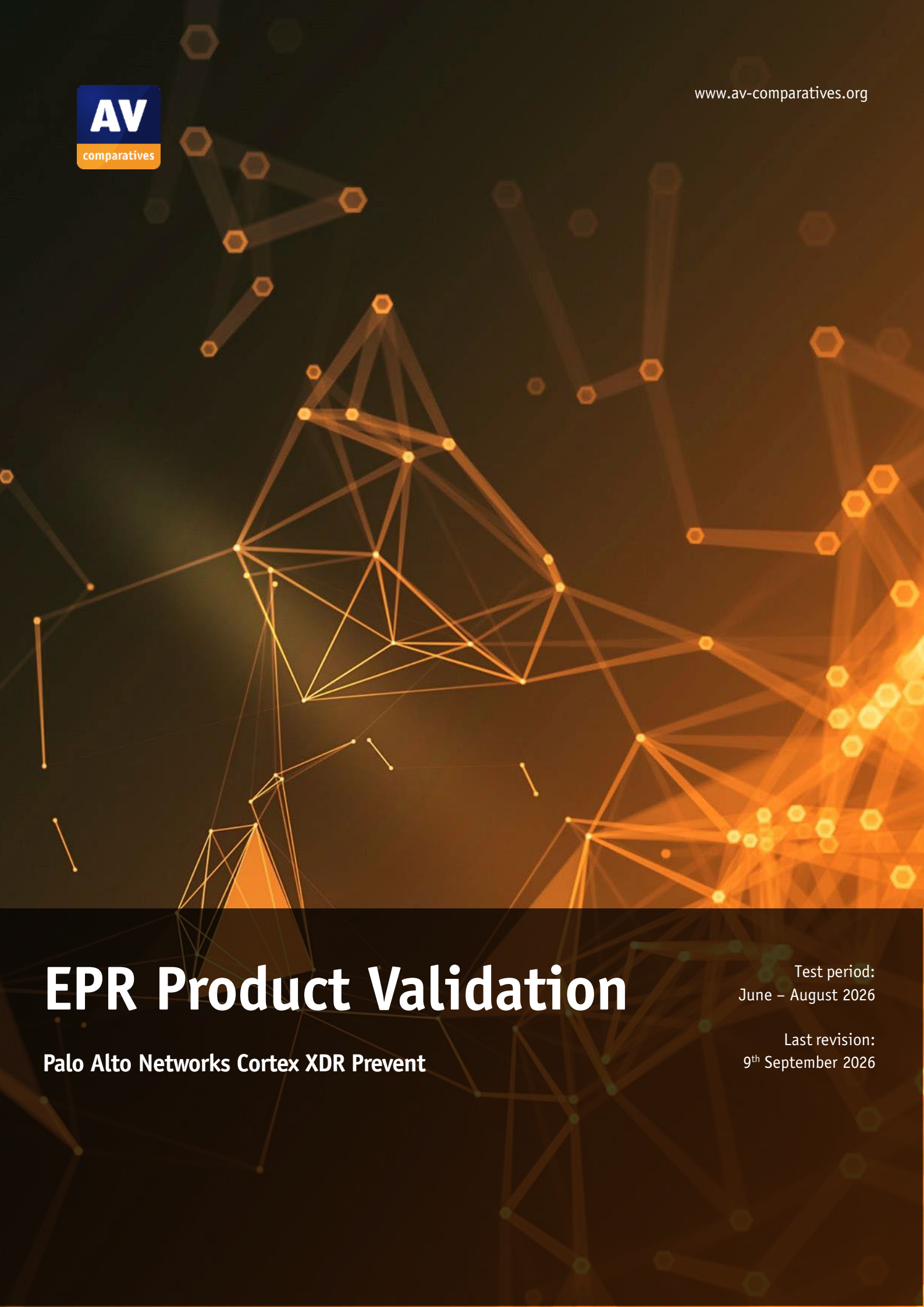

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EPR Product Validation

Palo Alto Networks Cortex XDR Prevent

Test period:
June – August 2026

Last revision:
9th September 2026

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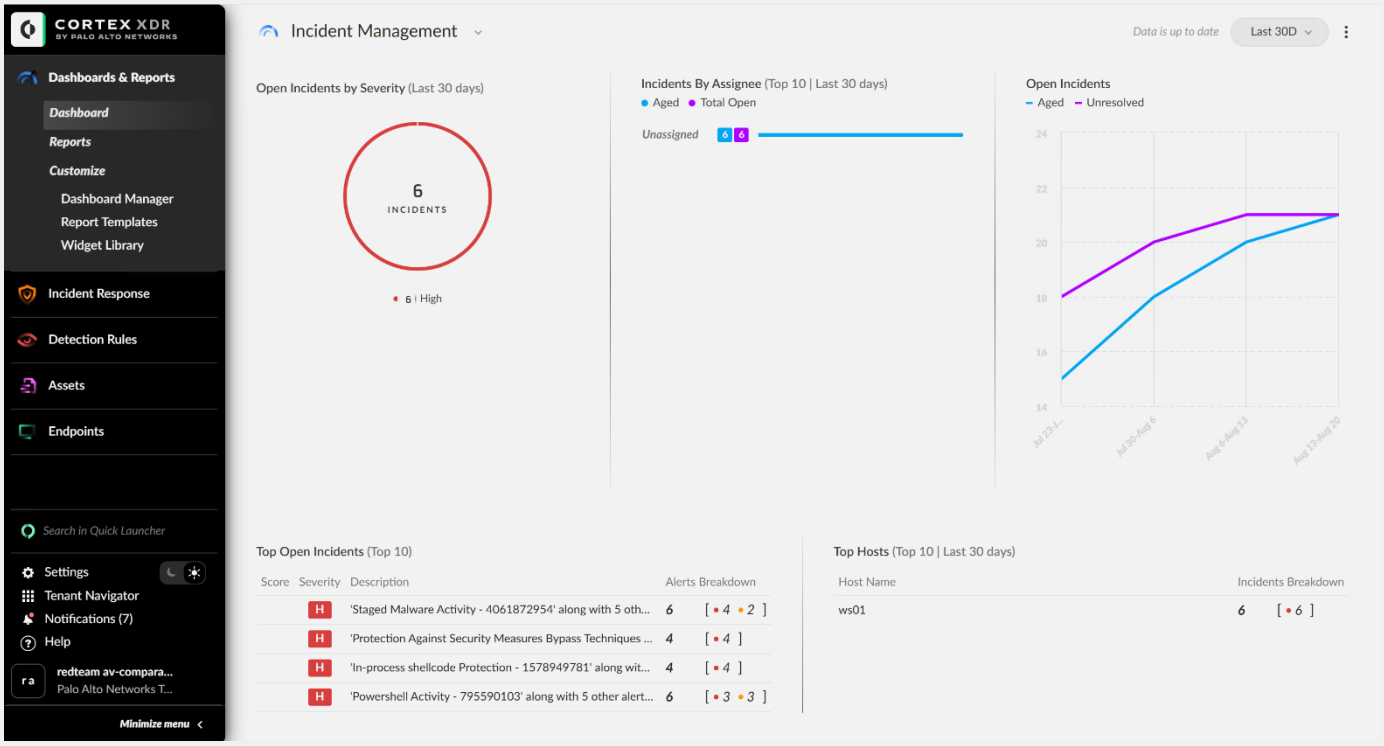
Tested Product

