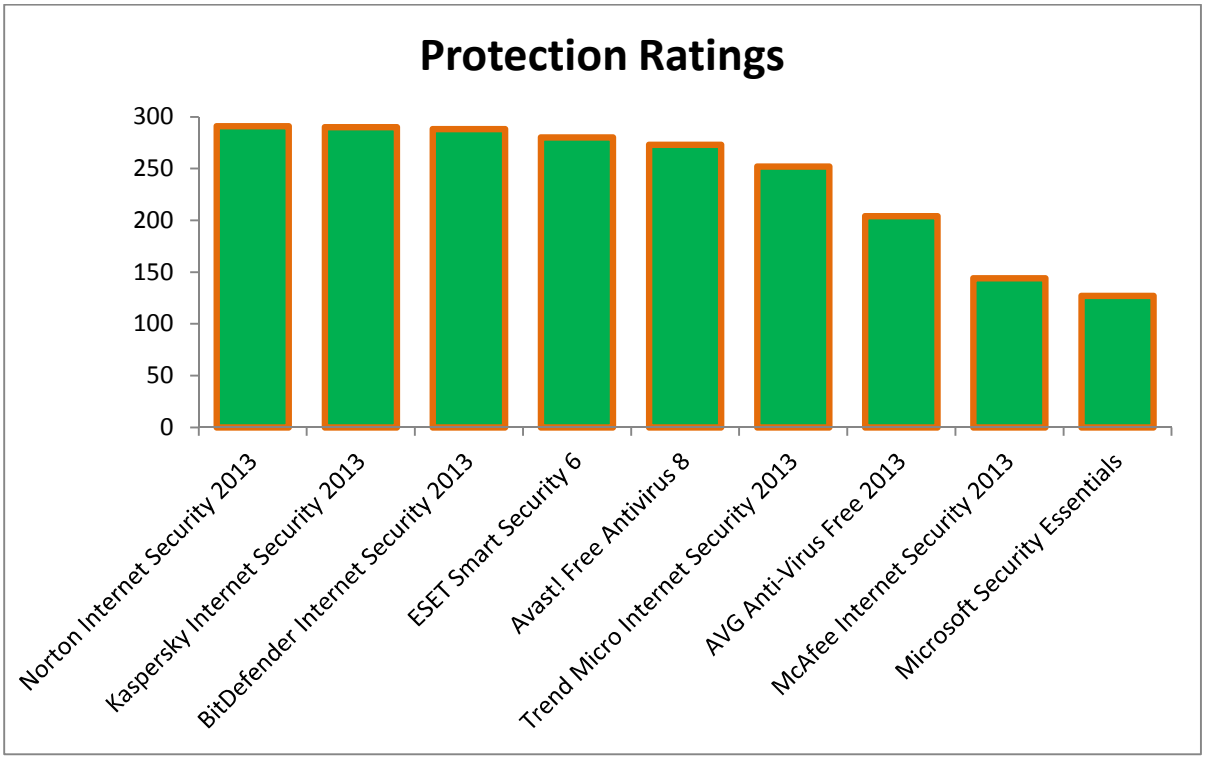
- **Defense (+3)**

Products that prevented threats from running 'defended' the system and were awarded three points.

- **Compromise (-5)**

If the threat ran uninhibited on the system, or the system was damaged, five points were deducted.

The best possible protection rating is 300 and the worst is -500.



With protection ratings we award products extra points for completely blocking a threat, while removing points when they are compromised by a threat.

How we calculate the ratings

Norton Internet Security 2013 defended against 98 of the 100 threats. It gained three points for each defense (3x98), totaling 294. It neutralized one threat (1x1) and gained a bonus point because it achieved full remediation. One compromise (-5x1) reduced the subtotal from 296 to 291.

AVG Anti-Virus Free 2013 scored much lower, although it protected the system against 95 per cent of the threats. This is because it often failed to completely remediate the neutralized threats. It defended 64 times; neutralized threats 31 times (six times with full remediation); and was compromised five times. Its score is calculated like this: (3x64) + (1x31+(1x6)) + (-5x5) = 204.

The score weighting gives credit to products that deny malware any opportunity to tamper with the system and penalizes heavily those that fail.

It is possible to apply your own weightings if you feel that compromises should be penalized more or less heavily. To do so use the results from *4. Protection Details* on page 8.

PROTECTION RATINGS

Product	Protection Rating
Norton Internet Security 2013	291
Kaspersky Internet Security 2013	290
BitDefender Internet Security 2013	288
ESET Smart Security 6	280
Avast! Free Antivirus 8	273
Trend Micro Internet Security 2013	252
AVG Anti-Virus Free 2013	204
McAfee Internet Security 2013	144
Microsoft Security Essentials	127

3. Protection Scores

The following illustrates the general level of protection, combining defended and neutralized results.

