

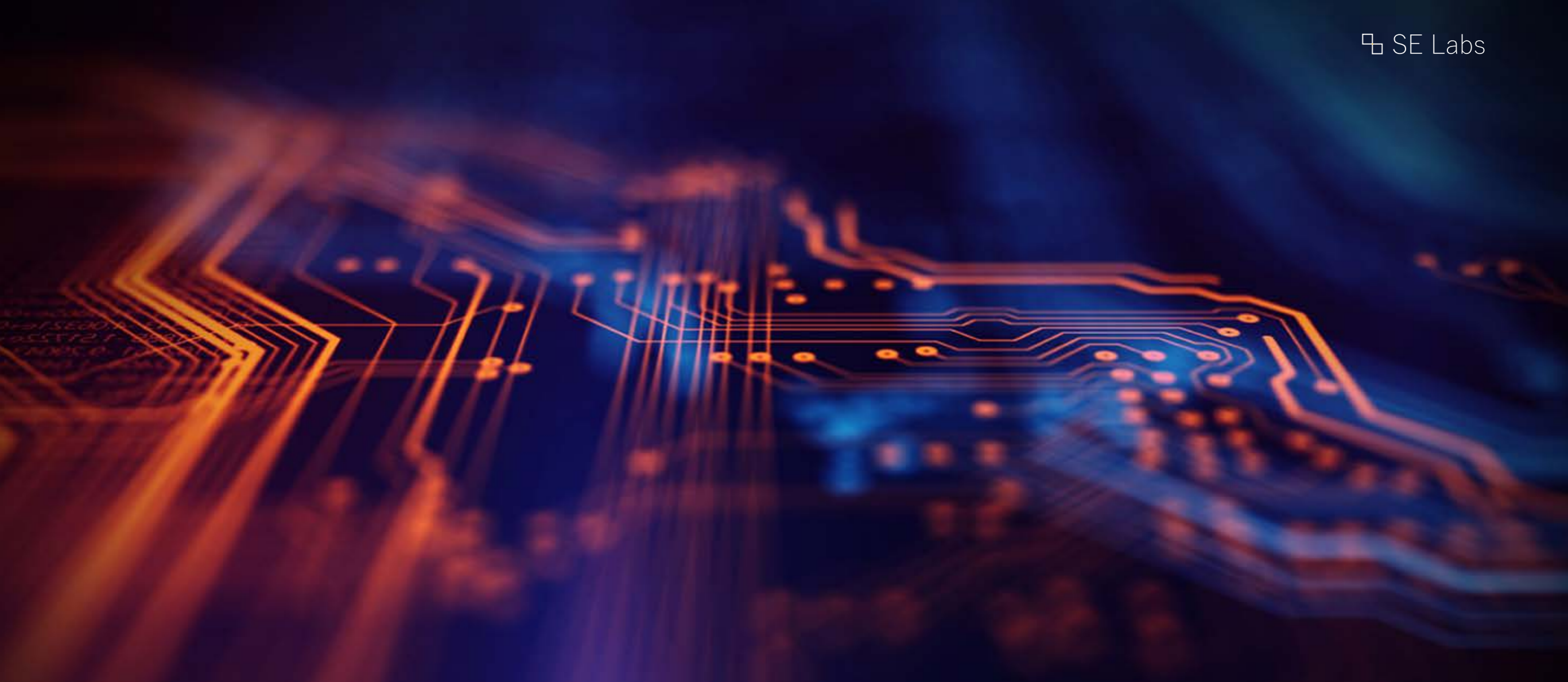
SE Labs

INTELLIGENCE-LED TESTING

ENTERPRISE ENDPOINT PROTECTION

JUL - SEP 2019





SE Labs tested a variety of anti-malware (aka ‘anti-virus’; aka ‘endpoint security’) products from a range of well-known vendors in an effort to judge which were the most effective.

Each product was exposed to the same threats, which were a mixture of targeted attacks using well-established techniques and public email and web-based threats that were found to be live on the internet at the time of the test.

The results indicate how effectively the products were at detecting and/or protecting against those threats in real time.

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SE Labs is a member of the Microsoft Virus Information
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AMTSO Standard reference:

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INTRODUCTION

Anti-malware is just one part of the picture

Beefing up security advice with facts

At SE Labs we spend our time testing things that are supposed to protect you but we also understand that securing your business, or your home network, is never as simple as installing one or more security products. The risks are many and varied, but the ways to mitigate them are often most successful with a good dose of common sense as well as the appropriate technology. You just need to think things through carefully and make sensible decisions. Fortunately, there are some schemes out there to help you through the process.

In the UK small businesses might consider the [Cyber Essentials](#) certification, which helps you address the most common computer security threats. The five technical controls involve securing internet connections; using security devices and software; controlling access to data and services; using protection from viruses and other malware; and keeping devices and software updated. All good advice and worth following, whether or not you want to achieve certification in the UK.

However, while the advice is good it not very specific. For example, you should install anti-virus software but neither the documentation nor the consultants you talk to will tell you to choose a good product. Any anti-virus will do, it seems!

A more international option is [ISO 27001](#), which is a Standard covering information security management systems. Completely over-the-top for home users and small businesses, but ideal for enterprises and smaller companies that work with sensitive data, this certification puts IT security into a central role in the way an organisation operates. It doesn't

specify what sort of anti-virus, firewalls and other systems should be used, but it leads you to research further and consider the risks when choosing security solutions.

So, while testing is not the be-all and end-all of choosing a good security system, it can definitely help. The testing behind this report is conducted in the most thorough and transparent way and the results are used by consultancies and large businesses around the world to help with purchasing decisions. This free report gives you an insight into the sort of advice that these large organisations follow when building a good security system.

If you spot a detail in this report that you don't understand, or would like to discuss, please contact us via our Twitter or Facebook accounts.

