SE Labs

INTELLIGENCE-LED TESTING

ENTERPRISE ENDPOINT PROTECTION

OCT - DEC 2018

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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Document version 1.0 Written 31st January 2019

INTRODUCTION

Can You Trust Security Tests?

Clear, open testing is needed and now available

A year ago we decided to put our support behind a new testing Standard proposed by the Anti-Malware Testing Standards Organization (AMTSO). The goal behind the Standard is good for everyone: if testing is conducted openly then testers such as us can receive due credit for doing a thorough job; you the reader can gain confidence in the results; and the vendors under test can understand their failings and make improvements, which then creates stronger products that we can all enjoy.

The Standard does not dictate how testers should test. There are **pages of detail**, but I can best summarise it like this: Say what you are going to do, then do it. And be prepared to prove it.

(Indeed, a poor test could still comply with the AMTSO Standard, but at least you would be able to understand how the test was conducted and could then judge its worth with clear information and not marketing hype!)

We don't think that it's unreasonable to ask testers to make some effort to prove their results. Whether you are spending £30 on a copy of a home anti-virus product or several million on a new endpoint upgrade project, if you are using a report to help with your buying decision you deserve to know how the test was run, whether or not some vendors were at a disadvantage and if anyone was willing and able to double-check the results.

Since the start of 2018 we put our endpoint reports through the public pilot and then, once the Standard was officially adopted, through the full public process. Our last reports were judged to comply with the AMTSO Standard and we've submitted this report for similar assessment.

At the time of writing we don't know if the reports from this round of testing comply. To find out if they did, please check the AMTSO reference link at the bottom of page three of this report.

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 provided with 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 Standard v1.0.

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 (%)
Kaspersky Endpoint Security	100%	100%	100%
Microsoft Windows Defender ATP's Antivirus	100%	100%	100%
Symantec Endpoint Security Enterprise Edition	98%	100%	99%
ESET Endpoint Security	97%	100%	99%
Bitdefender Gravity Zone Endpoint Security	93%	100%	98%
Sophos Intercept X Advanced	97%	98%	98%
Trend Micro OfficeScan, Intrusion Defense Firewall	96%	98%	97%
McAfee EndPoint Security	96%	98%	97%
Crowdstrike Falcon	83%	99%	94%
Trustport Antivirus for Business	59%	100%	86%
MalwareBytes Endpoint Security	27%	100%	76%

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. Products from Trustport and Malwarebytes were a little weaker than the competition.

■ **.. and targeted attacks were prevented in many cases.**

Many products were also competent at blocking more targeted, exploit-based attacks. However, while some did very well in this part of the test, others were very much weaker. **Malwarebytes**' was largely incapable of stopping the targeted attacks, stopping just two.

■ **False positives were not an issue for most products**

Most of the endpoint solutions were good at correctly classifying legitimate applications and websites. The vast majority allowed all of the legitimate websites and applications. Those that made some errors made only one or two.

■ **Which products were the most effective?**

Products from **Kaspersky Lab** and **Microsoft** achieved extremely good results due to a combination of their ability to block malicious URLs, handle exploits and correctly classify legitimate applications and websites. Products from **Symantec** and **ESET** were also excellent.

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.