There is no distinction made between these different levels of protection. Either a system is protected or it is not.

The protection scores simply indicate how many time each product prevented a threat from compromising the system.

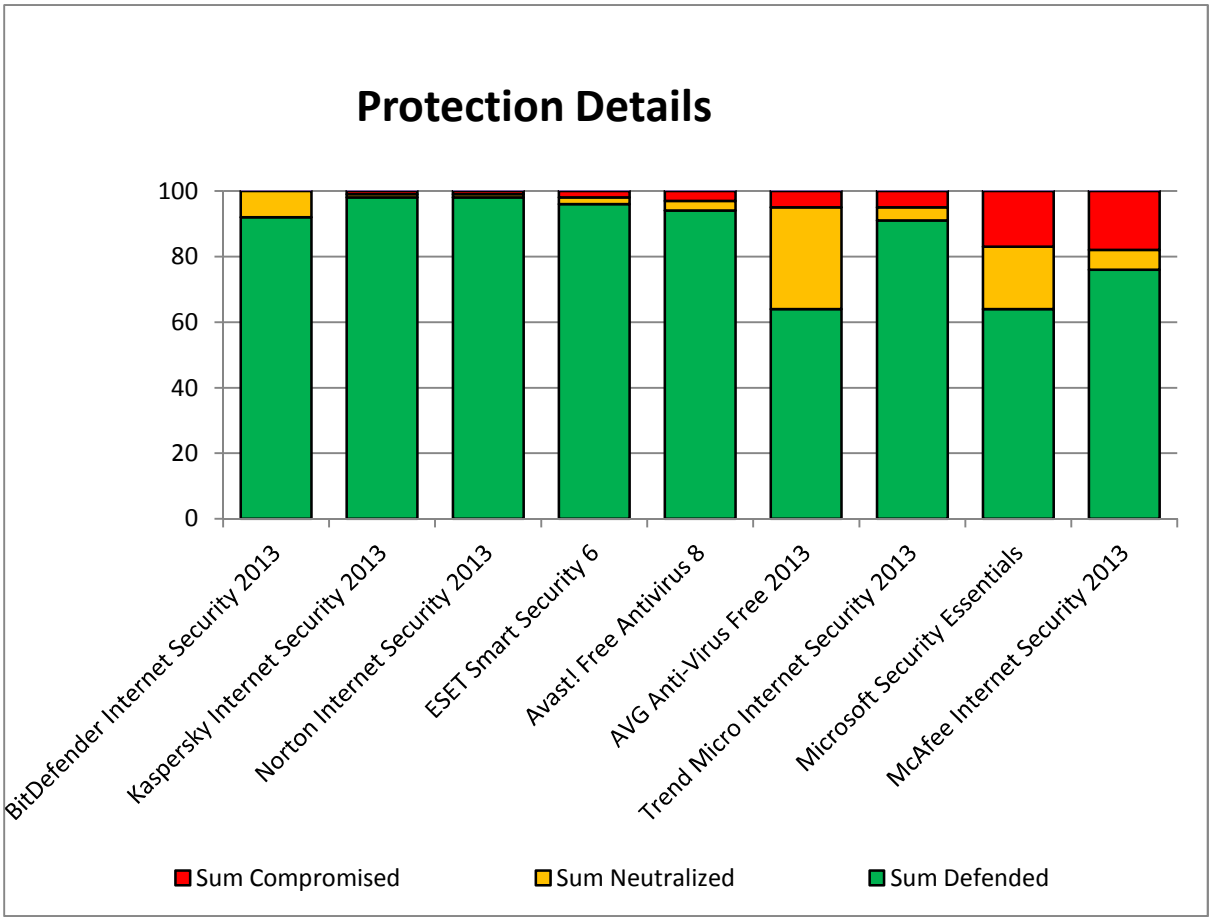
PROTECTION SCORES

Product	Protected Scores
BitDefender Internet Security 2013	100
Kaspersky Internet Security 2013	99
Norton Internet Security 2013	99
ESET Smart Security 6	98
Avast! Free Antivirus 8	97
AVG Anti-Virus Free 2013	95
Trend Micro Internet Security 2013	95
Microsoft Security Essentials	83
McAfee Internet Security 2013	82

(Average: 96 per cent)

4. Protection Details

The security products provided different levels of protection. When a product *defended* against a threat, it prevented the malware from gaining a foothold on the target system. A threat might have been able to exploit or infect the system and, in some cases, the product *neutralized* it either after the exploit ran or later. When it couldn't the system was *compromised*.



The graph shows details on how the products handled the attacks. They are ordered according to their protection scores. For overall protection scores see *3. Protection Scores* on page 7.