SE Labs uses current threat intelligence to make our tests as realistic as possible. To learn more about how we test, how we define 'threat intelligence' and how we use it to improve our tests please visit our website and follow us on Twitter.

This test report was funded by post-test consultation services provided by SE Labs to security vendors. Vendors of all products included in this report were able to request early access to results and the ability to dispute details for free. SE Labs has submitted the testing process behind this report for compliance with the AMTSO Testing Protocol Standard v1.2. To verify its compliance please check the AMTSO reference link at the bottom of page three of this report or [here](#).

Executive Summary

Product Names

It is good practice to stay up to date with the latest version of your chosen endpoint security product. We made best efforts to ensure that each product tested was the very latest version running with the most recent updates to give the best possible outcome.

For specific build numbers, see **Appendix C: Product Versions** on page 17.

EXECUTIVE SUMMARY			
Products Tested	Protection Accuracy Rating (%)	Legitimate Accuracy Rating (%)	Total Accuracy Rating (%)
Sophos Intercept X	100%	100%	100%
Kaspersky Endpoint Security	100%	100%	100%
McAfee EndPoint Security	100%	100%	100%
Symantec Endpoint Security Enterprise Edition	100%	100%	100%
Microsoft Windows Defender ATP's Antivirus	98%	100%	99%
ESET Endpoint Security	97%	100%	99%
CrowdStrike Falcon	96%	100%	99%
Trend Micro OfficeScan, Intrusion Defense Firewall	98%	99%	98%
Bitdefender Gravity Zone Endpoint Security	95%	98%	97%
VIPRE Endpoint Security	92%	98%	96%

Products highlighted in green were the most accurate, scoring 85 per cent or more for Total Accuracy. Those in yellow scored less than 85 but 75 or more. Products shown in red scored less than 75 per cent.

For exact percentages, see **1. Total Accuracy Ratings** on page 6.

■ The endpoints were generally effective at handling general threats from cyber criminals...

Most products were largely capable of handling public web-based threats such as those used by criminals to attack Windows PCs, tricking users into running malicious files or running scripts that download and run malicious files.

■ ...and targeted attacks were prevented in all cases.

All products were competent at blocking more targeted, exploit-based attacks. This was an uncommonly strong showing from the group.

■ False positives were not an issue for the products

All of the endpoint solutions were good at correctly classifying legitimate applications and websites. They allowed all of the legitimate websites and applications with the exception of products from Bitdefender and VIPRE, which each blocked one.

■ Which products were the most effective?

Products from Sophos, Kaspersky Lab, McAfee and Symantec achieved extremely good results due to a combination of their ability to block malicious URLs, handle exploits and correctly classify legitimate applications and websites. Unusually in this rigorous test, all of the other products also performed well enough to achieve a AAA award.

1. Total Accuracy Ratings

Judging the effectiveness of an endpoint security product is a subtle art, and many factors are at play when assessing how well it performs. To make things easier we've combined all the different results from this report into one easy-to-understand graph.

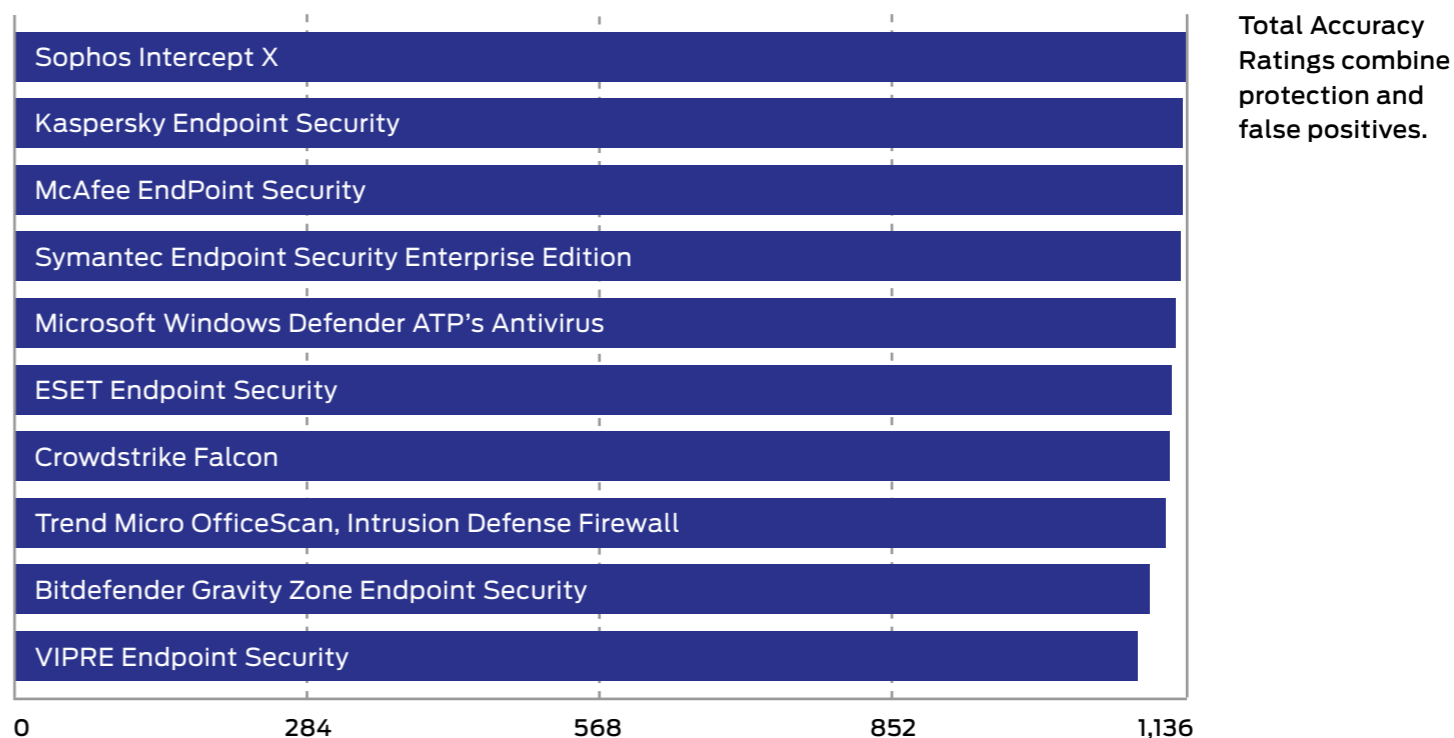
The graph below takes into account not only each product's ability to detect and protect against threats, but also its handling of non-malicious objects such as web addresses (URLs) and applications.