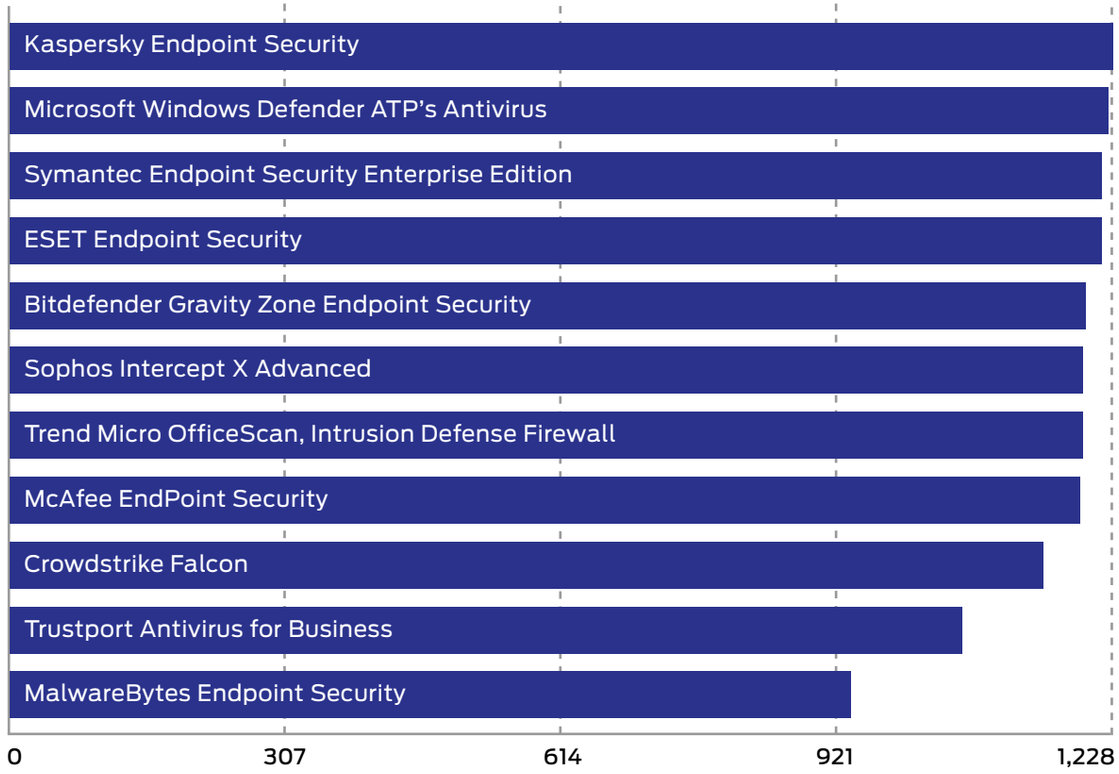
The graph below takes into account not only each product's ability to detect and protect against threats, but also its handling of non-malicious objects such as web addresses (URLs) and applications.

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
Kaspersky Endpoint Security	1,228	100%	AAA
Microsoft Windows Defender ATP's Antivirus	1,226	100%	AAA
Symantec Endpoint Security Enterprise Edition	1,221	99%	AAA
ESET Endpoint Security	1,216	99%	AAA
Bitdefender Gravity Zone Endpoint Security	1,199	98%	AAA
Sophos Intercept X Advanced	1,198	98%	AAA
Trend Micro OfficeScan, Intrusion Defense Firewall	1,195	97%	AAA
McAfee EndPoint Security	1,192	97%	AAA
Crowdstrike Falcon	1,152.5	94%	AA
Trustport Antivirus for Business	1,062	86%	A
MalwareBytes Endpoint Security	936	76%	C



Total Accuracy Ratings combine protection and false positives.

Enterprise Endpoint Protection Awards

The following products win SE Labs awards:

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

- **Crowdstrike** Falcon

- **Trustport** Antivirus for Business

- **MalwareBytes** 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.

Neutralised (+1)
Products that kill all running malicious processes 'neutralise' the threat and win one point.

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.

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:

Protection Rating =
(1x number of Detected) +
(2x number of Blocked) +
(1x number of Neutralised) +
(1x number of Complete remediation) +
(-5x number of Compromised)

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.