PROTECTION DETAILS

Product	Sum Defended	Sum Neutralized	Sum Compromised
BitDefender Internet Security 2013	92	8	0
Kaspersky Internet Security 2013	98	1	1
Norton Internet Security 2013	98	1	1
ESET Smart Security 6	96	2	2
Avast! Free Antivirus 8	94	3	3
AVG Anti-Virus Free 2013	64	31	5
Trend Micro Internet Security 2013	91	4	5
Microsoft Security Essentials	64	19	17
McAfee Internet Security 2013	76	6	18

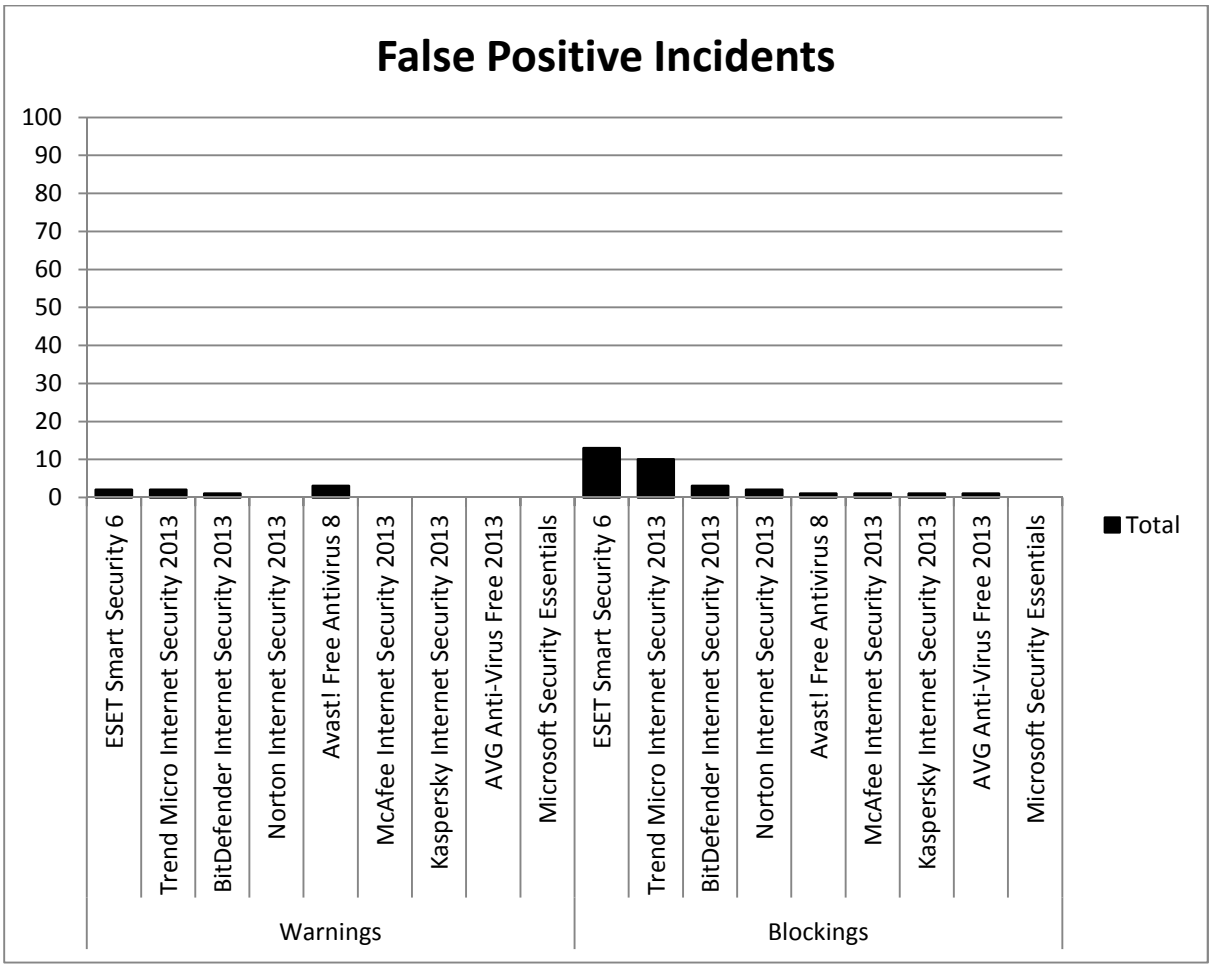
5. False Positives

5.1 False positive incidents

A security product needs to be able to protect the system from threats, while allowing legitimate software to work properly. When legitimate software is misclassified a *false positive* is generated.