Not all protections, or detections for that matter, are equal. A product might completely block a URL, which stops the threat before it can even start its intended series of malicious events. Alternatively, the product might allow a web-based exploit to execute but prevent it from downloading any further code to the target. In another case malware might run on the target for a short while before its behaviour is detected and its code is deleted or moved to a safe 'quarantine' area for future analysis. We take these outcomes into account when attributing points that form final ratings.

For example, a product that completely blocks a threat is rated more highly than one that allows a threat to run for a while before eventually evicting it. Products that allow all malware infections, or that block popular legitimate applications, are penalised heavily.

Categorising how a product handles legitimate objects is complex, and you can find out how we do it in **5. Legitimate Software Ratings** on page 12.

TOTAL ACCURACY RATINGS			
Product	Total Accuracy Rating	Total Accuracy (%)	Award
Sophos Intercept X	1,136	100%	AAA
Kaspersky Endpoint Security	1,135	100%	AAA
McAfee EndPoint Security	1,135	100%	AAA
Symantec Endpoint Security Enterprise Edition	1,134	100%	AAA
Microsoft Windows Defender ATP's Antivirus	1,126	99%	AAA
ESET Endpoint Security	1,123	99%	AAA
CrowdStrike Falcon	1,120	99%	AAA
Trend Micro OfficeScan, Intrusion Defense Firewall	1,117	98%	AAA
Bitdefender Gravity Zone Endpoint Security	1,098	97%	AAA
VIPRE Endpoint Security	1,088	96%	AAA



Enterprise Endpoint Protection Awards

The following products win SE Labs awards:

- **Sophos** Intercept X
- **Kaspersky** Endpoint Security
- **McAfee** EndPoint Security
- **Symantec** Endpoint Security Enterprise Edition
- **Microsoft** Windows Defender ATP's Antivirus
- **ESET** Endpoint Security
- **Crowdstrike** Falcon
- **Trend Micro** OfficeScan, Intrusion Defense Firewall
- **Bitdefender** Gravity Zone Endpoint Security
- **VIPRE** Endpoint Security



2. Protection Ratings

The results below indicate how effectively the products dealt with threats. Points are earned for detecting the threat and for either blocking or neutralising it.

■ Detected (+1)

If the product detects the threat with any degree of useful information, we award it one point.

■ Blocked (+2)

Threats that are disallowed from even starting their malicious activities are blocked. Blocking products score two points.

■ Complete Remediation (+1)

If, in addition to neutralising a threat, the product removes all significant traces of the attack, it gains an additional one point.

■ Neutralised (+1)

Products that kill all running malicious processes 'neutralise' the threat and win one point.

■ Persistent Neutralisation (-2)

This result occurs when a product continually blocks a persistent threat from achieving its aim, while not removing it from the system.

■ Compromised (-5)

If the threat compromises the system, the product loses five points. This loss may be reduced to four points if it manages to detect

the threat (see Detected, above), as this at least alerts the user, who may now take steps to secure the system.

Rating Calculations

We calculate the protection ratings using the following formula:

$$\begin{aligned} \text{Protection Rating} = & \\ & (1x \text{ number of Detected}) + \\ & (2x \text{ number of Blocked}) + \\ & (1x \text{ number of Neutralised}) + \\ & (1x \text{ number of Complete remediation}) + \\ & (-5x \text{ number of Compromised}) \end{aligned}$$

The 'Complete remediation' number relates to cases of neutralisation in which all significant traces of the attack were removed from the target. Such traces should not exist if the threat was 'Blocked' and so Blocked results imply Complete remediation.

These ratings are based on our opinion of how important these different outcomes are. You may have a different view on how seriously you treat a 'Compromise' or 'Neutralisation without complete remediation'. If you want to create your own rating system, you can use the raw data from **4. Protection Details** on page 11 to roll your own set of personalised ratings.

Targeted Attack Scoring

The following scores apply only to targeted attacks and are cumulative, ranging from -1 to -5.

■ Access (-1)

If any command that yields information about the target system is successful this score is applied. Examples of successful commands include listing current running processes, exploring the file system and so on. If the first command is attempted and the session is terminated by the product without the command being successful the score of Neutralised (see above) will be applied.

■ Action (-1)

If the attacker is able to exfiltrate a document from the target's Desktop of the currently logged in user then an 'action' has been successfully taken.