Palo Alto Networks Cortex XDR Prevent was tested as part of AV-Comparatives' Endpoint Prevention and Response (EPR) Test in summer 2026. The product version number was 9.1.

Product Thumbnail



Palo Alto Networks Cortex XDR Prevent management console

Certification

In this evaluation, certification is granted based on a product's performance in the AV-Comparatives EPR Test 2026. To achieve certification, a product must reach an average score of at least 92% for combined Active and Passive Response and meet the defined operational-accuracy and workflow-delay requirements. Products meeting these requirements are recognized as Certified Leaders in the Enterprise CyberRisk Quadrant. The tested solution achieved Certified Leader status in the EPR Test 2026.

Palo Alto Networks' EPR Product: Executive Summary

Palo Alto Networks Cortex XDR Prevent was tested by AV-Comparatives to validate if the product could provide effective enterprise prevention and response capabilities.

Palo Alto Networks Cortex XDR Prevent did well at handling threats targeted towards enterprise users, before the threats could progress inside and infiltrate the organisation's network. The product demonstrated several safeguards that helped in protecting the enterprise systems and network against the scenarios we tested.

The test included a wide mix of attack vectors - executables, scripts, installers, add-ins, and USB-propagated payloads. The product showed strong resilience, detecting these advanced attempts despite stealth and evasion layers.

The product's management console was easy to use, intuitive, and provided contextual data useful to SOC analysts in determining which threats to prioritize. The product had different response options for mitigated threats, and information for the SOC analyst to further investigate/inspect.

The product had good mapping to MITRE's TTPs, thus providing low-level SOC analysts with the data needed to investigate further and escalate when necessary. Alerts were prioritized and aggregated, to minimize noise from all the alerts generated. The product can be easily configured and deployed in a domain or workgroup environment.

Active Response (Prevention): This occurs when the product stops the attack automatically and reports it. The product had an Active Response to **50/50** scenarios across all the phases tested. This resulted in a cumulative Active Response rate of **100%**.

Passive Response (Detection): This occurs when the product does not stop the specific attack phase but reports suspicious activity. The product had a Passive Response to **50/50** scenarios across all the phases tested. This resulted in a cumulative Passive Response rate of **100%**.

Operational Accuracy Costs: These occur when legitimate programs/actions are blocked/detected. Palo Alto Networks had **low additional costs** from imperfect Operational Accuracy.

Workflow Delay Costs: These arise e.g. when the user must wait while a file is being analysed by the product. Palo Alto Networks had **no costs** relating to workflow delays.

Description	Details
EPR Certification Level Reached:	**CERTIFIED LEADER**
Overall **Active Response** Rate (Prevention Rate):	**98%**
Overall **Passive Response** Rate (Response Rate):	**98%**
Operational Accuracy Costs:	**Low**
Workflow Delay Costs:	**None**

Executive Summary

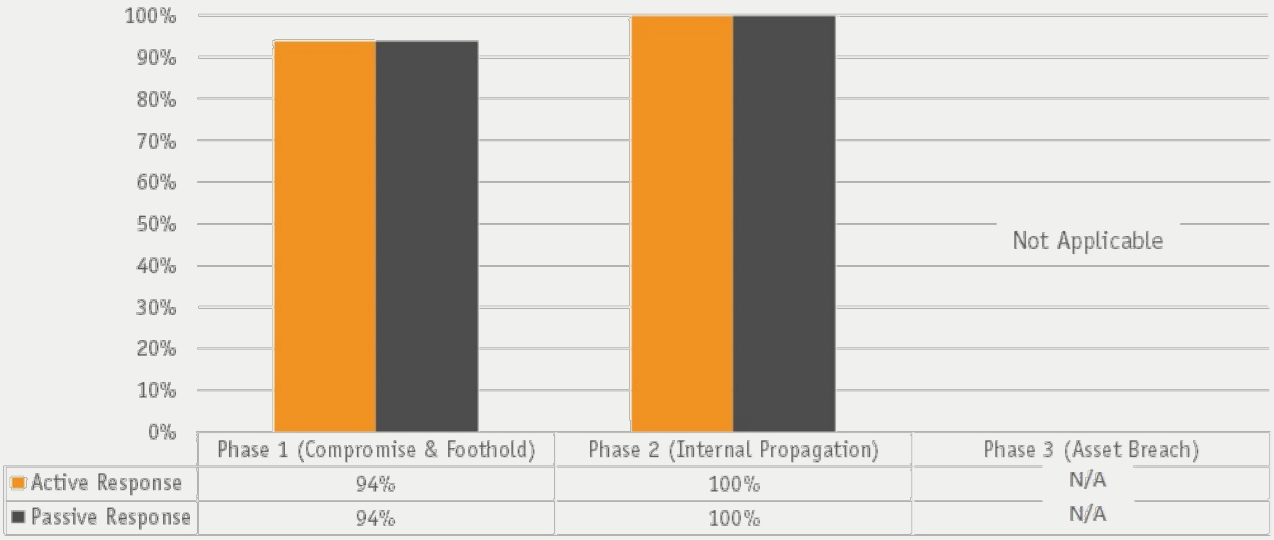
The table below depicts Palo Alto Networks' EPR prevention & detection rates across the different phases and categories of attack. For more details on the workflows and phases, please see the appendix.