We split the results into two main groups because most products we test take one of two basic approaches when attempting to protect the system from the legitimate programs. They either warn that the software was suspicious or take the more decisive step of blocking it.

Blocking a legitimate application is more serious than issuing a warning because it directly hampers the user.



Products that generated false positives tended to either warn users about legitimate software, or they blocked it completely.

FALSE POSITIVE INCIDENTS

False Positive Type	Product	Total
Warnings	ESET Smart Security 6	2
	Trend Micro Internet Security 2013	2
	BitDefender Internet Security 2013	1
	Norton Internet Security 2013	0
	Avast! Free Antivirus 8	3
	McAfee Internet Security 2013	0
	Kaspersky Internet Security 2013	0
	AVG Anti-Virus Free 2013	0
	Microsoft Security Essentials	0
Blockings	ESET Smart Security 6	13
	Trend Micro Internet Security 2013	10
	BitDefender Internet Security 2013	3
	Norton Internet Security 2013	2
	Avast! Free Antivirus 8	1
	McAfee Internet Security 2013	1
	Kaspersky Internet Security 2013	1
	AVG Anti-Virus Free 2013	1
	Microsoft Security Essentials	0

5.2 Taking file prevalence into account

The prevalence of each file is significant. If a product misclassified a common file then the situation would be more serious than if it blocked a less common one.

That said, it is usually expected that anti-malware programs should not misclassify any legitimate software.

The files selected for the false positive testing were organized into five groups: Very High Impact, High Impact, Medium Impact, Low Impact and Very Low Impact.

These categories were based on download numbers as reported by sites including Download.com at the time of testing. The ranges for these categories are recorded in the table below:

FALSE POSITIVE PREVALENCE CATEGORIES

Impact category	Prevalence (downloads in the previous week)
Very High Impact	>20,000
High Impact	1,000 - 20,000
Medium Impact	100 - 999
Low Impact	25 - 99
Very Low Impact	< 25

5.3 Modifying scores

The following set of score modifiers were used to create an impact-weighted accuracy score. Each time a product allowed a new legitimate program to install and run it was awarded one point. It lost points (or fractions of a point) if and when it generated false positives. We used the following score modifiers:

FALSE POSITIVE PREVALENCE SCORE MODIFIERS

False positive action	Impact category	Score modifier
Blocked	Very High Impact	-5
	High Impact	-2
	Medium Impact	-1
	Low Impact	-0.5
	Very Low Impact	-0.1
Warning	Very High Impact	-2.5
	High Impact	-1
	Medium Impact	-0.5
	Low Impact	-0.25
	Very Low Impact	-0.05

5.4 Distribution of impact categories

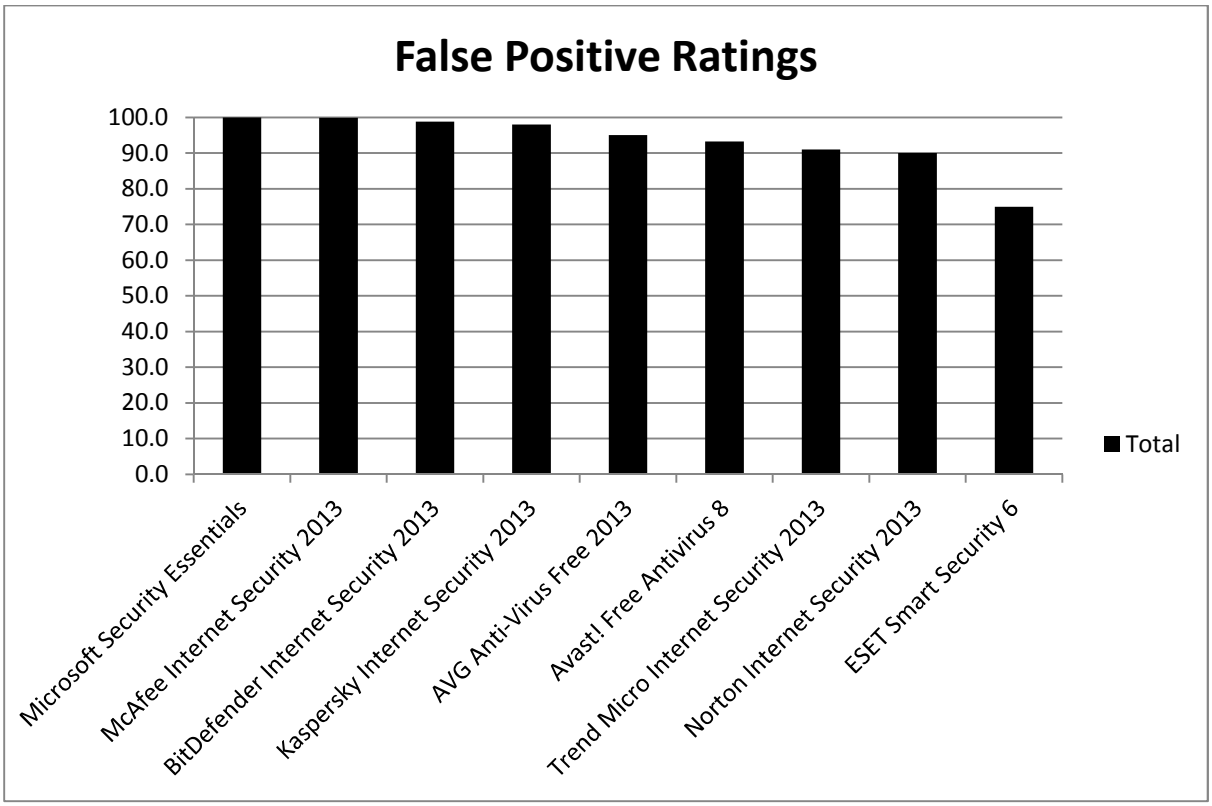
Products that scored highest were the most accurate when handling the legitimate applications used in the test. The best score possible is 100, while the worst would be -500 (assuming that all applications were classified as Very High Impact and were blocked). In fact the distribution of applications in the impact categories was not restricted only to Very High Impact. The table below shows the true distribution:

FALSE POSITIVE CATEGORY FREQUENCY

Prevalence Rating	Frequency
Very High Impact	27
High Impact	38
Medium Impact	16
Low Impact	10
Very Low Impact	9

5.5 False positive ratings

Combining the impact categories with weighted scores produces the following false positive accuracy ratings.



When a product misclassified a popular program it faced a stronger penalty than if the file was more obscure.

FALSE POSITIVE RATINGS

Product	Accuracy Rating
Microsoft Security Essentials	100.0
McAfee Internet Security 2013	99.9
BitDefender Internet Security 2013	98.8
Kaspersky Internet Security 2013	98.0
AVG Anti-Virus Free 2013	95.0
Avast! Free Antivirus 8	93.3
Trend Micro Internet Security 2013	91.0
Norton Internet Security 2013	90.0
ESET Smart Security 6	75.0

6. The Tests

6.1 The threats

Providing a realistic user experience was important in order to illustrate what really happens when a user encounters a threat on the internet.

For example, in these tests web-based malware was accessed by visiting an original, infected website using a web browser, and not downloaded from a CD or internal test website.

All target systems were fully exposed to the threats. This means that any exploit code was allowed to run, as were other malicious files, They were run and permitted to perform exactly as they were designed to, subject to checks made by the installed security software.

A minimum time period of five minutes was provided to allow the malware an opportunity to act.

6.2 Test rounds

Tests were conducted in rounds. Each round recorded the exposure of every product to a specific threat. For example, in 'round one' each of the products was exposed to the same malicious website.

At the end of each round the test systems were completely reset to remove any possible trace of malware before the next test began.

6.3 Monitoring

Close logging of the target systems was necessary to gauge the relative successes of the malware and the anti-malware software. This included recording activity such as network traffic, the creation of files and processes and changes made to important files.

6.4 Levels of protection

The products displayed different levels of protection. Sometimes a product would prevent a threat from executing, or at least making any significant changes to the target system.

In other cases a threat might be able to perform some tasks on the target (such as exploiting a security vulnerability or executing a malicious program), after which the security product would intervene and remove some or all of the malware.

Finally, a threat may be able to bypass the security product and carry out its malicious tasks unhindered. It may even be able to disable the security software.

Occasionally Windows' own protection system might handle a threat while the anti-virus program ignored it. Another outcome is that the malware may crash for various reasons.

The different levels of protection provided by each product were recorded following analysis of the log files.

If malware failed to perform properly in a given incident, perhaps because of the very presence of the security product, rather than any specific defending action that the product took, the product was given the benefit of the doubt and a Defended result was recorded.

If the test system was damaged, becoming hard to use following an attempted attack, this was counted as a compromise even if the active parts of the malware had eventually been removed by the product.

6.5 Types of protection

All of the products tested provided two main types of protection: real-time and on-demand. Real-time protection monitors the system constantly in an attempt to prevent a threat from gaining access.

On-demand protection is essentially a 'virus scan' that is run by the user at an arbitrary time.

The test results note each product's behavior when a threat is introduced and afterwards. The real-time protection mechanism was monitored throughout the test, while an on-demand scan was run towards the end of each test to measure how safe the product determined the system to be.