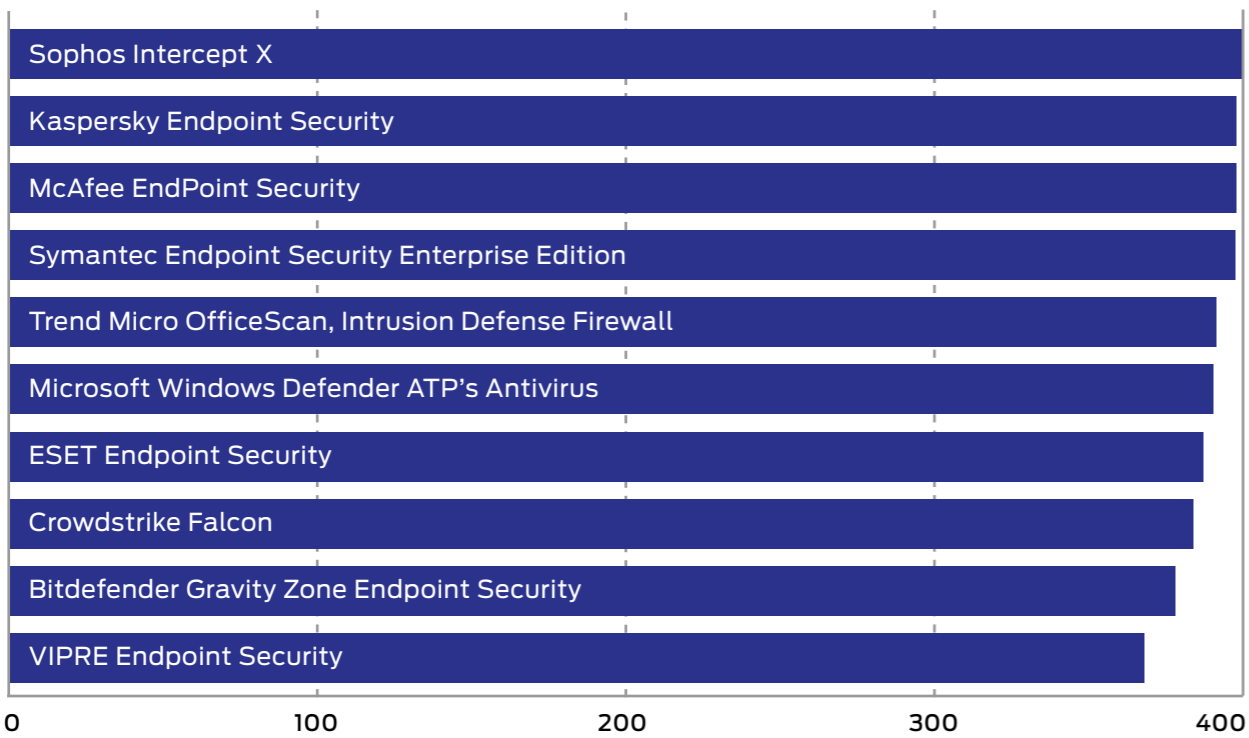
■ Escalation (-2)

The attacker attempts to escalate privileges to NT Authority/System. If successful, an additional two points are deducted.

■ Post-Escalation Action (-1)

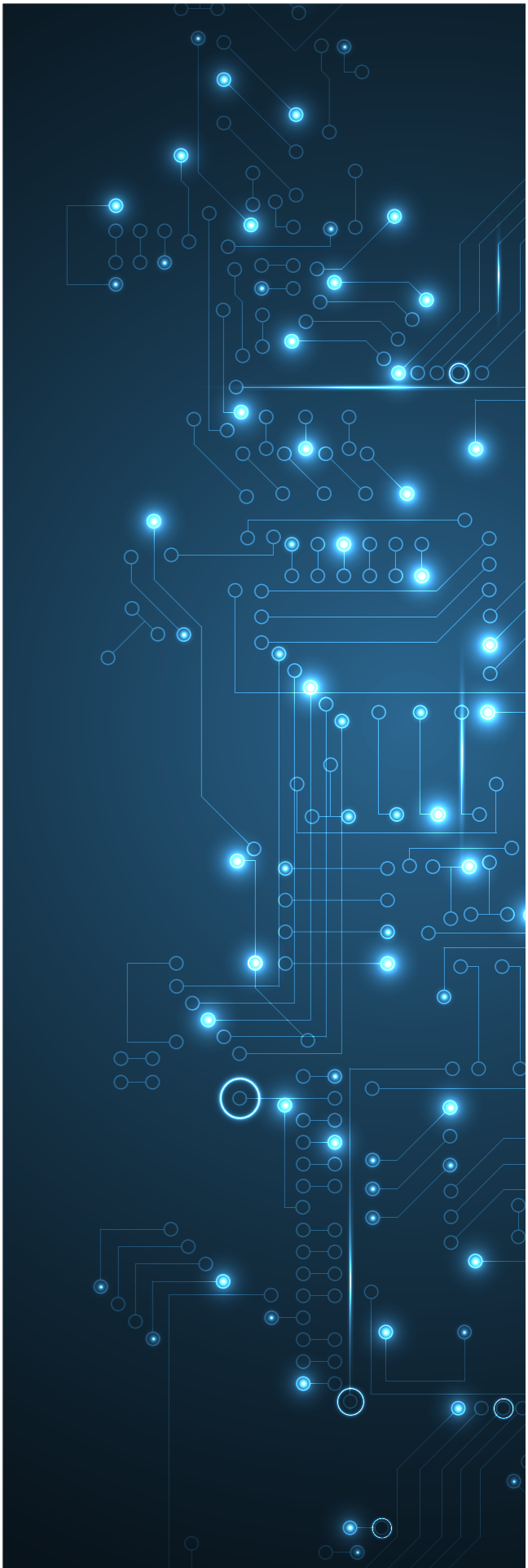
After escalation the attacker attempts actions that rely on escalated privileges. These include attempting to steal credentials, modifying the file system and recording keystrokes. If any of these actions are successful then a further penalty of one point deduction is applied.

PROTECTION RATINGS		
Product	Protection Rating	Protection Rating (%)
Sophos Intercept X	400	100%
Kaspersky Endpoint Security	399	100%
McAfee EndPoint Security	399	100%
Symantec Endpoint Security Enterprise Edition	398	100%
Trend Micro OfficeScan, Intrusion Defense Firewall	391	98%
Microsoft Windows Defender ATP's Antivirus	390	98%
ESET Endpoint Security	387	97%
CrowdStrike Falcon	384	96%
Bitdefender Gravity Zone Endpoint Security	378	95%
VIPRE Endpoint Security	368	92%



Protection Ratings are weighted to show that how products handle threats can be subtler than just 'win' or 'lose'.