Description	Number Tested
Scenarios	50
Phases	**Combined Prevention & Detection**
Phase 1 (Compromise & Foothold)	
Active Response (Prevention)	94%
Passive Response (Detection)	94%
Phase 2 (Internal Propagation)	
Active Response (Prevention)	100%
Passive Response (Detection)	100%
Phase 3 (Asset Breach)	
Active Response (Prevention)	N/A
Passive Response (Detection)	N/A
Operational Accuracy Costs	Low
Workflow Delay Costs	None

Combined Prevention & Detection Rates

Palo Alto Networks prevented 100% of the scenarios in Phase 2 (Internal Propagation). Hence, none of the scenarios progressed to Phase 3.

The graphic below breaks down Palo Alto Networks's Active versus Passive Response capabilities for the duration of the test.



Active vs Passive Response of Palo Alto Networks Cortex XDR Prevent

Modern threats usually come with layers of techniques to evade prevention and response, such as encryption, obfuscation, anti-analysis, packing, file-less malware, exploit, and privilege escalation.

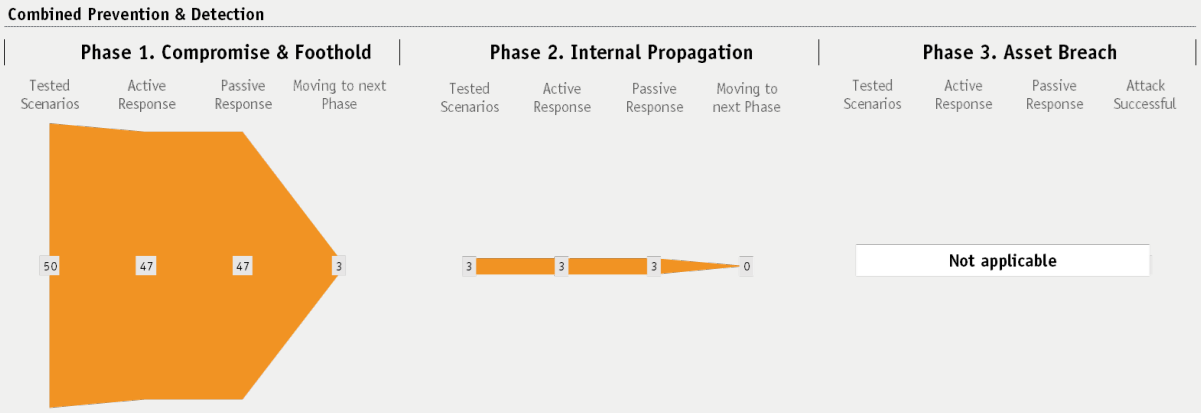
AV-Comparatives' Enterprise EPR methodology covers some of the most prevalent enterprise scenarios and system-administrator EPR workflows, specifically requested by enterprises based on inquiries and primary research.

Cumulative Prevention and Response by phases

Response Type	Phase 1 Only	Phase 1 & 2	Overall (Phase 1, 2 & 3)
Active Response	94% (47/50)	100% (50/50)	100% (50/50)
Passive Response	94% (47/50)	100% (50/50)	100% (50/50)

Combined Prevention & Detection Rates

The graphic below depicts Palo Alto Network's Active and Passive Response capabilities in the three attack phases tested.



EPR Efficacy per Phase of Palo Alto Networks Cortex XDR Prevent

Phase 1:

- 47 out of 50 scenarios prevented.
- 47 out of 50 scenarios detected.
- 3 scenarios were able to progress to Phase 2.

Phase 2:

- 3 out of 3 scenarios prevented.
- 3 out of 3 scenarios detected.
- 0 scenarios were able to progress to Phase 3.

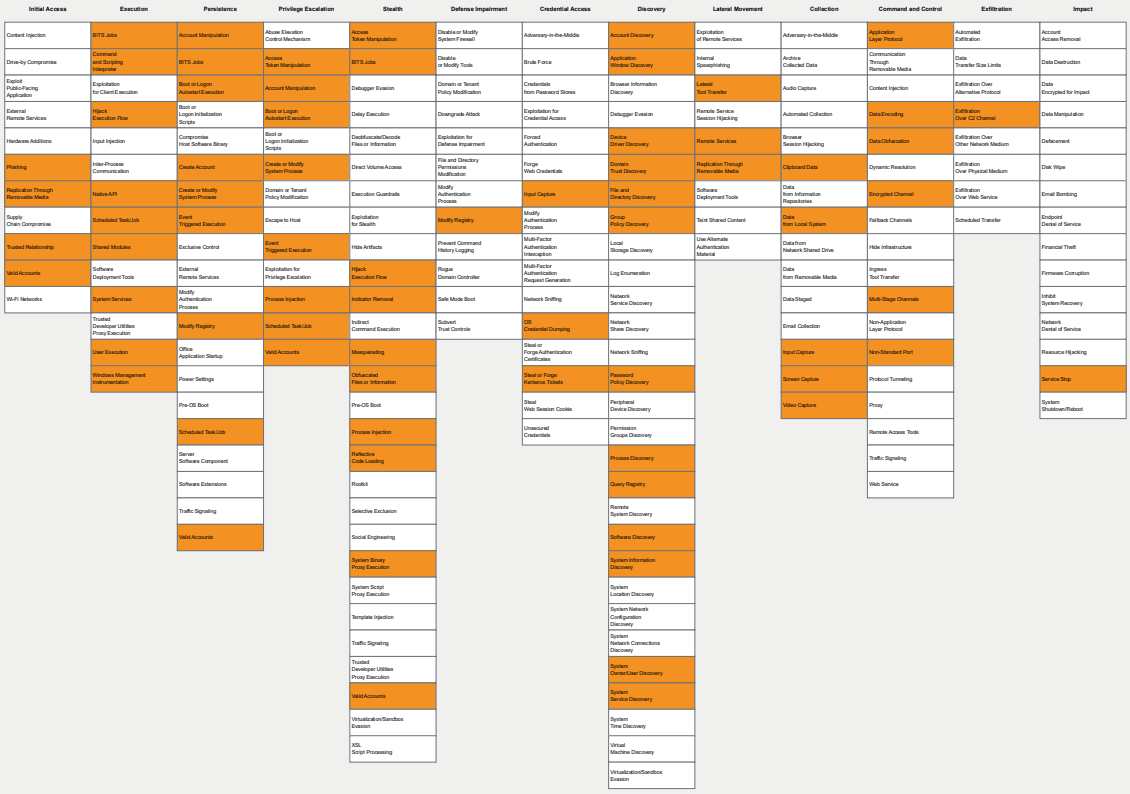
Phase 3:

- Not applicable, because no scenario was able to progress to Phase 3.