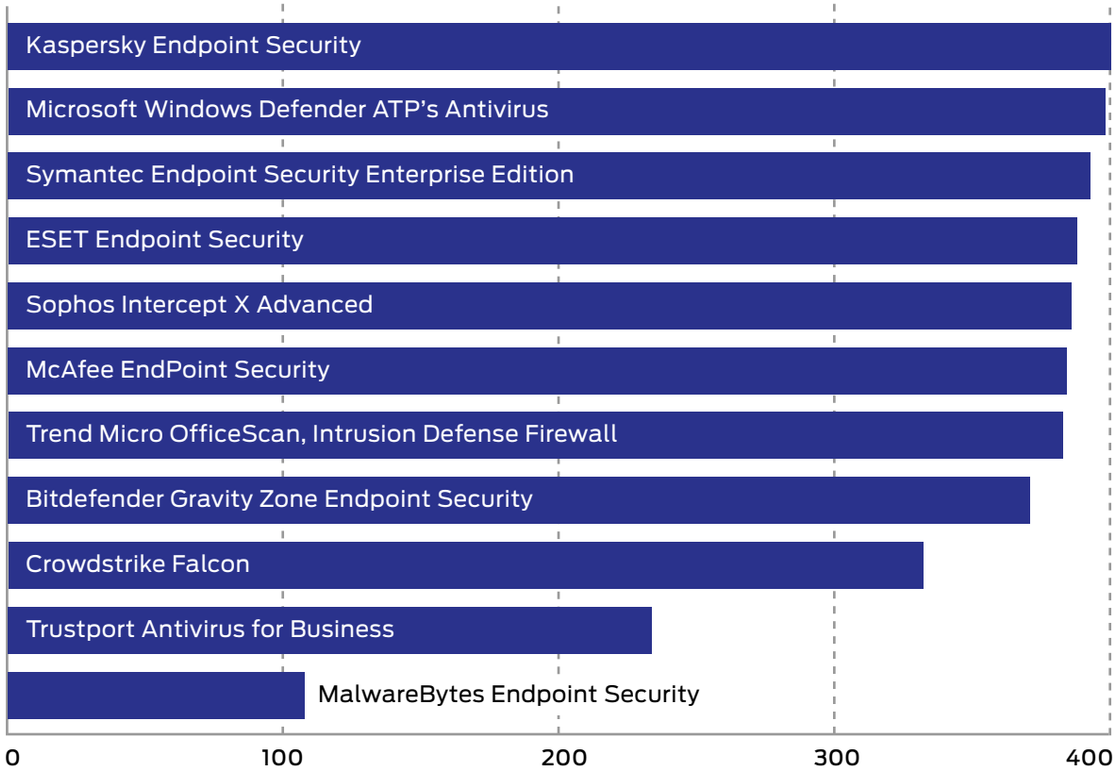
Access (-1)
If any command that yields information about the target system is successful this score is applied. Examples of successful commands include listing current running processes, exploring the file system and so on. If the first command is attempted and the session is terminated by the product 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.

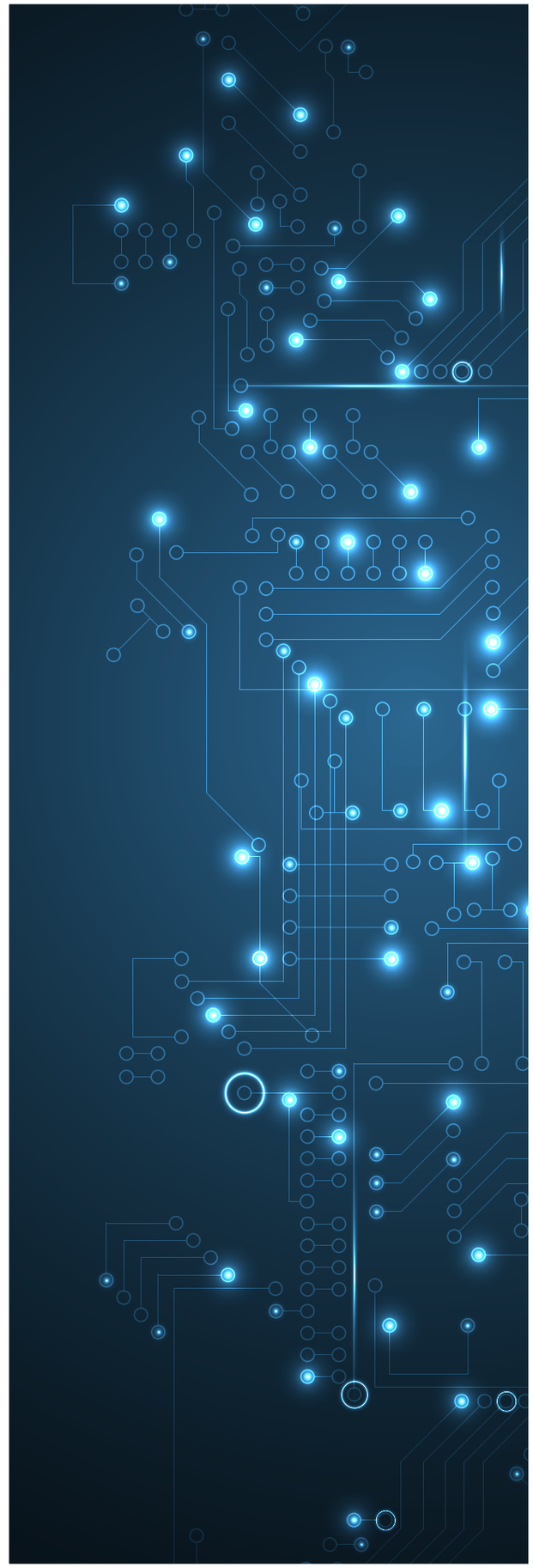
Post-Escalation Action (-1)
After escalation the attacker attempts actions that rely on escalated privileges. These include attempting to steal credentials, modifying the file system and recording keystrokes. If any of these actions are successful then a further penalty of one point deduction is applied.