Average 97%

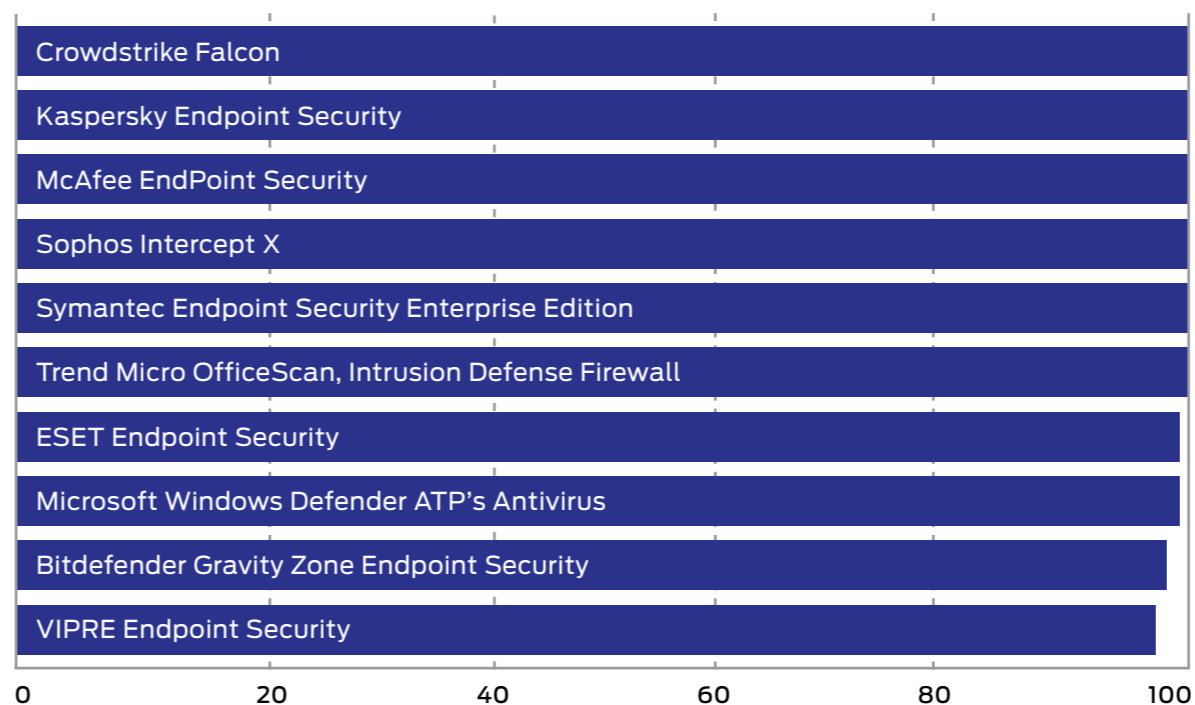


3. Protection Scores

This graph shows the overall level of protection, making no distinction between neutralised and blocked incidents.

For each product we add Blocked and Neutralised cases together to make one simple tally.

PROTECTION SCORES	
Product	Protection Score
CrowdStrike Falcon	100
Kaspersky Endpoint Security	100
McAfee EndPoint Security	100
Sophos Intercept X	100
Symantec Endpoint Security Enterprise Edition	100
Trend Micro OfficeScan, Intrusion Defense Firewall	100
ESET Endpoint Security	99
Microsoft Windows Defender ATP's Antivirus	99
Bitdefender Gravity Zone Endpoint Security	98
VIPRE Endpoint Security	97



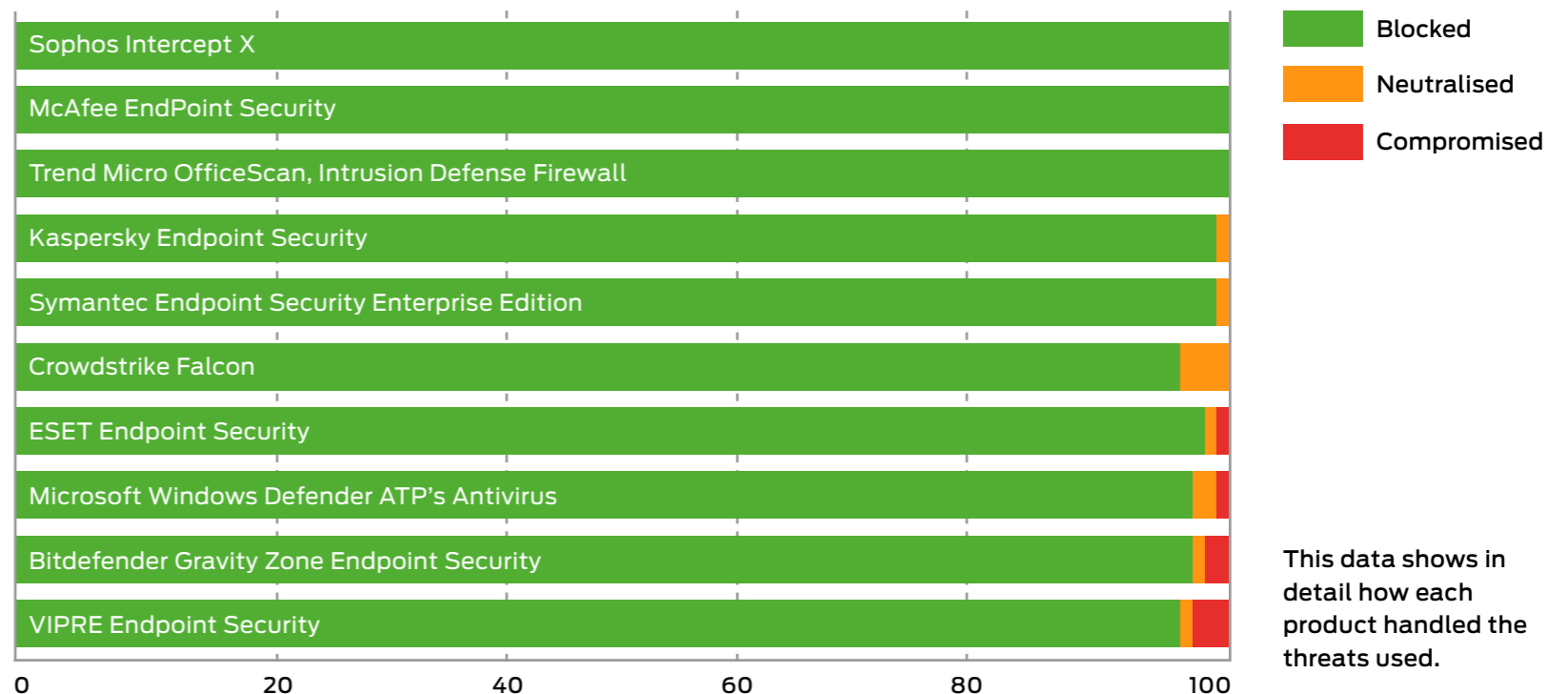
Protection Scores are a simple count of how many times a product protected the system.