Manual scans were run only when a tester determined that malware had made an interaction with the target system. In other words, if the security product claimed to block the attack at the initial stage, and the monitoring logs supported this claim, the case was considered closed and a Defended result was recorded

7. Test Details

7.1 The targets

To create a fair testing environment, each product was installed on a clean Windows XP Professional target system. The operating system was updated with Windows XP Service Pack 3 (SP3), although no later patches or updates were applied.

We test with Windows XP SP3 and Internet Explorer 7 due to the high prevalence of internet threats that work with this combination. We also want to collect a full year's worth of Windows XP-based test data before upgrading to Windows 7.

The prevalence of these threats suggests that there are many systems with this level of patching currently connected to the internet.

At the time of testing Windows XP was still being used heavily by consumers and businesses.

According to Net Applications, which monitors the popularity of operating systems and web browsers, nearly as many people were using Windows XP as Windows 7. Windows XP was running 39.5 per cent of PCs, while Windows 7 was installed on 44.4%[i].

Additionally, our aim is to test the security product and not the protection provided by keeping systems completely up to date with patches and other mechanisms.

A selection of legitimate but vulnerable software was pre-installed on the target systems. These posed security risks, as they contained known security issues. They included versions of Adobe Flash Player, Adobe Reader and Java.

A different security product was then installed on each system. Each product's update mechanism was used to download the latest version with the most recent definitions and other elements.

Due to the dynamic nature of the tests, which were carried out in real-time with live malicious websites, the products' update systems were allowed to run automatically and were also run manually before each test round was carried out.

The products were also allowed to 'call home' should they be programmed to query databases in real-time. Some products might automatically upgrade themselves during the test. At any given time of testing, the very latest version of each program was used.

Target systems used identical hardware, including an Intel Core 2 Duo processor, 1GB RAM, 160GB hard disk and DVD-ROM drive. Each was connected to the internet via its own virtual network (VLAN) to avoid cross-infection of malware.

7.2 Threat selection

The malicious web links (URLs) used in the tests were not provided by any anti-malware vendor.

They were picked from lists generated by Dennis Technology Labs' own malicious site detection system, which uses popular search engine keywords submitted to Google. It analyses sites that are returned in the search results from a number of search engines and adds them to a database of malicious websites.

In all cases, a control system (Verification Target System - VTS) was used to confirm that the URLs linked to actively malicious sites.

Malicious URLs and files are not shared with any vendors during the testing process.

7.3 Test stages

There were three main stages in each individual test:

1. Introduction
2. Observation
3. Remediation

During the *Introduction* stage, the target system was exposed to a threat. Before the threat was introduced, a snapshot was taken of the system. This created a list of Registry entries and files on the hard disk. The threat was then introduced.

Immediately after the system's exposure to the threat, the *Observation* stage is reached. During this time, which typically lasted at least 10 minutes, the tester monitored the system both visually and using a range of third-party tools.

The tester reacted to pop-ups and other prompts according to the directives described below (see *7.5 Observation and intervention* on page 15).

In the event that hostile activity to other internet users was observed, such as when spam was being sent by the target, this stage was cut short.

The *Observation* stage concluded with another system snapshot. This 'exposed' snapshot was compared to the original 'clean' snapshot and a report generated. The system was then rebooted.

The *Remediation* stage is designed to test the products' ability to clean an infected system. If it defended against the threat in the *Observation* stage then we skipped it. An on-demand scan was run on the target, after which a 'scanned' snapshot was taken. This was compared to the original 'clean' snapshot and a report was generated.

All log files, including the snapshot reports and the product's own log files, were recovered from the target.

In some cases the target may become so damaged that log recovery is considered impractical. The target was then reset to a clean state, ready for the next test.

7.4 Threat introduction

Malicious websites were visited in real-time using the web browser. This risky behavior was conducted using live internet connections. URLs were typed manually into the browser.

Web-hosted malware often changes over time. Visiting the same site over a short period of time can expose systems to what appear to be a range of threats (although it may be the same threat, slightly altered to avoid detection).

Also, many infected sites will only attack a particular IP address once, which makes it hard to test more than one product against the same threat.

In order to improve the chances that each target system received the same experience from a malicious web server, we used a web replay system.

When the verification target systems visited a malicious site, the page's content, including malicious code, was downloaded, stored and loaded into the replay system. When each target system subsequently visited the site, it received exactly the same content.

The network configurations were set to allow all products unfettered access to the internet throughout the test, regardless of the web replay systems.

7.5 Observation and intervention

Throughout each test, the target system was observed both manually and in real-time. This enabled the tester to take comprehensive notes about the system's perceived behavior, as well as to compare visual alerts with the products' log entries.

At certain stages the tester was required to act as a regular user. To achieve consistency, the tester followed a policy for handling certain situations, including dealing with pop-ups displayed by products or the operating system, system crashes, invitations by malware to perform tasks and so on.