MITRE ATT&CK Matrix for Enterprise

The diagram below[1] shows the entire MITRE ATT&CK Matrix for Enterprise[2]. The column headings represent the ATT&CK Tactics[3] (aims), while the boxes below them represent the ATT&CK Techniques[4] used to achieve those goals. Our EPR test covers the entire attack chain shown here, using the most realistic possible scenarios. Across the 50 attack scenarios used in this EPR test, we tried to employ all the Techniques shown in the orange boxes below.

The Tactics relate to our 3 attack Phases as follows:
Phase 1 = Initial Access, Execution, Persistence
Phase 2 = Privilege Escalation, Defense Evasion, Credential Access, Discovery, Lateral Movement
Phase 3 = Collection, Command and Control, Exfiltration, Impact



MITRE ATT&CK Tactics and Techniques covered by this EPR Test

For a magnified view of the above table, please click here: https://www.av-comparatives.org/wp-content/uploads/2026/08/EPR2026.svg

An example scenario might look like this: phishing mail with script payload is sent to user on Workstation A – internal discovery is performed – access to C$ share on Workstation B is found – lateral movement to Workstation B – network admin session on Workstation B is found – LSASS dumped to obtain admin credentials – lateral movement to Server 1 – defence evasion used to bypass security product on Server 1 – credit-card data found – data is extracted via open C2 channel.

1 Generated with https://mitre-attack.github.io/attack-navigator/
2 https://attack.mitre.org/matrices/enterprise/
3 https://attack.mitre.org/tactics/enterprise/
4 https://attack.mitre.org/techniques/enterprise/

Phase 1 Metrics: Endpoint Compromise and Foothold

The Phase 1 content of the executed attacks can be described by means of MITRE ATT&CK and other frameworks. The following Tactics are part of this phase.

Initial Access: Initial access is the method used by the attacker to get a foothold inside the environment that is being targeted. Attackers may use a single method, or a combination of different techniques. Threats may come from compromised websites, email attachments or removable media. Methods of infection can include exploits, drive-by downloads, spear phishing, macros, trusted relationships, valid accounts, and supply-chain compromises.

Execution: The next goal of the attacker is to execute their own code inside the target environment. Depending upon the circumstances, this could be done locally or via remote code execution. Some of the methods used include client-side execution, third-party software, operating-system features like PowerShell, MSHTA, and the command line.

Persistence: Once the attacker gets inside the target environment, they will try to gain a persistent presence there. Depending upon the target operating system, an attacker may use operating-system tools and features. These include registry manipulation, specifying dynamic-link-library values in the registry, shell scripts that can contain shell commands, application shimming, and account manipulation.

Palo Alto Networks Cortex XDR Prevent was subjected to the various attack steps as highlighted above and described in detail in AV-Comparatives' EPR CyberRisk Test Methodology. The resulting table below showcases the product's Active Response and Passive Response capabilities for the attack scenarios in Phase 1.

Tested Scenario	Frame work	File Type	Description	Active Response	Passive Response
1	Metasploit / Meterpreter	EXE	Obfuscated EXE loader with EDR unhooking and shellcode injection	✓	✓
2		ISO	ISO-delivered dropper bypassing MOTW restrictions	✓	✓
3		CPL	Obfuscated CPL with spoofed certificate and EDR bypass	✓	✓
4		XLL	USB-delivered Excel add-in with in-process shellcode injection	✓	✓
5		CHM	Compiled help file executing in-memory shellcode	✓	✓
6		VBS	USB VBScript decoding and executing embedded payload	✓	✓
7		PS1	PowerShell launcher with AMSI bypass and obfuscation	✓	✓
8		HTA	HTA payload abusing MSHTA for stealthy execution	✓	✓
9		MSI	Signed installer leveraging MSIExec for trusted execution	✓	✓
10		HTA	HTA launcher abusing MSHTA for proxy execution	✓	✓
11	Commercial #1	EXE	Obfuscated EXE loader with DNS-based shellcode staging	✓	✓
12		EXE	Decoy installer delivering stageless shellcode	✓	✓
13		CPL	USB CPL abusing trusted Control Panel execution	✓	✓
14		HTA	HTA stager executing without dropping a PE file	✓	✓
15		EXE	Installer dropper with DNS-based stageless payload	✓	✓

16	PowerShell Empire	EXE	Obfuscated EXE loader with EDR bypass and shellcode injection	✓	✓
17		CPL	Obfuscated CPL executing payload under trusted host	✓	✓
18		EXE	Memory-evasive loader with stealthy shellcode execution	✓	✓
19		SCR	Obfuscated screen saver with ETW bypass	✓	✓
20		EXE	Backdoored installer executing embedded shellcode	✓	✓
21		VBS	VBScript launcher executing under valid user context	✓	✓
22		VBS	Obfuscated VBScript launching encoded PowerShell	✓	✓
23		BAT	Batch script executing encoded PowerShell payload	✓	✓
24		EXE	Masqueraded dropper delivering embedded shellcode	✓	✓
25		HTA	HTA script staging payload through MSHTA	✓	✓
26	Commercial #2	EXE	Spoofed installer with weak certificate and in-memory implant	✗	✗
27		SCR	Obfuscated screen saver with EDR bypass	✗	✗
28		CPL	USB CPL disabling logging before payload execution	✓	✓
29		PIF	Stealthy PIF loader bypassing endpoint defences	✗	✗
30		EXE	Obfuscated EXE loader launching in-memory implant	✓	✓
31	Metasploit / Meterpreter	ISO	ISO-delivered dropper bypassing MOTW protections	✓	✓
32		HTA	HTA payload abusing MSHTA without dropping binaries	✓	✓
33		PIF	Obfuscated PIF loader with defence evasion	✓	✓
34		LNK	USB shortcut launching hidden payload	✓	✓
35		DLL	DLL sideloading via Rundll32	✓	✓
36		SCR	Obfuscated screen saver with shellcode injection	✓	✓
37		HTA	Trusted HTA launcher executing under insider context	✓	✓
38		MSI	Trusted MSI installer deploying payload silently	✓	✓
39		VBS	Trusted VBScript staging payload under user context	✓	✓
40		EXE	Trusted utility clone loading in-memory shellcode	✓	✓
41	PowerShell Empire	EXE	Spoofed utility loader with EDR unhooking	✓	✓
42		CHM	Compiled help file launching obfuscated PowerShell	✓	✓
43		CPL	Obfuscated CPL hosted under spoofed process	✓	✓
44		SCR	Screen saver abusing SCT-based execution	✓	✓
45		BAT	Batch script launching encoded PowerShell stager	✓	✓
46		XLL	USB Excel add-in executing in-memory payload	✓	✓
47		HTA	Trusted HTA staging payload via PowerShell	✓	✓
48		SCR	Spoofed screen saver with process masquerading	✓	✓
49		VBS	Trusted VBScript launching encoded PowerShell	✓	✓
50		DLL	Trusted DLL launcher executing in-memory shellcode	✓	✓