PROTECTION RATINGS		
Product	**Protection Rating**	**Protection Rating (%)**
Kaspersky Endpoint Security	400	100%
Microsoft Windows Defender ATP's Antivirus	398	100%
Symantec Endpoint Security Enterprise Edition	393	98%
ESET Endpoint Security	388	97%
Sophos Intercept X Advanced	386	97%
McAfee EndPoint Security	384	96%
Trend Micro OfficeScan, Intrusion Defense Firewall	383	96%
Bitdefender Gravity Zone Endpoint Security	371	93%
Crowdstrike Falcon	332	83%
Trustport Antivirus for Business	234	59%
MalwareBytes Endpoint Security	108	27%



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

Average 86%

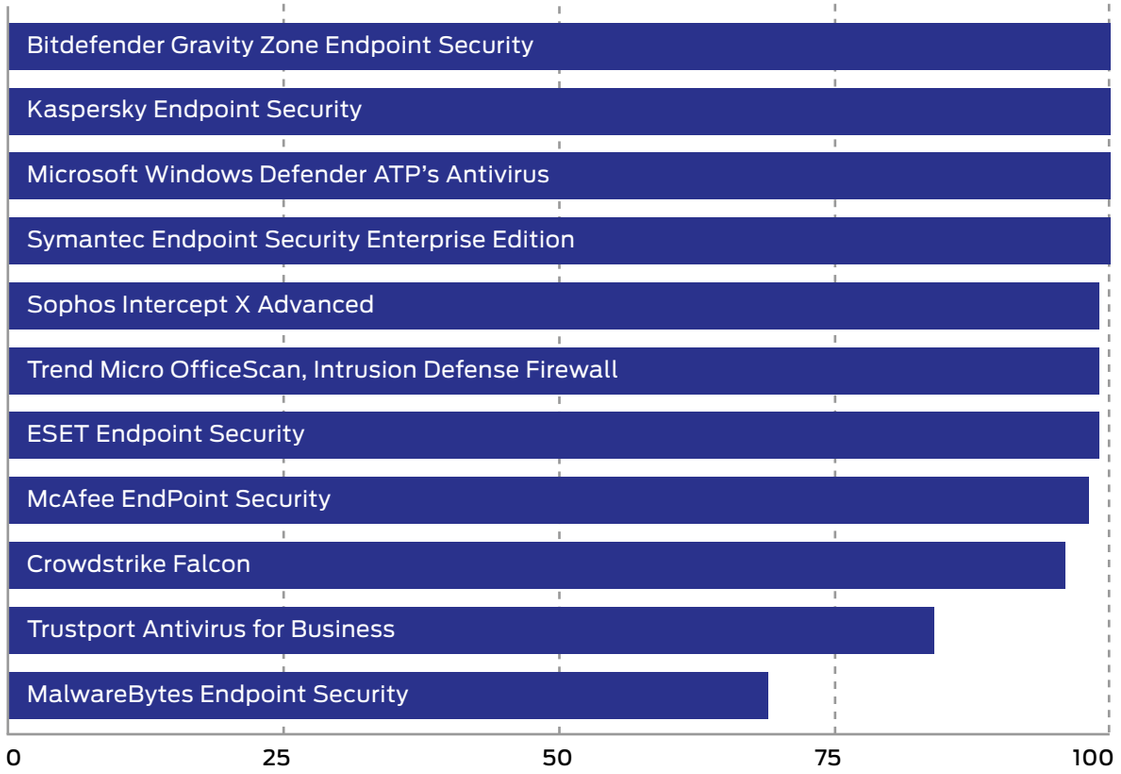


3. Protection Scores

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**
Bitdefender Gravity Zone Endpoint Security	100
Kaspersky Endpoint Security	100
Microsoft Windows Defender ATP's Antivirus	100
Symantec Endpoint Security Enterprise Edition	100
Sophos Intercept X Advanced	99
Trend Micro OfficeScan, Intrusion Defense Firewall	99
ESET Endpoint Security	99
McAfee EndPoint Security	98
Crowdstrike Falcon	96
Trustport Antivirus for Business	84
MalwareBytes Endpoint Security	69



