SE Labs

INTELLIGENCE-LED TESTING

Enterprise Advanced Security

CrowdStrike Falcon

EDR

RANSOMWARE

October 2022

SE Labs tested **CrowdStrike Falcon** against a range of ransomware attacks designed to extort victims. These attacks were realistic, using the same tactics and techniques as those used against victims in recent months.

Target systems, protected by **CrowdStrike Falcon**, were attacked by testers acting in the same way as we observe ransomware groups to behave.

Attacks were initiated from the start of the attack chain, using phishing email links and attachments, as just two examples. Each attack was run from the very start to its obvious conclusion, which means attempting to steal, encrypt and destroy sensitive data on the target systems.

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SE Labs is a member of the Microsoft Virus Information Alliance (VIA); the Anti-Malware Testing Standards Organization (AMTSO); and NetSecOPEN.

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Contents

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INTRODUCTION

Deep and Direct Ransomware Testing

300 ways to run a ransomware attack

Ransomware is the most visible, most easily understood cyber threat affecting businesses today. Paralysed computer systems mean stalled business and loss of earnings. On top of that, a ransom demand provides a clear, countable value to a threat. A demand for "one million dollars!" is easier to quantify than the possible leak of intellectual property to a competitor.

Given the global interest and terror around ransomware, we have created a comprehensive test that shows how effective security products are when faced with the whole range of threats posed by ransomware itself and the criminal groups operating in the shadows.

In this report we have taken two main approaches to assessing how well products can detect and protect against ransomware.

Ransomware Deep Attacks

For the first part of this test, we analysed the common tactics of ransomware gangs and created two custom gangs that use a wider variety of methods. In all cases we run the attack from the very start, including attempting to access targets with stolen credentials or other means. We then move through the system and sometimes the network, before deploying the ransomware as the final payload.

In the first two attacks for each group, we gain access and deploy ransomware onto the target immediately. In the third, fourth and fifth attacks we move through the network and deploy ransomware on a target deeper into the network.

The ransomware payloads used in this part of the report were known files from five of the families listed in **Hackers vs. Targets** on page 9.

This test shows a product's ability to track the movement of the attacker through the entire attack chain. We disable the product's protection features and rely on its detection mode for this part of the test. The results demonstrate how incident response teams can use the product to gain visibility on ransomware attacks.

Ransomware Direct Attacks

The second part of the test takes a wide distribution of known malware and adds variations designed to evade detection. We've listed the ransomware families used in **Hackers vs. Targets** on page 9. We sent each of these ransomware payloads directly to target systems using realistic techniques, such as through email social engineering attacks. This is a full but short attack chain.

In this part of the test, we ensure any protection features are enabled in the product.

If products can detect and protect against the known version of each of these files, all well and good. But if they also detect and block each ransomware's two variations then we can conclude that the protection available is more proactive than simply reacting to yesterday's unlucky victims.

Ransomware Tested

This detailed report looks at ransomware detection during a full network attack; and protection against known ransomware attacks and their unknown variants. For details about how the product handled the different types of attack please read **3. Response Details (Ransomware Deep Attacks)** on page 11 and **7. Protection Details (Ransomware Direct Attacks)** on page 16.

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

Executive Summary

We tested **CrowdStrike Falcon** against direct attacks using known and unknown ransomware, as well as deeper hacking attacks that culminated in deployment of ransomware on target systems. All tests used live ransomware, delivered in a realistic fashion.

We examined its abilities to:

- Detect and protect against known ransomware
- Detect and protect against new ransomware variants
- Track full network breaches
- Detect deployment of ransomware on internal targets

Legitimate files were used alongside the threats to measure any false positive detections or other sub-optimum interactions.

CrowdStrike Falcon performed exceptionally well, providing complete detection and protection coverage against all direct ransomware attacks. It also provided thorough insight into the full network breaches that concluded with ransomware deployments. There were no false positive results. An excellent result in an extremely challenging test.

Executive Summary				
Product Tested	Protection Accuracy (%)	EDR Rating (%)	Legitimate Accuracy Rating (%)	Total Accuracy Rating (%)
CrowdStrike Falcon	100%	94%	100%	99%

The Protection rating shows how effective the product was at preventing the ransomwares attacks from achieving their goals. The EDR rating reflects the level of detection at different stages of the attack.

For exact percentages, see **2. Total Accuracy Ratings** on page 10.

Enterprise Advanced Security Award

The following product wins the SE Labs award:

CrowdStrike
Falcon

1. How we Tested

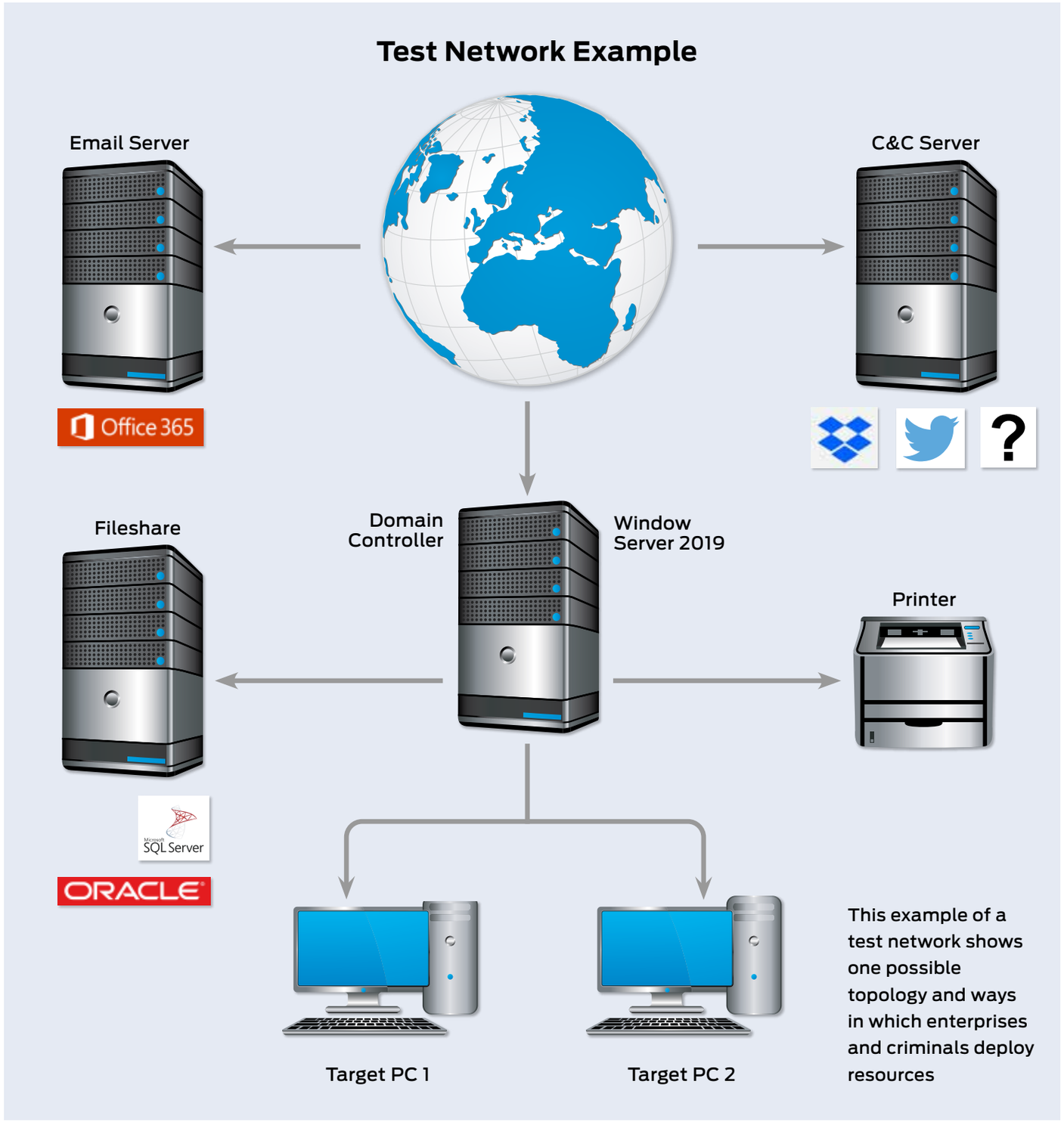
Testers can't assume that products will work a certain way, so running a realistic advanced security test means setting up real networks and hacking them in the same way that real adversaries behave.

In the diagram on the right you will see an example network that contains workstations, some basic infrastructure such as file servers and a domain controller, as well as cloud-based email and a malicious command and control (C&C) server, which may be a conventional computer or a service such as Dropbox, Twitter, Slack or something else more imaginative.

As you will see in the **Threat Responses** section on page 7, attackers often jump from one compromised system to another in so-called 'lateral movement'. To allow products to detect this type of behaviour the network needs to be built realistically, with systems available, vulnerable and worth compromising.

It is possible to compromise devices such as enterprise printers and other so-called 'IoT' (internet of things) machines, which is why we've included a representative printer in the diagram.

The techniques that we choose for each test case are largely dictated by the real-world behaviour of online criminals. We observe their tactics and replicate what they do in this test. To see more details about how the specific attackers behaved, and how we copied them, see **Hackers vs. Targets** on page 9 and, for a really detailed drill down on the details, **4. Threat Intelligence (Ransomware Direct Attacks)** on pages 13 to 15 and **Appendix C: Ransomware Deep Attack Details**.



Threat Responses

Full Attack Chain: Testing every layer of detection and protection

Attackers start from a certain point and don't stop until they have either achieved their goal or have reached the end of their resources (which could be a deadline or the limit of their abilities). This means, in a test, the tester needs to begin the attack from a realistic first position, such as sending a phishing email or setting up an infected website, and moving through many of the likely steps leading to actually stealing data or causing some other form of damage to the network.

If the test starts too far into the attack chain, such as executing malware on an endpoint, then many products will be denied opportunities to use the full extent of their protection and detection abilities. If the test concludes before any 'useful' damage or theft has been achieved, then similarly the product may be denied a chance to demonstrate its abilities in behavioural detection and so on.

Attack Stages

The illustration (below) shows some typical stages of an attack. In a test each of these should be attempted to determine the security solution's effectiveness. This test's results record detection and protection for each of these stages.

We measure how a product responds to the first stages of the attack with a detection and/ or protection rating. Sometimes products allow threats to run but detect them. Other times they might allow the threat to run briefly before neutralising it. Ideally they detect and block the threat before it has a chance to run. Products may delete threats or automatically contains them in a 'quarantine' or other safe holding mechanism for later analysis.

Should the initial attack phase succeed we then measure post-exploitation stages, which are represented by steps two through to seven below. We broadly categorise these stages as: Access (step 2); Action (step 3); Escalation (step 4); and Post-escalation (steps 5-7).

In figure 1. you can see a typical attack running from start to end, through various 'hacking' activities. This can be classified as a fully successful breach.