Phase 1: Active versus Passive Response of Palo Alto Networks Cortex XDR Prevent

✗ - Indicates the product **failed** to prevent/detect the attack in the tested scenario during this phase.
✓ - Indicates the product **successfully** prevented/detected the attack in the tested scenario during this phase.

Palo Alto Networks achieved an Active Response rate of 94% and a Passive Response rate of 94% in Phase 1 (Compromise and Foothold). Consequently, the remaining 6% of scenarios, which were not prevented, progressed to Phase 2 (Internal Propagation).

Phase 2 Metrics: Internal Propagation

In this phase, the EPR product must prevent internal propagation if Phase 1 doesn't stop the attack. It should empower the system admin to immediately detect and track the threat's internal spread in real-time. Relevant tactics from the MITRE ATT&CK Framework include:

Privilege Escalation: In enterprise networks, users typically use standard accounts without admin privileges. If an enterprise endpoint is attacked, the attacker won't have the needed permissions. Privilege escalation methods involve user-access token manipulation, exploitation, application shimming, hooking, or permission weaknesses. Active response assessment considered preventive actions within each method.

Defense Evasion: Attackers aim to go undetected while achieving their objectives. Defense evasion involves actions like tampering with security software, process obfuscation, and abusing system tools to hide the attack.

Credential Access: Attackers secure legitimate network user account access for their activities, avoiding detection. Methods vary depending on the network's nature, from on-site input capture (e.g., keyloggers) to offline copying of the password database for later cracking.

Discovery: Once the attacker has gained access to the target network, they will explore the environment, with the aim of finding those assets that are the ultimate target of the attack. This is typically done by scanning the network.

Lateral Movement: The attacker will move laterally within the environment, to access those assets that are of interest. Techniques used include pass the hash, pass the ticket, and exploitation of remote services and protocols like RDP.

Tested Scenario	Description	Active Response	Passive Response
26	Commercial #2 - Spoofed installer with weak certificate and in-memory implant	✓	✓
27	Commercial #2 - Obfuscated screen saver with EDR bypass	✓	✓
29	Commercial #2 - Stealthy PIF loader bypassing endpoint defences	✓	✓

Phase 2: Active versus Passive Response of Palo Alto Networks Cortex XDR Prevent

In Phase 2 (Internal Propagation), Palo Alto Networks achieved an Active Response rate of 100% and a Passive Response rate of 100% across the progressed scenarios. With all remaining threats mitigated in this phase, none advanced to Phase 3.

Phase 3 Metrics: Asset Breach

The final phase of the workflow is asset breach. This is the stage where an attacker starts carrying out their ultimate objective. We have explained below the relevant Tactics from the MITRE ATT&CK Framework.

Collection: This involves gathering the target information – assuming of course that information theft, rather than sabotage, is the object of the exercise. The data concerned could be in the form of documents, emails or databases.

Command and Control: A Command-and-Control mechanism allows communication between the attacker's system and the targeted network. This means that the attacker can send commands to, or receive data from, the compromised system. Typically, the attacker will try to mask such communications by disguising them as normal network traffic.

Exfiltration: Once the attacker has reached the objective of collecting the target information, they will want to copy it covertly from the targeted network to their own server. In almost all cases, exfiltration involves the use of a command-and-control infrastructure.

Impact: This can be defined as the direct damage done to the targeted organisation's network. It includes the manipulation, disruption or destruction of operational systems and/or data. This might be an end in itself (sabotage), or a means of covering up data theft, by making it more difficult to investigate the breach.

Phase 3 scenarios were **N/A** (**not applicable**) to Palo Alto Networks, as the threats had already been prevented in a previous phase.

Operational-Accuracy and Workflow-Delay

Operational accuracy testing evaluates whether legitimate programs, administrative tools, scripts, websites and common enterprise activities are incorrectly blocked or reported by the product. Such behaviour can create unnecessary investigation effort and operational friction. Workflow delay testing evaluates whether product behaviour, such as cloud or sandbox analysis, introduces noticeable delays into normal user or administrator workflows. Costs arising from imperfect operational accuracy and workflow delays are calculated as follows.

Costs arising from imperfect operational accuracy or malfunctions

Operational accuracy testing was performed by simulating a typical user activity in the enterprise environment. This included opening clean files of different types (such as executables, scripts, documents with macros) and browsing to different clean websites. Furthermore, different administrator-friendly tools and scripts were also executed in the test environment to ensure that productivity was not affected by the respective product configuration used for the test. To assess operational accuracy, each product is tested with a battery of clean scenarios. Over-blocking or over-reporting of such scenarios means that a product reaches high prevention and detection rates but also causes increased costs. Where legitimate programs/actions are blocked, the system administrator will have to investigate, restore/reactivate any blocked programs etc, and take steps to prevent it happening again. The principle of "The boy who cried wolf" may also apply; the greater the number of false alerts, the more difficult it becomes to recognise a genuine alert. Products are then assigned to one of five Groups (None, Low, Moderate, High, and Very High, whereby lower is better), according to the number of affected scenarios. These are shown in the table below.