4. Protection Details

These results break down how each product handled threats into some detail. You can see how many detected a threat and the levels of protection provided.

Products sometimes detect more threats than they protect against. This can happen when they recognise an element of the threat but aren't equipped to stop it. Products can also provide protection even if they don't detect certain threats. Some threats abort on detecting specific endpoint protection software.

PROTECTION DETAILS					
Product	Detected	Blocked	Neutralised	Compromised	Protected
Sophos Intercept X	100	100	0	0	100
McAfee EndPoint Security	100	100	0	0	100
Trend Micro OfficeScan, Intrusion Defense Firewall	100	100	0	0	100
Kaspersky Endpoint Security	100	99	1	0	100
Symantec Endpoint Security Enterprise Edition	100	99	1	0	100
CrowdStrike Falcon	100	96	4	0	100
ESET Endpoint Security	99	98	1	1	99
Microsoft Windows Defender ATP's Antivirus	100	97	2	1	99
Bitdefender Gravity Zone Endpoint Security	99	97	1	2	98
VIPRE Endpoint Security	100	96	1	3	97



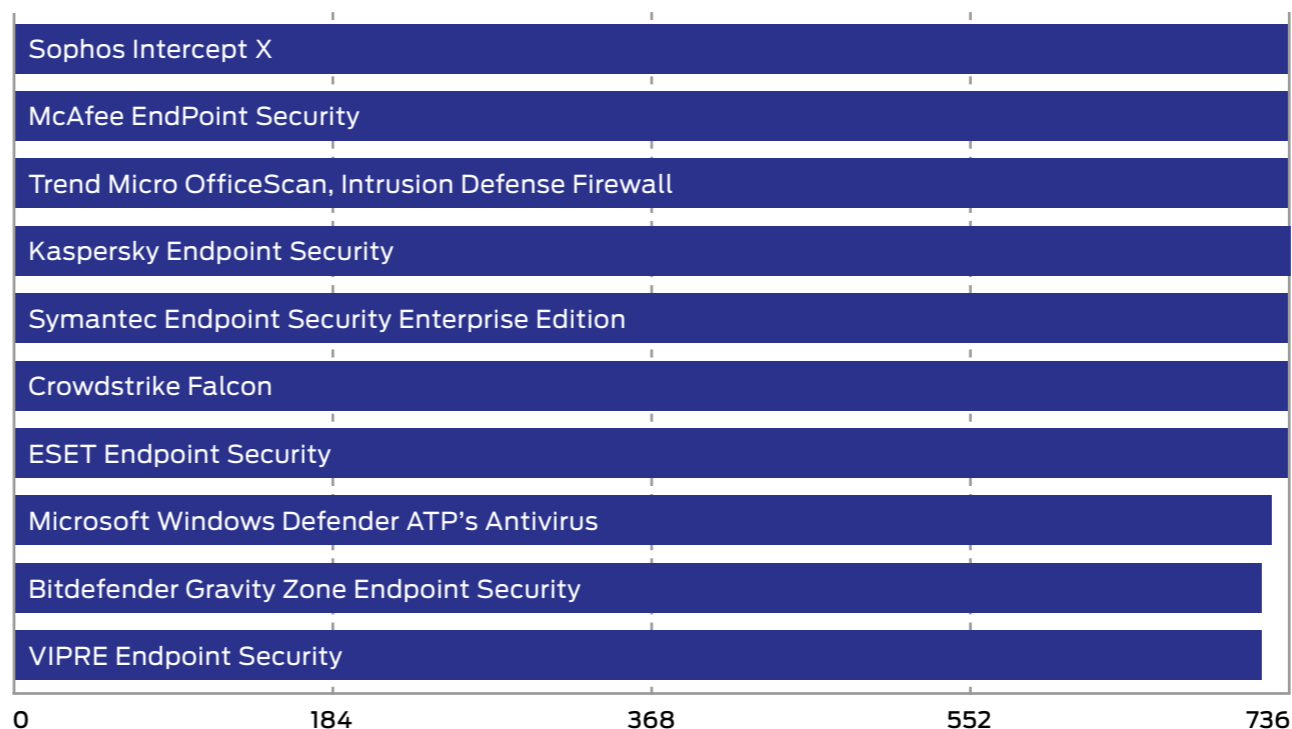
5. Legitimate Software Ratings

These ratings indicate how accurately the products classify legitimate applications and URLs, while also taking into account the interactions that each product has with the user. Ideally a product will either not classify a legitimate object or will classify it as safe. In neither case should it bother the user.

We also take into account the prevalence (popularity) of the applications and websites used in this part of the test, applying stricter penalties for when products misclassify very popular software and sites.

To understand how we calculate these ratings, see [5.3 Accuracy Ratings](#) on page 14.