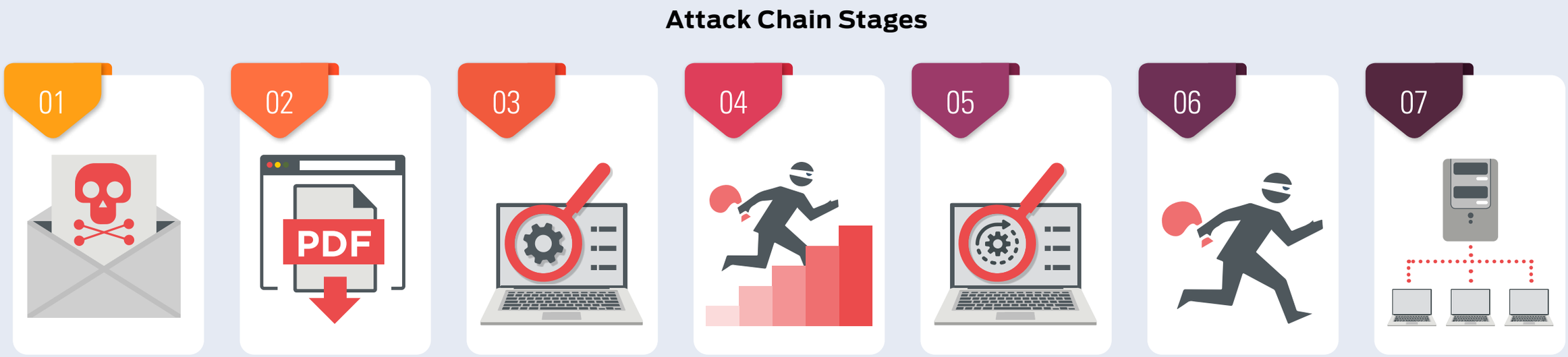


Figure 1. A typical attack starts with an initial contact and progresses through various stages, including reconnaissance, stealing data and causing damage

In figure 2. a product or service has interfered with the attack, allowing it to succeed only as far as stage 3, after which it was detected and neutralised. The attacker was unable to progress through stages 4 and onwards.

It is possible for an attack to run in a different order with, for example, the attacker attempting to connect to other systems without needing to escalate privileges. However, it is common for password theft (see step 5) to occur before using stolen credentials to move further through the network.

It is also possible that attackers will not cause noticeable damage during an attack. It may be that their goal is persistent presence on the systems to monitor for activities, slowly steal information and other more subtle missions.

In figure 3. the attacker has managed to progress as far as stage five. This means that the system has been seriously compromised. The attacker has a high level of access and has stolen passwords. However, attempts to exfiltrate data from the target were blocked, as were attempts to damage the system.

Attack Chain: How Hackers Progress

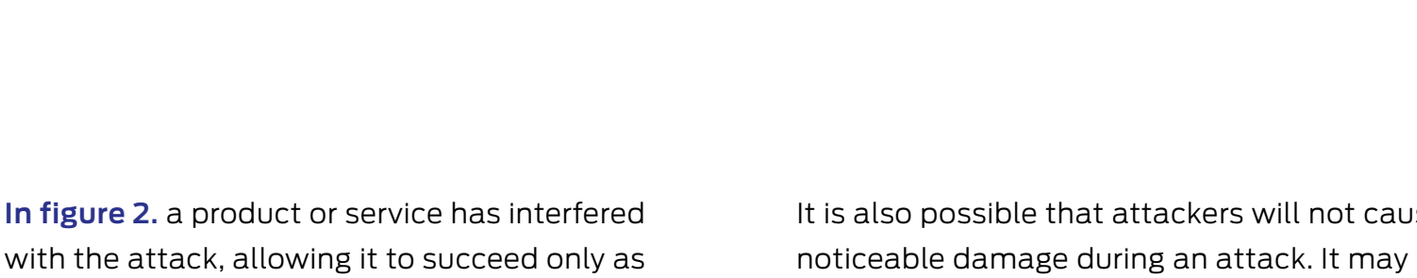


Figure 2. This attack was initially successful but only able to progress as far as the reconnaissance phase

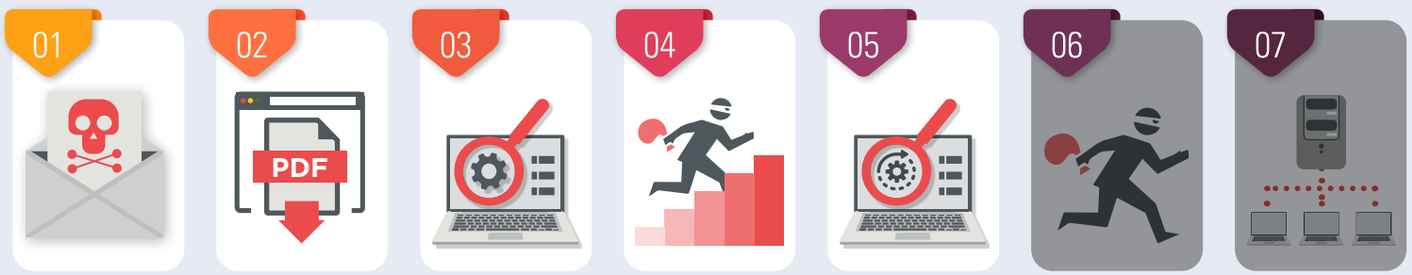


Figure 3. A more successful attack manages to steal passwords but wholesale data theft and destruction was blocked

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Hackers vs. Targets

When testing services against targeted attacks it is important to ensure that the attacks used are relevant. Anyone can run an attack randomly against someone else. It is the security vendor's challenge to identify common attack types and to protect against them. As testers, we need to generate threats that in some way relate to the real world.

All of the attacks used in this test are valid ways to compromise an organisation. Without any security in place, all would succeed in attacking the target. Outcomes would include systems infected with ransomware, remote access to networks and data theft.

But we didn't just sit down and brainstorm how we would attack different companies. Instead we used current threat intelligence to look at what the bad guys have been doing over the last few years and copied them quite closely. This way we can test the services' abilities to handle similar threats to those faced by global governments, financial institutions and national infrastructure.