Group	Number of affected scenarios	Operational Accuracy	
		Active Response Multiplying Factor	*Passive Response Multiplying Factor*
None	0	x0	x0
Low	1	x1	x0.75
Moderate	2-3	x5	x3.75
High	4-5	x10	x7.5
Very High	5+	x20	x15

Multiplying factors for Operational Accuracy costs

The costs arising from imperfect Operational Accuracy are worked out using Cost Units of USD 1.47 million. The number of Cost Units a product is deemed to have caused is calculated using a Multiplying Factor. This varies according to the Group, and whether the scenario was affected by an Active Response (action blocked), or by a Passive Response (action not blocked, but detection alert shown in the console). The Multiplying Factor for an erroneous Passive Response is always three-quarters of that of an erroneous Active Response, because less time and effort is required to resolve the problem. How this works in practice is best explained by looking at the table above. Products in the "None" Group have a Multiplying Factor of 0 for both Active and Passive Responses, therefore Operational Accuracy costs are zero. Products in the "Low" Group (1 affected scenario) have a Multiplying Factor of 1 for erroneous Active Responses, but only 0.75 for an erroneous Passive Response. Hence, a product with one erroneous Active Response incurs one Cost Unit, while a product with one erroneous Passive Responses only incurs 0.75 Cost Units. If a product had 2 affected scenarios, one being an Active Response, the other a Passive Response, it would incur 8.75 Cost Units (5 for the Active Response, and 3.75 for the Passive Response). Products that exhibit significant bugs or malfunctions during testing incur an additional penalty factor of 12. We are pleased to report that no such issues were observed in this year's test.

Costs arising from workflow delays

Some EPR products will cause delays in the user's workflow because they e.g. stop the execution of a previously unknown file and send it to the vendor's online sandbox for further analysis. Due to this behaviour, execution is stalled, and the user cannot proceed till the analysis comes back from the sandbox. We noted the delay caused by such analysis, for both scenarios (clean and malicious). Where a product caused significant delays when analysing a scenario, this was penalised. The analysis time for each product was calculated as follows. For clean scenarios, we took the longest observed delay for any one scenario. So, for example, a product with two delays - of 2 minutes and 10 minutes respectively - for clean scenarios would have a recorded time of 10 minutes. For malicious scenarios, we took the average of all the delays. So, a product with two delays - of 2 minutes and 10 minutes respectively - for malicious scenarios, would have a recorded time of 6 minutes. Products are then assigned to one of five Workflow Delay Groups (None, Low, Moderate, High and Very High), depending on how long the respective delay is. These are shown in the table below.

Group	Delay Caused (in minutes)	Workflow Delay Multiplying Factor
None	under 2	x0
Low	2-5	x0.5
Moderate	6-10	x2.5
High	11-20	x5
Very High	over 20	x10

Multiplying factors for Workflow Delay costs

The costs of these delays are calculated using the same Cost Units as for operational accuracy. Again, there is a multiplying factor, which varies according to the Workflow Delay Group. Products in the Low Workflow Delay Group have a Multiplying Factor of 0.5, hence incurring costs of 1 Cost Unit; products in the Very High Workflow Delay Group have a Multiplying Factor of 10, thus incurring costs of 10 Cost Units. Products in the latter category would be disqualified from certification, due to the excessive costs incurred.

Results

The costs arising from imperfect Operational Accuracy and Workflow Delays are shown below:

	Operational Accuracy		Workflow Delays
	Active Response	*Passive Response*	
Palo Alto Networks	Low	None	None

Combined results table for Operational Accuracy and Workflow Delays

Palo Alto Networks had low additional costs in Operational Accuracy and no additional costs in Workflow Delays.

EPR Competitive Product Differentiator (provided by Palo Alto Networks)

Cortex XDR Prevent delivers unified endpoint protection, detection, and response across Windows, macOS, and Linux — natively integrated with Palo Alto Networks NGFW, Prisma Access, and Cortex Cloud. The following capabilities distinguish Cortex XDR in the EPR evaluation context.

Prevention

- OOTB bare-metal and VM sandbox detonation — Built-in integration with WildFire detonates unknown files in parallel VM and bare-metal environments simultaneously. Bare-metal analysis can help identify sandbox-aware evasion techniques that may behave differently in virtualized environments.
- Cross-platform BYOVD and supply chain protection — Kernel-level monitoring for vulnerable driver loading across Windows, macOS, and Linux with OOTB global blocklists.
- macOS-exclusive protection modules — Three modules exist only on the macOS agent: Dylib hijacking protection, Gatekeeper enhancement, and Malicious device protection — covering Mac-specific attack vectors through dedicated macOS protection modules.
- Web shell detection with integrated response — OOTB behavioural controls for web shell implantation on Windows and Linux servers, surfaced with forensic context and immediate in-console response actions without pivoting to a separate tool.

Detection

- Full-fidelity endpoint telemetry — no sensor-level filtering — All endpoint events transmitted to the Cortex Data Lake without pre-filtering or sensor-level down-selection, preserving the complete event record for retroactive investigation and threat hunting.
- Network-to-endpoint attack chain reconstruction — Natively ingests NGFW, Prisma Access, and Cortex Cloud telemetry without connectors, reconstructing the full kill chain from network packet to endpoint execution in a single incident timeline. particularly relevant to environments using Palo Alto Networks infrastructure.
- XQL unified query language with network-inclusive schema — One query language spans endpoint, NGFW, cloud, and identity telemetry — including network-layer data — converting directly to detection rules, prevention policies, and dashboards in a single schema.

Response & Recovery

- Cross-platform registry removal and system state restoration — Programmatic removal of malicious registry keys and file restoration to a pre-infection baseline on Windows and macOS, executable individually or in bulk across the fleet.
- Integrated live terminal with Python across all supported OS — Persistent interactive CMD, PowerShell, Shell, and Python sessions on Windows, macOS, and Linux from a single console — consistent capability parity across all supported OS without switching tools.
- Built-in automation library with native agentic execution — Over 800 OOTB response playbooks are embedded directly in Cortex XDR — no separate SOAR platform required — covering third-party integrations, enrichment, and remediation actions out of the box. AI agents built into the platform autonomously triage alerts, invoke the relevant playbooks, and execute containment workflows with configurable human-in-the-loop approval and full audit trails. The combination of content depth and autonomous execution is native to the platform.