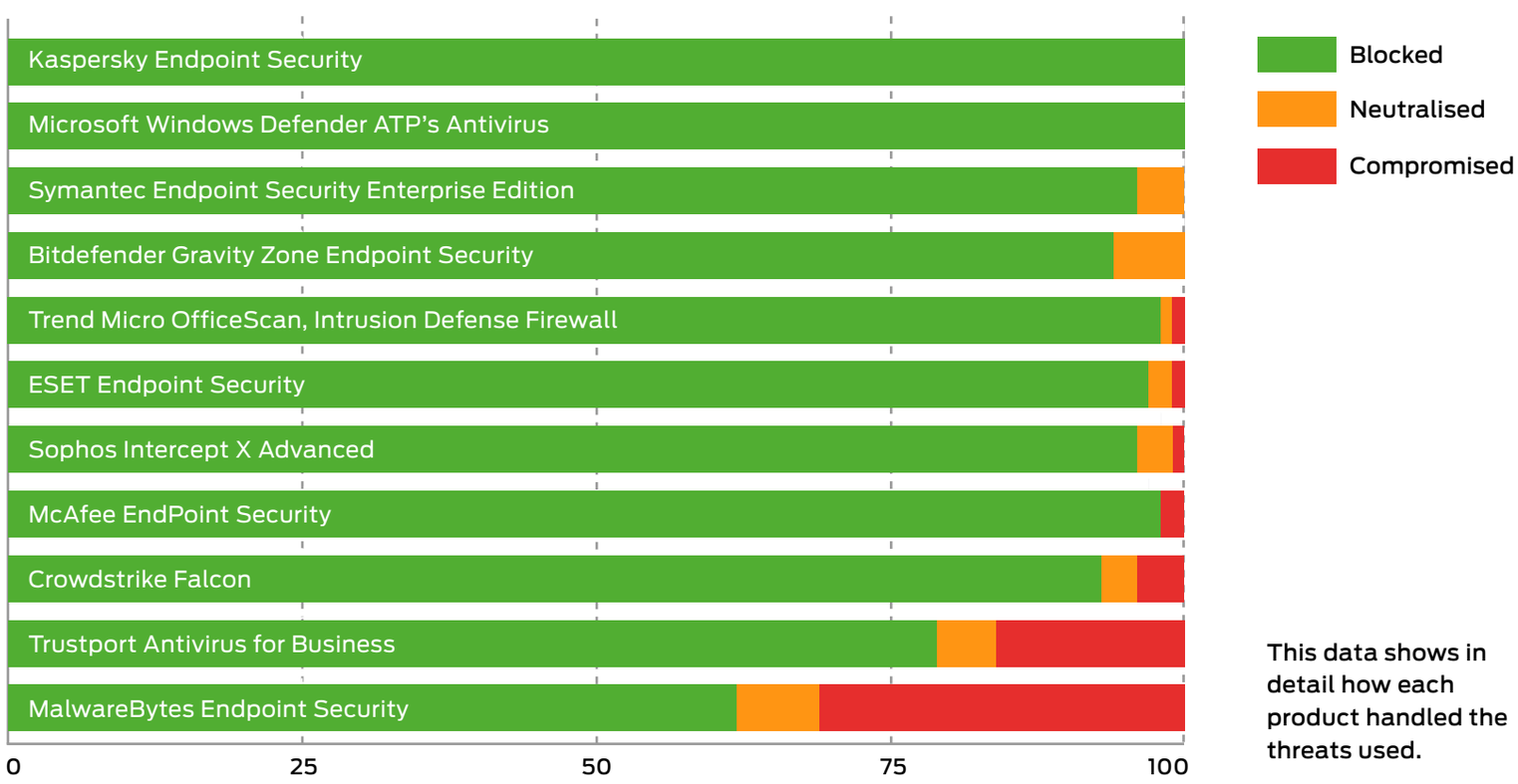
Protection Scores are a simple count of how many times a product protected the system.