LEGITIMATE SOFTWARE RATINGS		
Product	Legitimate Accuracy Rating	Legitimate Accuracy (%)
Crowdstrike Falcon	736	100%
ESET Endpoint Security	736	100%
Kaspersky Endpoint Security	736	100%
McAfee EndPoint Security	736	100%
Microsoft Windows Defender ATP's Antivirus	736	100%
Sophos Intercept X	736	100%
Symantec Endpoint Security Enterprise Edition	736	100%
Trend Micro OfficeScan, Intrusion Defense Firewall	726	99%
Bitdefender Gravity Zone Endpoint Security	720	98%
VIPRE Endpoint Security	720	98%



Legitimate Software Ratings can indicate how well a vendor has tuned its detection engine.

5.1 Interaction Ratings

It's crucial that anti-malware endpoint products not only stop – or at least detect – threats, but that they allow legitimate applications to install and run without misclassifying them as malware. Such an error is known as a 'false positive' (FP).

In reality, genuine FPs are quite rare in testing. In our experience it is unusual for a legitimate application to be classified as 'malware'. More often it will be classified as 'unknown', 'suspicious' or 'unwanted' (or terms that mean much the same thing).

We use a subtle system of rating an endpoint's approach to legitimate objects, which takes into account how it classifies the application and how it presents that information to the user. Sometimes the endpoint software will pass the buck and demand that the user decide if the application is safe or not. In such cases the product may make a recommendation to allow or block. In other cases, the product will make no recommendation, which is possibly even less helpful.

If a product allows an application to install and run with no user interaction, or with simply a brief notification that the application is likely to be safe, it has achieved an optimum result. Anything else is a Non-Optimal Classification/Action (NOCA). We think that measuring NOCAs is more useful than counting the rarer FPs.

	None (Allowed)	Click to Allow (Default Allow)	Click to Allow/Block (No Recommendation)	Click to Block (Default Block)	None (Blocked)	
Object is Safe	2	1.5	1			A
Object is Unknown	2	1	0.5	0	-0.5	B
Object is not Classified	2	0.5	0	-0.5	-1	C
Object is Suspicious	0.5	0	-0.5	-1	-1.5	D
Object is Unwanted	0	-0.5	-1	-1.5	-2	E
Object is Malicious				-2	-2	F
	1	2	3	4	5	

INTERACTION RATINGS		
Product	None (Allowed)	None (Blocked)
CrowdStrike Falcon	100	0
ESET Endpoint Security	100	0
Kaspersky Endpoint Security	100	0
McAfee EndPoint Security	100	0
Microsoft Windows Defender ATP's Antivirus	100	0
Sophos Intercept X	100	0
Symantec Endpoint Security Enterprise Edition	100	0
Trend Micro OfficeScan, Intrusion Defense Firewall	100	0
Bitdefender Gravity Zone Endpoint Security	99	1
VIPRE Endpoint Security	99	1

Products that do not bother users and classify most applications correctly earn more points than those that ask questions and condemn legitimate applications.

5.2 Prevalence Ratings

There is a significant difference between an endpoint product blocking a popular application such as the latest version of Microsoft Word and condemning a rare Iranian dating toolbar for Internet Explorer 6. One is very popular all over the world and its detection as malware (or something less serious but still suspicious) is a big deal. Conversely, the outdated toolbar won't have had a comparably large user base even when it was new. Detecting this application as malware may be wrong, but it is less impactful in the overall scheme of things.

With this in mind, we collected applications of varying popularity and sorted them into five separate categories, as follows:

1. **Very High Impact**
2. **High Impact**
3. **Medium Impact**
4. **Low Impact**
5. **Very Low Impact**

Incorrectly handling any legitimate application will invoke penalties, but classifying Microsoft Word as malware and blocking it without any way for the user to override this will bring far greater penalties than doing the same for an ancient niche toolbar. In order to calculate these relative penalties, we assigned each impact category with a rating modifier, as shown in the table above.

LEGITIMATE SOFTWARE PREVALENCE RATING MODIFIERS	
Impact Category	Rating Modifier
Very High Impact	5
High Impact	4
Medium Impact	3
Low Impact	2
Very Low Impact	1

Applications were downloaded and installed during the test, but third-party download sites were avoided and original developers' URLs were used where possible. Download sites will sometimes bundle additional components into applications' install files, which may correctly cause anti-malware products to flag adware. We remove adware from the test set because it is often unclear how desirable this type of code is.

The prevalence for each application and URL is estimated using metrics such as third-party download sites and the data from Alexa.com's global traffic ranking system.

5.3 Accuracy Ratings

We calculate legitimate software accuracy ratings by multiplying together the interaction and prevalence ratings for each download and installation:

Accuracy rating = Interaction rating x Prevalence rating

If a product allowed one legitimate, Medium impact application to install with zero interaction with the user, then its Accuracy rating would be calculated like this:

Accuracy rating = 2 x 3 = 6

This same calculation is made for each legitimate application/site in the test and the results are summed and used to populate the graph and table shown under **5. Legitimate Software Ratings** on page 12.

5.4 Distribution of Impact Categories

Endpoint products that were most accurate in handling legitimate objects achieved the highest ratings. If all objects were of the highest prevalence, the maximum possible rating would be 1,000 (100 incidents x (2 interaction rating x 5 prevalence rating)).

In this test there was a range of applications with different levels of prevalence. The table below shows the frequency:

LEGITIMATE SOFTWARE CATEGORY FREQUENCY	
Prevalence Rating	Frequency
Very High Impact	32
High Impact	34
Medium Impact	14
Low Impact	10
Very Low Impact	10
TOTAL	100

6. Conclusions

Attacks in this test included threats that affect the wider public and more closely-targeted individuals and organisations. You could say that we tested the products with 'public' malware and full-on hacking attacks. We introduced the threats in a realistic way such that threats seen in the wild on websites were downloaded from those same websites, while threats caught spreading through email were delivered to our target systems as emails.