The graphic on this page shows a summary of the attack groups that inspired the targeted attacks used in this test. If a service was able to detect and protect against these then there's a good chance they are on track to blocking similar attacks in the real world. If they fail, then you might take their bold marketing claims about defeating hackers with a pinch of salt.

Hackers vs. Targets

Attacker/APT Group	Method	Target	Details
AvosLocker			Hired out as 'Ramsomware as a Service (RaaS)' and used against a wide range of targets.
Conti			Affects all versions of Windows. Attackers known to leak stolen data.
DarkSide			An RaaS operation that focusses on large, well resourced organisations.
Dharma			Installed on target systems over remote desktop connections (RDP).
Maze			Often installed using stolen or guessed credentials.
NetWalker			File-less ransomware that uses DLL injection in memory.
Revil/ Sodinokibi			Considered the 4th most used ransomware globally.
Ragnar Locker			Highly customised. Attackers known to leak stolen data.
Ryuk			Focussed on businesses. Attackers known to leak stolen data.

Key

Aviation
Banking and ATMs
Energy
Entertainment
Financial
Gambling
Generic
Generic RaaS
Generic/ UK
Generic/ US
Government Espionage
Healthcare
Law
Natural Resources
US Retail, Restaurant and Hospitality

2. 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 chart.

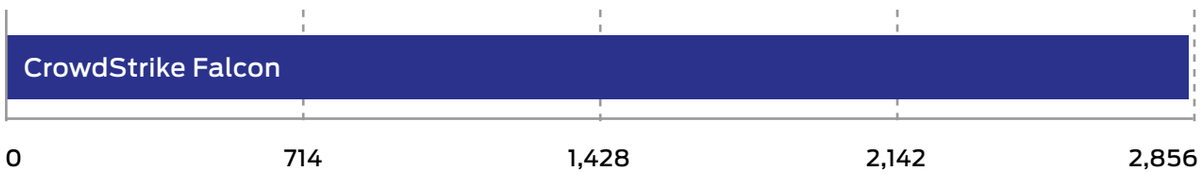
The chart below takes into account not only the product's ability to detect and protect against threats, but also its handling of non-malicious objects such as web addresses (URLs) and applications.

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.

Scoring a product's response to a potential breach requires a granular method, which we outline in **3. Response Details (Ransomware Deep Attacks)** on page 11.

Total Accuracy Ratings			
Product	Total Accuracy Rating	Total Accuracy (%)	Award
CrowdStrike Falcon	2,836	99%	AAA



Total Accuracy Ratings combine protection and false positives

3. Response Details (Ransomware Deep Attacks)

In this test security products are exposed to attacks, which comprise multiple stages. The perfect product will detect all relevant elements of an attack. The term 'relevant' is important, because sometimes detecting one part of an attack means it's not necessary to detect another.

For example, in the table below certain stages of the attack chain have been grouped together. These groups are as follows:

Delivery/ Execution (+10)
If the product detects either the delivery or execution of the initial attack stage then a detection for this stage is recorded.

Action (+10)
When the attack performs one or more actions, while remotely controlling the target, the product should detect at least one of those actions.

Privilege escalation/ action (+10)
As the attack progresses there will likely be an attempt to escalate system privileges and to perform more powerful and insidious actions. If the product can detect either the escalation process itself, or any resulting actions, then a detection is recorded.

Lateral movement/ action (+10)
The attacker may attempt to use the target as a launching system to other vulnerable systems.

Ransomware Deep Attack Group 1

Incident No:	Detection	Delivery	Execution	Action	Escalation	PE Action	Lateral Movement	Lateral Action
1	✓	✓	✓	✓	✓	✓	N/A	N/A
2	✓	✓	✓	✓	✓	✓	N/A	N/A
3	✓	✓	✓	—	✓	—	—	✓
4	✓	✓	✓	✓	N/A	✓	✓	✓
5	✓	✓	✓	✓	✓	✓	✓	✓

Ransomware Deep Attack Group 2

Incident No:	Detection	Delivery	Execution	Action	Escalation	PE Action	Lateral Movement	Lateral Action
6	✓	✓	✓	✓	✓	✓	N/A	N/A
7	✓	✓	✓	✓	✓	✓	N/A	N/A
8	✓	✓	✓	✓	✓	✓	✓	✓
9	✓	✓	✓	—	✓	✓	✓	✓
10	✓	✓	✓	✓	✓	✓	✓	✓

If this attempt is discovered, or any subsequent action, a detection is reported.

The Detection Rating is calculated by adding points for each group in a threat chain that contains a detection. When at least one detection occurs in a single group, a 'group detection' is recorded and 10 points are awarded.

Each test round contains one threat chain, which itself contains four groups (as shown above), meaning that complete visibility of each attack adds 40 points to the total value.

A product that detects the delivery of a threat, but nothing subsequently to that, wins only 10 points, while a product that detects delivery and action, but not privilege escalation or lateral behaviours, is rated at 20 for that test round.