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
Kaspersky Endpoint Security	100	100	0	0	100
Microsoft Windows Defender ATP's Antivirus	100	100	0	0	100
Symantec Endpoint Security Enterprise Edition	100	96	4	0	100
Bitdefender Gravity Zone Endpoint Security	100	94	6	0	100
Trend Micro OfficeScan, Intrusion Defense Firewall	100	98	1	1	99
ESET Endpoint Security	99	97	2	1	99
Sophos Intercept X Advanced	100	96	3	1	99
McAfee EndPoint Security	100	98	0	2	98
Crowdstrike Falcon	97	93	3	4	96
Trustport Antivirus for Business	91	79	5	16	84
MalwareBytes Endpoint Security	91	62	7	31	69



This data shows in detail how each product handled the threats used.

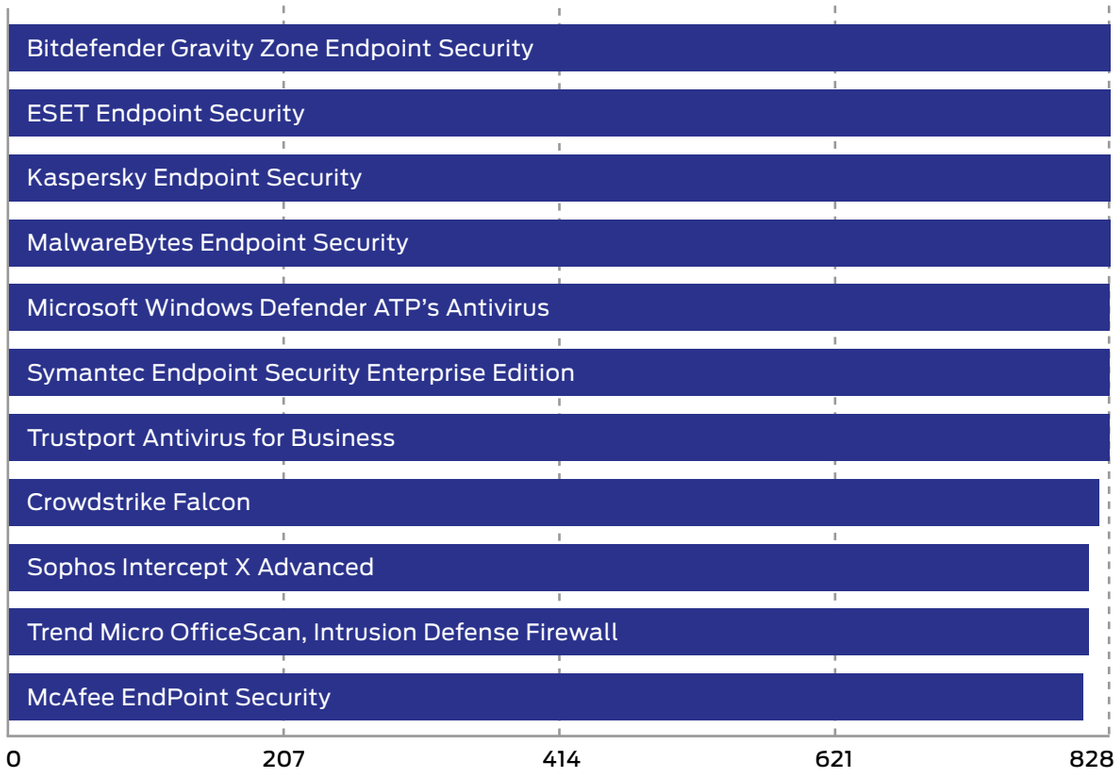
5. Legitimate Software Ratings

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 (%)**
Bitdefender Gravity Zone Endpoint Security	828	100%
ESET Endpoint Security	828	100%
Kaspersky Endpoint Security	828	100%
MalwareBytes Endpoint Security	828	100%
Microsoft Windows Defender ATP's Antivirus	828	100%
Symantec Endpoint Security Enterprise Edition	828	100%
Trustport Antivirus for Business	828	100%
Crowdstrike Falcon	820.5	99%
Sophos Intercept X Advanced	812	98%
Trend Micro OfficeScan, Intrusion Defense Firewall	812	98%
McAfee EndPoint Security	808	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)
Bitdefender Gravity Zone Endpoint Security	100	0
Crowdstrike Falcon	100	0
ESET Endpoint Security	100	0
Kaspersky Endpoint Security	100	0
MalwareBytes Endpoint Security	100	0
Microsoft Windows Defender ATP's Antivirus	100	0
Symantec Endpoint Security Enterprise Edition	100	0
Trustport Antivirus for Business	100	0
McAfee EndPoint Security	99	1
Sophos Intercept X Advanced	98	2
Trend Micro OfficeScan, Intrusion Defense Firewall	98	2

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	54
High Impact	22
Medium Impact	12
Low Impact	8
Very Low Impact	4
GRAND 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 every 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 two products protected the target systems in the vast majority of cases. Targeted attacks were also handled well by most but caused some significant problems for **Malwarebytes Endpoint Security**, which failed to stop all but two of the targeted attacks, which is an unusually poor performance in our tests.