All of the products tested are well-known and should do well in this test. While we do 'create' threats by using publicly available free hacking tools, we don't write unique malware so there is no technical reason why any vendor being tested should do poorly.

Consequently, it's not a shock to see all products handle the public threats very effectively. Even the weaker products protected the target systems in the vast majority of cases. Targeted attacks were also handled well by all.

Products from **Bitdefender**, **ESET**, **Symantec** and **Trend Micro** protected against all of the public and targeted attacks. **Bitdefender** scored lower because it neutralised some threats rather than blocking them outright. They also handled the legitimate applications correctly.

Products from **Kaspersky Lab** and **McAfee** stopped all the public threats and all but one of the targeted attacks. **Microsoft Defender** and **Sophos Intercept X** stopped all of targeted attacks and allowed one public threat through each. **CrowdStrike Falcon** stopped all of the targeted attacks but missed three of the public threats.

The leading products from **ESET**, **Symantec**, **Kaspersky Lab**, **Microsoft**, **Trend Micro**, **Sophos**, **Bitdefender**, **McAfee** and **CrowdStrike** all win AAA awards.

Appendices

APPENDIX A: Terms Used

TERM	MEANING
Compromised	The attack succeeded, resulting in malware running unhindered on the target. In the case of a targeted attack, the attacker was able to take remote control of the system and carry out a variety of tasks without hindrance.
Blocked	The attack was prevented from making any changes to the target.
False positive	When a security product misclassifies a legitimate application or website as being malicious, it generates a 'false positive'.
Neutralised	The exploit or malware payload ran on the target but was subsequently removed.
Complete Remediation	If a security product removes all significant traces of an attack, it has achieved complete remediation.
Target	The test system that is protected by a security product.
Threat	A program or sequence of interactions with the target that is designed to take some level of unauthorised control of that target.
Update	Security vendors provide information to their products in an effort to keep abreast of the latest threats. These updates may be downloaded in bulk as one or more files, or requested individually and live over the internet.

APPENDIX B: FAQs

A **full methodology** for this test is available from our website.

- The products chosen for this test were selected by SE Labs.
- The test was unsponsored.
- The test was conducted between 21st June to 8th August 2019.
- All products were configured according to each vendor's recommendations, when such recommendations were provided.
- Malicious URLs and legitimate applications and URLs were independently located and verified by SE Labs.
- Targeted attacks were selected and verified by SE Labs.
- Malicious and legitimate data was provided to partner organisations once the test was complete.
- SE Labs conducted this endpoint security testing on physical PCs, not virtual machines.
- The web browser used in this test was Google Chrome. When testing Microsoft products Chrome was equipped with the Windows Defender Browser Protection browser extension (<https://browserprotection.microsoft.com>).

Q What is a partner organisation? Can I become one to gain access to the threat data used in your tests?

A Partner organisations benefit from our consultancy services after a test has been run. Partners may gain access to low-level data that can be useful in product improvement initiatives and have permission to use award logos, where appropriate, for marketing purposes. We do not share data on one partner with other partners. We do not partner with organisations that do not engage in our testing.

Q I am a security vendor and you tested my product without permission. May I access the threat data to verify that your results are accurate?

A We are willing to share a certain level of test data with non-partner participants for free. The intention is to provide sufficient data to demonstrate that the results are accurate. For more in-depth data suitable for product improvement purposes we recommend becoming a partner.

APPENDIX C: Product Versions

The table below shows the service's name as it was being marketed at the time of the test.

PRODUCT VERSIONS			
Provider	Product Name	Build Version (start)	Build Version (end)
Bitdefender	Gravity Zone Endpoint Security	6.6.11.159	6.6.12.1270
CrowdStrike	Falcon	5.10.9106.0	5.15.9601.0
ESET	Endpoint Security	7.1.2045.5	7.1.2045.5
Kaspersky Lab	Endpoint Security	11.1.0.15919 aes256	11.1.1.126 aes256
McAfee	EndPoint Security	Agent version: 5.6.1.157	Agent version: 5.6.1.157
Microsoft	Windows Defender ATP's Antivirus	Antimalware Client Version: 4.18.1904.1, Engine Version: 1.1.15900.4, Antivirus Version: 1.293.2614.0, Anti-spyware Version: 1.293.2614.0	Antimalware Client Version: 4.18.1907.4, Engine Version: 1.1.16200.1, Antivirus Version: 1.299.2387.0, Anti-spyware Version: 1.299.2387.0
Sophos	Intercept X	Core Agent 2.3.0, EndpointAdvanced 10.8.3.441, Sophos Intercept X 2.0.14, Device Encryption 1.4.103	Core Agent 2.4.0, EndpointAdvanced 10.8.3.441, Sophos Intercept X 2.0.15.1, Device Encryption 1.4.103
Symantec	Endpoint Security Enterprise Edition	Version 14 (14.2) build 770 (14.2.770.0000)	Version 14 (14.2) build 770 (14.2.770.0000)
Trend Micro	OfficeScan, Intrusion Defense Firewall	12.0.1861	12.0.1861
VIPRE	Endpoint Security	11.0.7629	11.0.7629

APPENDIX D: Attack Types

The table below shows how each product protected against the different types of attacks used in the test.

ATTACK TYPES			
Product	Web-Download	Targeted Attack	Protected
CrowdStrike Falcon	75	25	100
Kaspersky Endpoint Security	75	25	100
McAfee EndPoint Security	75	25	100
Sophos Intercept X	75	25	100
Symantec Endpoint Security Enterprise Edition	75	25	100
Trend Micro OfficeScan, Intrusion Defense Firewall	75	25	100
ESET Endpoint Security	74	25	99
Microsoft Windows Defender ATP's Antivirus	74	25	99
Bitdefender Gravity Zone Endpoint Security	73	25	98
VIPRE Endpoint Security	72	25	97

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