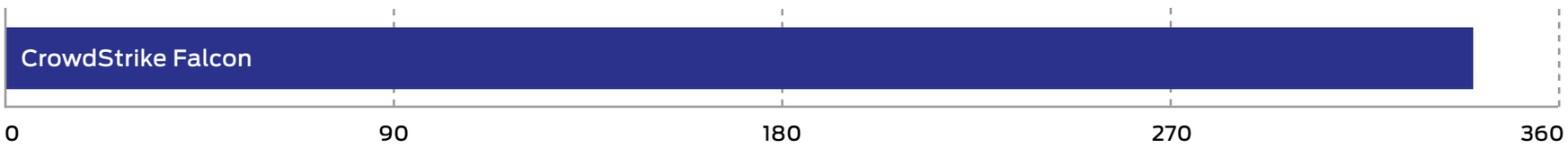
Response Details						
Ransomware Deep Attack	Number of Test Cases	Attacks Detected	Delivery/ Execution	Action	Privilege Escalation/Action	Lateral Movement/Action
Group 1	5	5	5	4	5	3
Group 2	5	5	5	4	5	3
Total	**10**	**10**	**10**	**8**	**10**	**6**

This data shows how the product handled different group stages of each APT. The Detection column shows the basic level of detection

Detection Accuracy Rating Details				
Ransomware Deep Attack	Number of Test Cases	Attacks Detected	Group Detections	Detection Rating
Group 1	5	5	17	170
Group 2	5	5	17	170
Total	**10**	**10**	**34**	**340**

Different levels of detection, and failure to detect, are used to calculate the Detection Rating

Detection Accuracy Ratings		
Product	Detection Accuracy Rating	Detection Accuracy Rating %
CrowdStrike Falcon	340	94%



Detection Ratings are weighted to show that how products detect threats can be subtler than just ‘win’ or ‘lose’

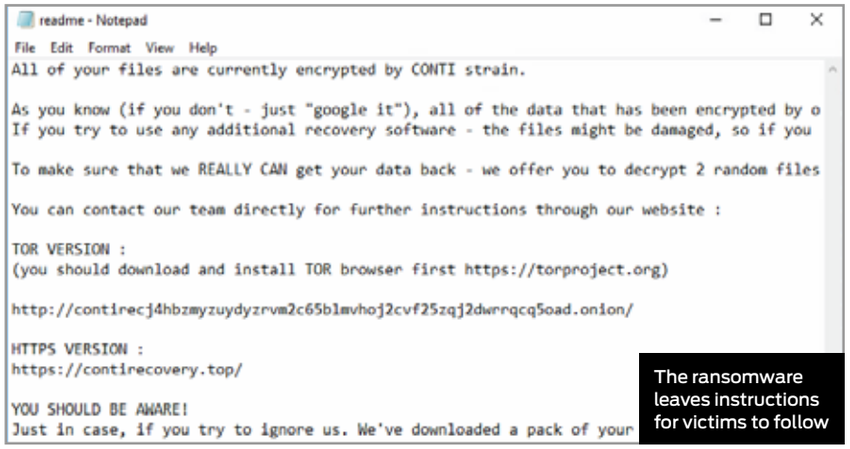
4. Threat Intelligence (Ransomware Deep Attacks)

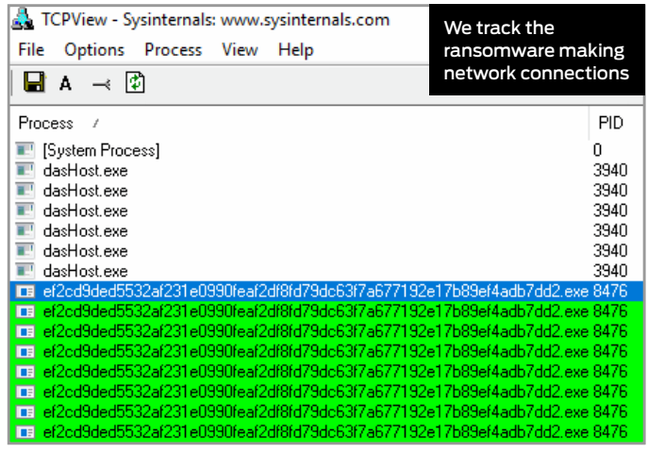
Group 1

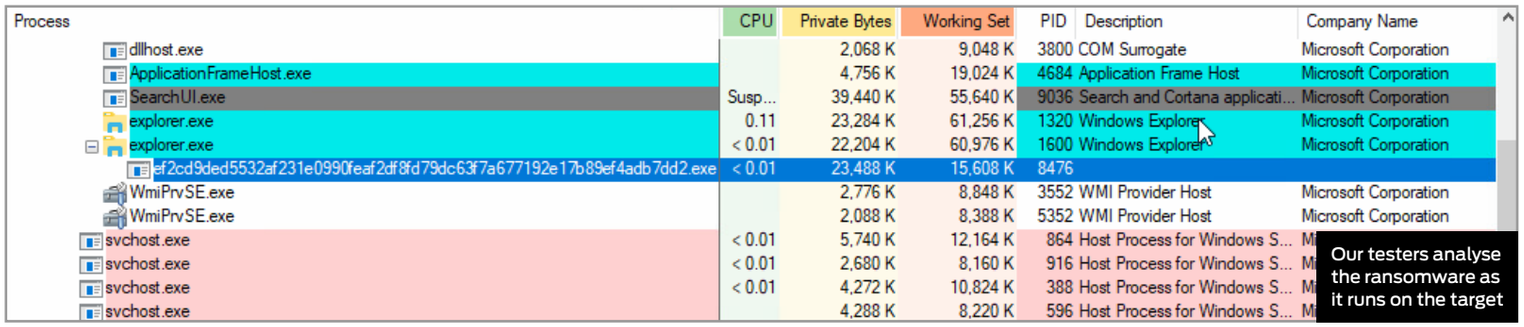
We focussed on scripts, such as PowerShell, Visual Basic and the Windows command shell to gain initial access to the targets.

Once we gained access we used a number of methods to gain privileged access. These techniques involved access token manipulation.

When the system was completely compromised we deployed malware from ransomware families including Conti, DarkSide, Dharma, Maze and Revil.