Products from **BitDefender**, **Kaspersky Lab**, **Symantec** and **Microsoft** protected against all of the public and targeted attacks. They also handled the legitimate applications correctly. **Sophos Intercept X Advanced** stopped all of the public threats and missed only one targeted attack. **ESET Endpoint Security** stopped all of targeted attacks but allowed one public threat through.

Products from **Crowdstrike**, **McAfee** and **Trend Micro** performed strongly, both stopping the vast majority of public threats.

The leading products from **Kaspersky Lab**, **Microsoft**, **Symantec**, **ESET**, **BitDefender**, **Sophos**, **Trend Micro** and **McAfee** 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 25th September and 25th October 2018.
- 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 (tart)**	**Build Version (end)**
Bitdefender	Gravity Zone Endpoint Security	Version: 6.6.1.37, Engine version: 7.76257	product version: 6.6.7.97; engines version: 7.78484 (12032683)
Crowdstrike	Falcon	4.2.6402.0	4.12.7504.0
ESET	Endpoint Security	6.4.2014.0	ESET Endpoint Security Version 6.6.2078.5, Windows 10 Pro (64-bit) Version 10.0.16299
Kaspersky Lab	Endpoint Security	10.3.0.6294 aes256	11.0.0.6499 aes256
MalwareBytes	Endpoint Security	1.80.2.1012	1.80.2.1012
McAfee	EndPoint Security	5.0.6.220	McAfee Agent Version: 5.5.0.447, McAfee Endpoint Security Version: 10.6
Microsoft	Windows Defender ATP's Antivirus	4.12.17007.18022 (Antimalware Client Version) 1.263.824.0 (Antivirus Version)	Antimalware Client Version: 4.18.1810.5 Engine Version: 1.1.15400.5, Antivirus Version: 1.281.899.0
Sophos	Intercept X Advanced	Core Agent (2.0.2), Endpoint Advanced (10.8.1.1), Sophos Intercept X (2.0.2), Device Encryption (1.3.90)	Core Agent: 2.0.5, Endpoint Advanced: 10.8.1.2, Sophos Intercept X: 2.0.7, Device Encryption: 1.4.103
Symantec	Endpoint Security Enterprise Edition	Version 14 (14.0 RU1) build 3752 (14.0.3752.1000)	Version 14 (14.2) build (14.2.770.0000)
Trend Micro	OfficeScan, Intrusion Defense Firewall	12.0.1861	12.0.1861
Trustport	Antivirus for Business	17.0.5.7060	17.0.5.7060

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**
Bitdefender Gravity Zone Endpoint Security	75	25	100
Kaspersky Endpoint Security	75	25	100
Microsoft Windows Defender ATP's Antivirus	75	25	100
Symantec Endpoint Security Enterprise Edition	75	25	100
ESET Endpoint Security	74	25	99
Sophos Intercept X Advanced	75	24	99
Trend Micro OfficeScan, Intrusion Defense Firewall	75	24	99
McAfee EndPoint Security	75	23	98
Crowdstrike Falcon	72	24	96
Trustport Antivirus for Business	65	19	84
MalwareBytes Endpoint Security	67	2	69