This user behavior policy included the following directives:

1. Act naively. Allow the threat a good chance to introduce itself to the target by clicking OK to malicious prompts, for example.
2. Don't be too stubborn in retrying blocked downloads. If a product warns against visiting a site, don't take further measures to visit that site.
3. Where malware is downloaded as a Zip file, or similar, extract it to the Desktop then attempt to run it. If the archive is protected by a password, and that password is known to you (e.g. it was included in the body of the original malicious email), use it.
4. Always click the default option. This applies to security product pop-ups, operating system prompts (including Windows firewall) and malware invitations to act.
5. If there is no default option, wait. Give the prompt 20 seconds to choose a course of action automatically.
6. If no action is taken automatically, choose the first option. Where options are listed vertically, choose the top one. Where options are listed horizontally, choose the left-hand one.

7.6 Remediation

When a target is exposed to malware, the threat may have a number of opportunities to infect the system. The security product also has a number of

chances to protect the target. The snapshots explained in *7.3 Test stages* on page 14 provided information that was used to analyze a system's final state at the end of a test.

Before, during and after each test, a 'snapshot' of the target system was taken to provide information about what had changed during the exposure to malware. For example, comparing a snapshot taken before a malicious website was visited to one taken after might highlight new entries in the Registry and new files on the hard disk.

Snapshots were also used to determine how effective a product was at removing a threat that had managed to establish itself on the target system. This analysis gives an indication as to the levels of protection that a product has provided.

These levels of protection have been recorded using three main terms: defended, neutralized, and compromised. A threat that was unable to gain a foothold on the target was *defended* against; one that was prevented from continuing its activities was *neutralized*; while a successful threat was considered to have *compromised* the target.

A defended incident occurs where no malicious activity is observed with the naked eye or third-party monitoring tools following the initial threat introduction. The snapshot report files are used to verify this happy state.

If a threat is observed to run actively on the system, but not beyond the point where an on-demand scan is run, it is considered to have been neutralized.

Comparing the snapshot reports should show that malicious files were created and Registry entries were made after the introduction. However, as long as the 'scanned' snapshot report shows that either the files have been removed or the Registry entries have been deleted, the threat has been neutralized.

The target is compromised if malware is observed to run after the on-demand scan. In some cases a product might request a further scan to complete the removal. We considered secondary scans to be acceptable, but continual scan requests may be ignored after no progress is determined.

An edited 'hosts' file or altered system file also counted as a compromise.

7.7 Automatic monitoring

Logs were generated using third-party applications, as well as by the security products themselves.

Manual observation of the target system throughout its exposure to malware (and legitimate applications) provided more information about the security products' behavior.

Monitoring was performed directly on the target system and on the network.

Client-side logging

A combination of Process Explorer, Process Monitor, TcpView and Wireshark were used to monitor the target systems. Regshot was used between each testing stage to record a system snapshot.

A number of Dennis Technology Labs-created scripts were also used to provide additional system information. Each product was able to generate some level of logging itself.

Process Explorer and TcpView were run throughout the tests, providing a visual cue to the tester about possible malicious activity on the system. In addition, Wireshark's real-time output, and the display from the web proxy (see Network logging, below), indicated specific network activity such as secondary downloads.

Process Monitor also provided valuable information to help reconstruct malicious incidents. Both Process Monitor and Wireshark were configured to save their logs automatically to a file. This reduced data loss when malware caused a target to crash or reboot.

Network logging

All target systems were connected to a live internet connection, which incorporated a transparent web proxy and a network monitoring system. All traffic to and from the internet had to pass through this system.

The network monitor was a dual-homed Linux system running as a transparent router, passing all web traffic through a Squid proxy.

An HTTP replay system ensured that all target systems received the same malware as each other. It was configured to allow access to the internet so that products could download updates and communicate with any available 'in the cloud' servers.

8. Conclusions

Where are the threats?

The threats used in this test were genuine, real-life threats that were infecting victims globally at the same time as we tested the products. In almost every case the threat was launched from a legitimate website that had been compromised by an attacker.

The types of infected or malicious sites were varied, which demonstrates that effective anti-virus software is essential for those who want to use the web using a Windows PC.

Most threats installed automatically when a user visited the infected webpage. This infection was often invisible to a casual observer.

Where does protection start?

There were a significant number of compromises in this test, as well as a relatively large number of neutralizations.

The strongest products blocked the site before it was even able to deliver its payload. The weakest tended to handle the threat after it had started to interact with the target system.

Sorting the wheat from the chaff

Norton Internet Security 2013 scored highest in terms of malware protection, while Kaspersky Internet Security 2013 took an incredibly close second place. BitDefender Internet Security 2013 came third.