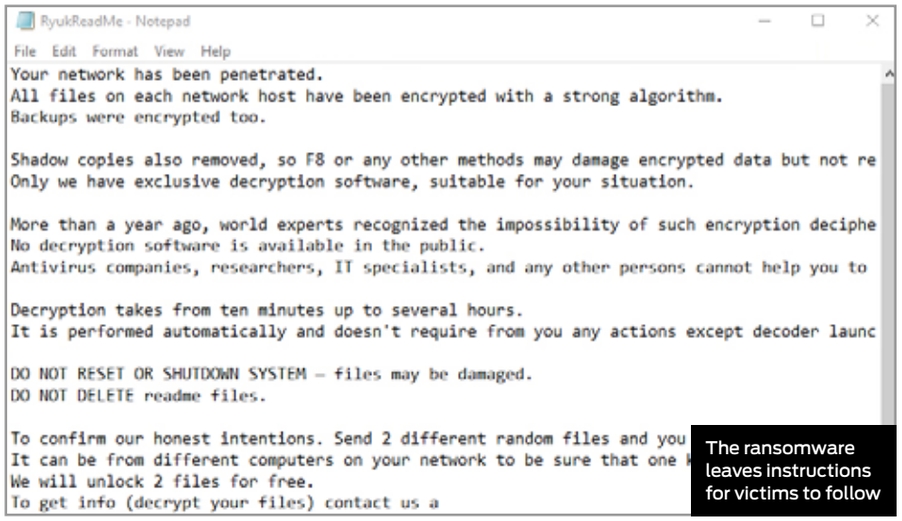
Example Ransomware Deep Attack Group 1						
Delivery	**Execution**	**Action**	**Privilege Escalation**	**Post-Escalation Action**	**Lateral Movement**	**Lateral Action**
Spearphishing Link	PowerShell	Query Registry	Access Token Manipulation - Create Process with Token	Modify Registry	External Remote Services	Exfiltration over C2 Channel
	Malicious File	System Information Discovery		Exfiltration Over C2 Channel	Domain Accounts	Data Destruction
	Windows Command Shell	System Location Discovery - System Language Discovery		Service Stop		Data Encrypted for Impact
	Asymmetric Cryptography	File Deletion				Inhibit System Recovery
						Service Stop
 Spearphishing Link	 Malicious File	 File Deletion	 Access Token Manipulation - Create Process with Token	 Exfiltration Over C2 Channel	 Domain Accounts	 Data Destruction

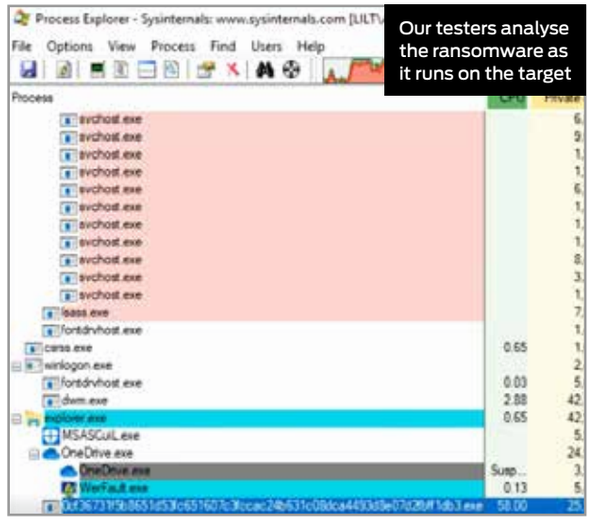
Group 2

In this group we used executable malware files to gain initial access to the targets. Subsequently we gained higher levels of access by using Bypass User Account Control exploits.

We were able to become the equivalent of systems administrators without permission from the user.

Once the system was completely compromised we deployed malware from ransomware families including Conti, DarkSide, Dharma, Maze and Revil.





Example Ransomware Deep Attack Group 2						
Delivery	**Execution**	**Action**	**Privilege Escalation**	**Post-Escalation Action**	**Lateral Movement**	**Lateral Action**
Spearphishing Attachment	Malicious File	Process Discovery	Bypass User Account Control	Credentials in Files	External Remote Services	Exfiltration Over Alternative Protocol
	Windows Command Shell	System Information Discovery	Valid Accounts	System Owner/User Discovery		Data Destruction
	Software Packing	Credentials from Web Browsers		Modify Registry		Data Encrypted for Impact
	Masquerading			Windows Service		Inhibit System Recovery
						Service Stop
 **Spearphishing Attachment**	 **Masquerading**	 **System Information Discovery**	 **Valid Accounts**	 **System Owner/User Discovery**	 **External Remote Services**	 **Data Encrypted**

5. Protection Ratings (Ransomware Direct Attacks)

The following results relate to the direct ransomware attacks, in which ransomware payloads are sent directly to targets in realistic ways, such as via phishing emails.

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

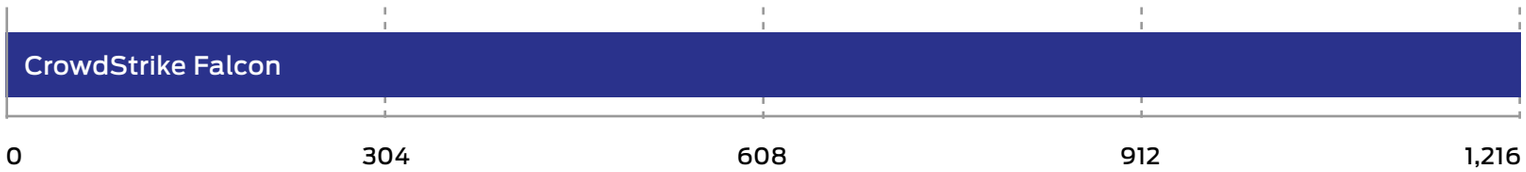
We calculate the protection ratings using the following formula:

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.

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 **7. Protection Details (Ransomware Direct Attacks)** on page 16 to roll your own set of personalised ratings.