Product Features

In this section, we provide an overview of the products' features and the associated services provided by their respective vendors. Please note that in each case, these refer only to the specific product, tier and configuration used in our test. A different product/tier from the same vendor may have a different feature set. On the following pages we describe the General features, Product Response, Management and Reporting, IOC Integration features, Support features and then provide a feature list showing which products support these features.

General features

This section looks at general features such as phishing protection, web access control, device control, interface languages, and supported operating systems.

Product Response Mechanism

EPR products will use their response mechanisms to deal with the intrusions that have occurred inside the protected environment. At a minimum, an EPR product is expected to allow the correlation of endpoints, processes and network communications, as well as the correlation of external IOCs with the internal environment. EDR capabilities were tested and examined by using the detection and response capabilities of the product. We were able to examine the events that correlated with the various steps that attacker took while attempting to breach the environment.

The EPR product should enable complete visibility of the malicious artifacts/operations that make up the attack chain, making any response-based activities easy to complete. This means that where any form of intended remediation mechanism is available in the product (Response Enablement), this mechanism is shown below. Please note that the capabilities shown below only apply to the specific product/version used in this test. A vendor might offer additional features as an add-on or in another product.

Central Management and Reporting

Management workflow is a top differentiator for enterprise security products. If a product is difficult to manage, it will not be used efficiently. The intuitiveness of a product's management interface is a good determiner of how useful the product will be. Minutes saved per activity can translate into days and even weeks over the course of a year.

Management: Threat Visibility, System Visibility, and Data Sharing

The ability to provide threat context is a key component of an EPR product. This visibility can be critical when organizations are deciding whether to either supplement an existing technology or replace it. The management console can be deployed as physical appliance, virtual appliance, or cloud-based appliance. A full trail of audit logs is available in the management console. Communication between the agent and management console is done via SSL. The following tables provide information on the applicable capabilities of each of the tested products.

EPR Product Reporting Capabilities

An EPR platform should have the ability to unify data, bring together information from disparate sources, and present it all within its own UI as a coherent picture of the situation. Technical integration with the operating system and third-party applications (Syslog, Splunk, SIEM or via API) is an important part of this. An EPR system should be able to offer response options appropriate to the organization.

IOC Integration

This is to identify the digital footprint by means of which the malicious activity on an endpoint/network can be identified. We will examine this use case by looking at the EPR product's ability to use external IOCs including Yara signatures or threat intelligence feeds etc. as shown in the table below.

Support features

Free, basic human support for deployment: this means real-time communication with a member of the support staff, who will talk you through the deployment process and can provide immediate answers to any basic questions you have. Of course, many vendors will provide user manuals, videos and premium (paid-for) deployment support services instead/in addition.

Professionally assisted training: this includes any form of interactive training with an instructor. A few vendors include professional training as part of the license fee paid for 5,000 clients, while others charge additionally for it. Some other vendors might only offer videos and other online material for self-training.

Feature List

Below you can find the list of features. Please note that this only applies to the test product and version (9.1).

Feature List	
Product Name	Cortex XDR Prevent
Version Number	9.1
Supported languages - endpoint client	English, German, Japanese, Spanish, French, Chinese
Supported languages - management console	English
Product Features for 5,000 endpoints (included in the given list price)	
Do you also offer a managed version (MDR) of the tested product in your portfolio?	✓
Is Incident Response service included?	☐
Are Incident Response services available in general (which can be purchased separately)	✓
General Features	
Third-party scan engine used (in addition to its own)	proprietary
2-factor authentication	optional
Phishing protection for web browsers	☐
Web access control	✓
External device control	✓
Sandbox feature	✓
Right-click on-demand scan	✓
Lock settings	✓
Lock uninstalling	✓
Supported Operating Systems	
Microsoft Windows	
↳Windows 10	✓
↳Windows 11	✓
Virtual environments (such as VMware, HyperV)	✓
Apple macOS	✓
Linux	✓
Google Android	✓
Apple iOS	✓
Response Actions	
Guided Response Available	✓
Quarantine	✓
Delete Files and Directories	✓
Process Termination	✓
Shutdown or Reboot of Endpoint	✓
Edit Registry Keys and Values	✓
Network Isolation	✓
User Isolation	☐
Execution Prevention	✓
Block Processes from Communication	✓
Uninstall Services	✓
Start Services	✓
Stop Services	✓
Pause Services	✓

Resume Services	✓
Delete Services	✓
Modify startup type of Service	✓
Patching	✓
System Restoration	✓
System Imaging	☐
Reporting Features	
Attack Visualization	✓
Attack Context	✓
Attack Timeline	✓
Continuous Monitoring	✓
Behaviour Monitoring (File/registry/etc..)	✓
Whitelisting capability	✓
Running applications & process	✓
Endpoint Forensics	
Get process list	✓
Get file list	✓
Get file	✓
Get autorun points	✓
Get registry key	✓
Get process memory dump	✓
Get full memory dump	✓
Get NTFS service files	✓
Data Sharing Features	
Customizable default security policies	✓
Customized reporting and management	✓
Custom reporting and filtering	✓
Report automation	✓
Standard output format (JSON, Syslog, CEF, etc..)	✓
Are SIEM / 3rd party Log Managers supported	✓
Automated data export	✓
Policy and/or signature rollback	✓
System scanning capability	✓
Standards-based application programming interface (API) for access	✓
Disaster Recovery	✓
Audit trail support in the management console	✓
Multiple EPR system-administrator/user-focused workflow support	✓
Built-in-reporting capabilities for different user categories	✓
Can users create customizable dashboards for monitoring?	✓
Enterprise recording and data storage –forensic analysis	✓
Management to agent encryption	✓
Encryption of data at rest	✓
Cloud marketplace support	✓
Compliance reports (GDPR, PCI-DSS, etc.)	✓