Norton Internet Security 2013 was compromised just once and neutralized one threat; Kaspersky Internet Security behaved the same, but its single neutralization was without full remediation so it just loses out on first place by one single point.

BitDefender was not compromised at all, but neutralized eight threats. This pushed it down to third place.

ESET Smart Security 6 and Avast! Free Antivirus 8 performed well in terms of protection.

However, anti-malware products need to be able to distinguish between malicious and non-malicious programs. This is where ESET's product particularly failed to excel.

ESET Smart Security 6 misclassified legitimate applications often, blocking 13 legitimate programs. This was more than any other product in this test, although Trend Micro was not far behind with 10 blocked applications.

In contrast, Microsoft Security Essentials generated no false positives but was quite poor at protecting the system from malware. It failed to prevent 17 per cent of the threats from compromising the system.

Overall, considering each product's ability to handle both malware and legitimate applications, the winners were Kaspersky Internet Security 2013, BitDefender Internet Security 2013 and Norton Internet Security 2013. All win the AAA award.

Anti-virus is important (but not a panacea)

This test shows that with even a relatively small sample set of 100 threats there is a significant difference in performance between the anti-virus programs. Most importantly, it illustrates this difference using real threats that attacked real computers at the time of testing.

The average protection level of the tested products is 96 per cent (see *3. Protection Scores* on page 7). This figure is much lower than some detection results typically quoted in anti-malware marketing material.

The presence of anti-malware software can be seen to decrease the chances of a malware infection even when the only sites being visited are proven to be actively malicious. That said, only one product produced a 100 per cent protection rate, which is rare in our tests, while all but one generated false positive results.

APPENDIX A: TERMS USED

Compromised	Malware continues to run on an infected system, even after an on-demand scan.
Defended	Malware was prevented from running on, or making changes to, the target.
False Positive	A legitimate application was incorrectly classified as being malicious.
Introduction	Test stage where a target system is exposed to a threat.
Neutralized	Malware or exploit was able to run on the target, but was then removed by the security product.
Observation	Test stage during which malware may affect the target.
On-demand (protection)	Manual 'virus' scan, run by the user at an arbitrary time.
Prompt	Questions asked by software, including malware, security products and the operating system. With security products, prompts usually appear in the form of pop-up windows. Some prompts don't ask questions but provide alerts. When these appear and disappear without a user's interaction, they are called 'toasters'.
Real-time (protection)	The 'always-on' protection offered by many security products.
Remediation	Test stage that measures a product's abilities to remove any installed threat.
Round	Test series of multiple products, exposing each target to the same threat.
Snapshot	Record of a target's file system and Registry contents.
Target	Test system exposed to threats in order to monitor the behavior of security products.
Threat	A program or other measure designed to subvert a system.
Update	Code provided by a vendor to keep its software up to date. This includes virus definitions, engine updates and operating system patches.

APPENDIX B: FAQS

- This test was unsponsored.
- The test rounds were conducted between 10th April 2013 and 12th June 2013 using the most up to date versions of the software available on any given day.
- All products were able to communicate with their back-end systems over the internet.
- The products selected for this test were chosen by Dennis Technology Labs.
- Samples were located and verified by Dennis Technology Labs.
- Products were exposed to threats within 24 hours of the same threats being verified. In practice there was only a delay of up to three to four hours.
- Details of the samples, including their URLs and code, were provided to partner vendors only after the test was complete.
- The sample set comprised 100 actively-malicious URLs and 100 legitimate applications.

Do participating vendors know what samples are used, before or during the test?

No. We don't even know what threats will be used until the test starts. Each day we find new ones, so it is impossible for us to give this information before the test starts. Neither do we disclose this information until the test has concluded.

What is the difference between a vendor and a partner vendor?

Partner vendors contribute financially to the test in return for a preview of the results, an opportunity to challenge results before publication and the right to use award logos in marketing material. Other participants first see the results on the day of publication and may not use award logos for any purpose.

Do you share samples with the vendors?

Partner vendors are able to download all samples from us after the test is complete.

Other vendors may request a subset of the threats that compromised their products in order for them to verify our results. The same applies to client-side logs, including the network capture files. There is a small administration fee for the provision of this service.

What is a sample?

In our tests a sample is not simply a set of malicious executable files that runs on the system. A sample is an entire replay archive that enables researchers to replicate the incident, even if the original infected website is no longer available. This means that it is possible to reproduce the attack and to determine which layer of protection is was able to bypass. Replaying the attack should, in most cases, produce the relevant executable files. If not, these are usually available in the client-side network capture (pcap) file.

ENDNOTES

[i] http://news.cnet.com/8301-10805_3-57567081-75/windows-8-ekes-out-2.2-percent-market-share/

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