Protection Ratings		
Product	Protection Rating	Protection Rating (%)
CrowdStrike Falcon	1,216	100%



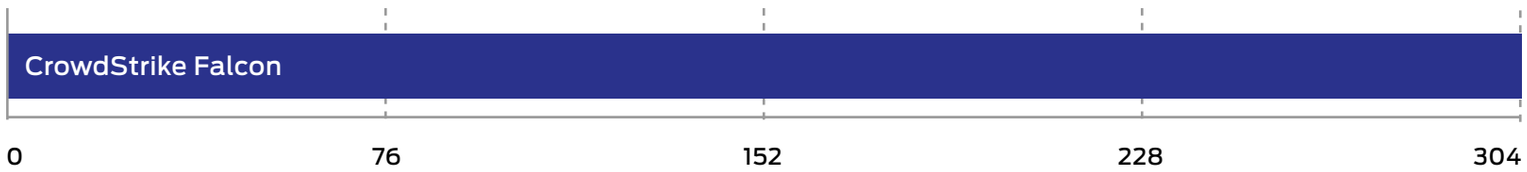
Protection Ratings are weighted to show that how products handle threats can be subtler than just 'win' or 'lose'

6. Protection Scores (Ransomware Direct Attacks)

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	304



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

7. Protection Details (Ransomware Direct Attacks)

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
CrowdStrike Falcon	304	304	0	0	304

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

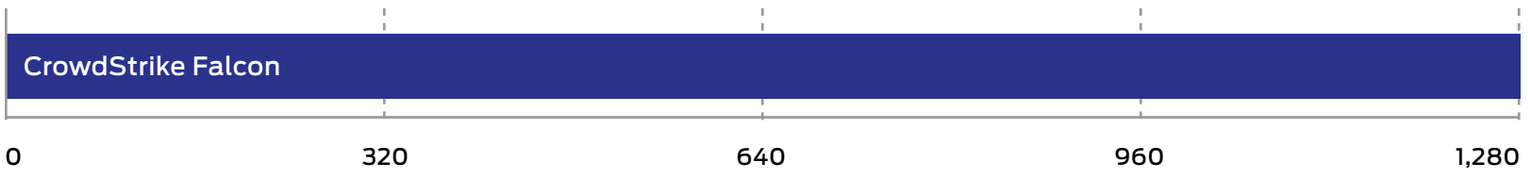
8. Legitimate Software Ratings

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 **8.3 Accuracy Ratings** on page 19.

Legitimate Software Ratings		
Product	Legitimate Accuracy Rating	Legitimate Accuracy (%)
CrowdStrike Falcon	1,280	100%



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

8.1 Interaction Ratings

It is crucial that endpoint security 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)	Click to allow/block (no recommendation)	None (blocked)
CrowdStrike Falcon	50	0	0

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

8.2 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.

8.3 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 **8. Legitimate Software Ratings** on page 17.

8.4 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 500 (50 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	8
High Impact	15
Medium Impact	12
Low Impact	9
Very Low Impact	6

9. Conclusions

This report looks at how effectively a security product can protect against a wide range of ransomware attacks. It also investigates the product's capabilities in tracking the behaviour of attackers that use ransomware as a final payload.

Ransomware Deep Attacks

In the first part of the test, we ran full, advanced hacking attacks against the target systems and installed ransomware at the end of each attack. This accurately reflects how attackers breach large organisations.

We wanted to assess how well **CrowdStrike Falcon** could track the hacking attacks through the network, as well as registering the ransomware attacks at the end. For these test cases we used 10 different ransomware payloads. These were selected from the larger group of ransomware files used in the second part of the testing.

The methods of attacking the target systems were a combination of tactics used by a number of different ransomware groups. You can see a summary of these in **4. Threat Intelligence**, pages 13 and 14, and a full rundown of each in **Appendix C: Ransomware Deep Attack Details**.

CrowdStrike Falcon detected all 10 of the attacks and managed to generate alerts for at least one attack stage in each, with two exceptions. Let's look at what this means in terms of overall, useful detection in the real world.

We use a concept called 'group detection'. For example, we expect a product to detect either the delivery or execution of a malicious file. If it detects both events in this group then that's fabulous, but our scoring allows the product to achieve top marks if it detects one or the other.

In test cases 3 and 9 the product detected both delivery and execution. However, it didn't detect the hacker's actions immediately following those stages. It then detected at least one stage in all subsequent groups. The Detection Accuracy Rating is 94% because it did not detect those two 'Action' stages of the attacks.

We deployed ransomware at different stages in the attacks. For test cases 1, 2, 6 and 7 we installed ransomware on the main target systems. For the other test cases we jumped from these target systems to others on the internal network (moving laterally) and ran ransomware on these deeper targets. This is why the Lateral Movement and Lateral Action results for test cases 1, 2, 6 and 7 are not applicable (N/A).

The results show that **CrowdStrike Falcon** not only detected the ransomware in every case but had a thorough insight into the entire process of hacking the network.

Ransomware Direct Attacks

In the second part of the test, we used a large group of ransomware attack files. The files formed a combination of malicious software both known and unknown by security researchers. Our goal was to see how well a product could identify ransomware that has already been analysed by security experts, as well as new, never-before-seen variations that represent potential future attacks.

We identified nine prevalent families of ransomware and from each selected 10 malware files that attackers have used in the past. We then modified these files using techniques designed to make the malware look different (although the malware would perform the same malicious activities). These files represented malware that could reasonably be expected to appear now and in the near future. For each 'original' malware file we created two variations.

At this stage we had 270 ransomware files – 90 originals and 180 variations. They were all functional in the absence of protective software.

We exposed target systems to these ransomware files using very direct methods of attack, such as sending the malware (or links to the malware) via phishing emails.

CrowdStrike Falcon detected and blocked every single ransomware file, including all of the new variants. This is an excellent result.

Final Words

Finally, we tested how CrowdStrike Falcon handled legitimate software. It made no mistakes, demonstrating that it was configured in a realistic and usable way.

CrowdStrike Falcon performed exceptionally well at protecting against known and new variants of ransomware, as well as tracking network attacks that concluded with ransomware payloads.

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 test was conducted between 24th May to 11th July 2022.
- The product was configured according to its vendor's recommendations.
- 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.

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 We are a customer considering buying or changing part of our security infrastructure. Can you help?

A Yes, we frequently run private testing for organisations that are considering changing their security products. Please contact us at **info@selabs.uk** for more information.

Appendix C: Ransomware Deep Attack Details

Ransomware Deep Attack Group 1							
Test Case	**Delivery**	**Execution**	**Action**	**Privilege Escalation**	**Post-Escalation Action**	**Lateral Movement**	**Lateral Action**
1	Spearphishing Attachment	PowerShell	File Deletion	Access Token Manipulation - Create Process with Token	Disable or Modify Tools	N/A	N/A
		Obfuscated Files or Information	Process Injection		Exfiltration Over C2 Channel		
		Malicious File	System Information Discovery		Data Destruction		
		Windows Command Shell	System Service Discovery		Data Encrypted for Impact		
		Asymmetic Cryptography			Inhibit System Recovery		
					Service Stop		
2	Spearphishing Link	Visual Basic	System Information Discovery	Access Token Manipulation - Token Impersonation/ Theft Process Injection	Ingress Tool Transfer	N/A	N/A
		Windows Command Shell	System Location Discovery - System Language Discovery		Data Destruction		
		Malicious File	Permission Groups Discovery - Domain Groups		Data Encrypted for Impact		
		Native API	Query Registry		Inhibit System Recovery		
		Match Legitimate Name or Location			Service Stop		
3	Spearphishing Link	PowerShell	Query Registry	Access Token Manipulation - Create Process with Token	Modify Registry	External Remote Services	Exfiltration over C2 Channel
		Malicious File	System Information Discovery		Exfiltration Over C2 Channel	Domain Accounts	Data Destruction
		Windows Command Shell	System Location Discovery - System Language Discovery		Service Stop		Data Encrypted for Impact
		Asymmetric Cryptography	File Deletion				Inhibit System Recovery
							Service Stop
4	Spearphising Attachment	Windows Command Shell	System Information Discovery	N/A	Disable or Modify Tools	Lateral Tool Transfer	Exfiltration over C2 Channel
		Malicious File	Permission Groups Discovery - Domain Groups		Inhibit System Recovery	Remote Desktop Protocol	Data Destruction
			Process Injection				Data Encrypted for Impact
			File Deletion				Inhibit System Recovery
							Service Stop
5	Spearphishing Attachment	Windows Command Shell	System Information Discovery	Access Token Manipulation - Token Impersonation/ Theft Process Injection	Ingress Tool Transfer	External Remove Services	Exfiltration over C2 Channel
		Malicious File	Query Registry		Modify Registry	Domain Accounts	Data Destruction
		Native API					Data Encrypted for Impact
		Match Legitimate Name or Location					Inhibit System Recovery
							Service Stop

Ransomware Deep Attack Group 2							
Test Case	**Delivery**	**Execution**	**Action**	**Privilege Escalation**	**Post-Escalation Action**	**Lateral Movement**	**Lateral Action**
6	Spearphishing Attachment	Malicious File	Process Discovery	Bypass User Account Control	Data From Local System	N/A	N/A
		Windows Command Shell	System Information Discovery	Valid Accounts	Exfiltration Over C2 Channel		
		PowerShell	Permission Groups Discovery		System Owner/User Discovery		
		Deobfuscate/Decode Files or Information	System Network Configuration Discovery		Data Destruction		
		Obfuscated Files or Information			Data Encrypted for Impact		
					Inhibit System Recovery		
					Service Stop		
7	Spearphishing Link	Malicious File	Process Discovery	Bypass User Account Control	Data From Local System	N/A	N/A
		Windows Command Shell	System Information Discovery	Valid Accounts	Exfiltration Over C2 Channel		
		Masquerading	Account discovery - Local Account		Credentials from Web Browsers		
		Software Packing	System Network Configuration Discovery		Data Destruction		
		Native API			Data Encrypted for Impact		
		Symmetric Cryptography			Inhibit System Recovery		
					Service Stop		
8	Spearphishing Link	Malicious File	Process Discovery	Bypass User Account Control	Data From Local System	External Remote Services	Exfiltration Over Alternative Protocol
		Windows Command Shell	System Information Discovery	Valid Accounts	Exfiltration Over C2 Channel		Automated Collection
		Software Packing	Network Share Discovery		Modify Registry		Data Destruction
		Obfuscated Files or Information	System Service Discovery				Data Encrypted for Impact
							Inhibit System Recovery
							Service Stop
9	Spearphishing Attachment	Malicious File	Process Discovery	Bypass User Account Control	Credentials in Files	External Remote Services	Exfiltration Over Alternative Protocol
		Windows Command Shell	System Information Discovery	Valid Accounts	System Owner/User Discovery		Data Destruction
		Software Packing	Credentials from Web Browsers		Modify Registry		Data Encrypted for Impact
		Masquerading			Windows Service		Inhibit System Recovery
							Service Stop
10	Spearphishing Link	Malicious File	Process Discovery	Bypass User Account Control	Scheduled Task	Lateral Tool Transfer	Exfiltration Over C2 Channel
		Windows Command Shell	System Information Discovery	Valid Accounts	Registry Run Keys / Startup Folder		Automated Collection
		Obfuscated Files or Information	Credentials from Web Browsers		Credentials in Files		Data Destruction
			System Owner/User Discovery				Data Encrypted for Impact
							Inhibit System Recovery
							Service Stop

SE Labs

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