External Data Correlation	
Threat Intelligence data assimilation	✓
Are there APIs available for integration with other systems?	✓
Proprietary product integration (NGFW, IPS, ...)	✓
YARA Signatures	✓
Support of IoC upload	✓
Sandboxing logs	✓
Scan results	✓
Retrospective analysis and logs	✓
Endpoint prevention product logs	✓
Multi-factor authentication logs	✓
Network traffic flow logs	✓
DNS Logs	✓
DHCP Logs	✓
EDR Features	
Does the solution offer remote control capabilities for endpoints?	✓
Are there built-in tools for incident response?	✓
Are memory forensics included to analyse volatile data?	☐
Additional Security Features	
Does it analyse user behaviour to identify potential security incidents (adaptive anomaly detection)?	✓
Are there DLP features to prevent unauthorized data exfiltration?	✓
Does it leverage AI for threat detection and response?	✓
Does the product include remote browser isolation (RBI) to prevent web-based threats?	☐
Support	
Is free, basic, human support for the deployment process included in the licence for 5,000 endpoints?	✓
Assisted training for the IT staff in portfolio	✓
Supported languages of support	English

Overview of EDR technologies

In the dynamic field of cybersecurity, IT security professionals need a deep understanding of antivirus (AV/EPP) and endpoint detection and response (EDR) systems, which are crucial for comprehensive defence strategies. One key aspect is understanding how different AV and EDR systems implement essential technologies[5]. The following information offers a high-level overview of these technologies, highlighting their importance in the ever-changing cybersecurity landscape. These technologies encompass the Antimalware Scan Interface (AMSI), User-Mode Hooking, Callbacks, and Kernel Drivers.

1. **Antimalware Scan Interface (AMSI):** AMSI in Windows is an API set designed for enhanced malware detection. Integrated into components such as PowerShell, Windows Script Host, and .NET, it intercepts scripts post-deobfuscation at runtime. AMSI communicates directly with the system's antimalware solution, forwarding content for analysis. As an interface, it's agnostic to the specific antimalware vendor. Its integration ensures real-time threat detection, even for dynamically executed content.
2. **User-Mode Hooking:** User-mode hooking intercepts function calls in application-level processes in Windows. By overwriting a function's start, calls are redirected to a custom function. For instance, an EDR might hook `CreateFileW` in kernel32.dll, redirecting it to its own DLL. When an application uses `CreateFileW`, it's first processed by the EDR's function, allowing real-time monitoring or restrictions before proceeding with the original call.
3. **Kernel Callback Routines:** EPP/EDR solutions leverage kernel callback routines for deep system monitoring. These routines notify registered callbacks when specific OS events occur. By tapping into these events, EPPs/EDRs observe real-time system behaviour. For instance, an EPP/EDR might monitor process creation events. When a new process starts, the callback inspects its details and origin. This allows the EPP/EDR to quickly detect, assess, and respond to potential threats.
4. **Kernel Drivers:** EPP/EDR solutions employ kernel drivers to deeply integrate with the operating system for advanced threat mitigation. Minifilter drivers, part of the Windows Filter Manager, allow EPP/EDR tools to monitor, modify, or block operations on files and data streams. This is crucial for real-time scanning and access restrictions. ELAM (Early Launch Anti-Malware) drivers, on the other hand, start early during the boot process, ensuring that only legitimate, signed drivers are loaded, thereby preventing rootkits or bootkits from compromising the system. Collectively, these drivers ensure comprehensive protection from boot-up to system operation.

This information equips IT security professionals with valuable insights for making informed decisions about cybersecurity solutions. Whether you need a comprehensive understanding or a quick reference, these insights empower you to navigate the complex world of IT security effectively.

It's important to note that these are just some of the technologies employed in modern cybersecurity, and others may also be included in the arsenal of IT security professionals. The absence or presence of a certain technology does not necessarily mean that a product is worse or better. The effectiveness of a cybersecurity strategy depends on its holistic approach and adaptability to evolving threats. The listed data was verified and provided by the vendors.

[5] https://kwcsec.gitbook.io/the-red-team-handbook/techniques/defense-evasion/basics/iocs/high-level-overview-of-edr-technologies

EDR Technology	Palo Alto Networks
Antimalware Scan Interface (AMSI) - This is a standard interface that allows applications and services to integrate with any antimalware product present on a machine.	●
Event Tracing for Windows (ETW) - This is a mechanism for tracing and logging events that are raised by both user-mode applications and kernel-mode drivers.	●
Microsoft Threat Intelligence (EtwTi) - This is a mechanism for tracing and logging events using Microsoft Threat Intelligence.	●
User Space API-Hooking - This is a technique used to intercept API function calls in user space. This can be used by EPP/EDR solutions to monitor and potentially block suspicious behaviour.	●
Kernel Space API-Hooking - Like user space API hooking, but this intercepts API function calls in the kernel space.	●
Kernel Callback Routines - These are functions that the kernel calls when certain events or conditions occur. EPP/EDR solutions can use these to monitor system events.	●
Filter Driver - This is a type of driver used to monitor and potentially modify the behaviour of device drivers. EPP/EDR solutions may use this to monitor for suspicious device behaviour.	●
Minifilter Driver - This is a specific type of filter driver that can be used to monitor and potentially modify the behaviour of file system operations.	●
Early Launch Antimalware (ELAM) Driver - This is a driver that starts early in the boot process to scan drivers for malware before they're loaded.	●
Firmware Protection Driver - This is a driver that protects the system's firmware from modification. EPP/EDR solutions may use this to prevent malware from modifying the firmware.	●
Hardware Breakpoints - These are CPU functions that pause program execution when specific memory locations are accessed or modified. Used, for example, to trigger a registered VEH.	○
PEB Manipulation - This involves modifying the Process Environment Block (PEB), more specifically double linked lists within the PEB, e.g. InLoadOrderModuleList, to manipulate the order in which DLLs are loaded, for example.	○
Vectored Exception Handling - The product registers its own Vectored Exception Handler (VEH) to handle specific exceptions and take control (avoiding handling by the SEH), such as when a specific guard page flag or hardware breakpoint is triggered.	○
Call Stack Analysis User Mode - This involves examining the call stack of a running application to trace function calls and debug execution flow.	●

Palo Alto Networks Product Configurations and Settings

In business environments, and with business products in general, it is usual for products to be configured by the system administrator, in accordance with vendor's guidelines. Therefore, we asked vendors to request us to implement any changes they wanted to the default configuration of their respective products. Results presented in this test were only accomplished by applying the respective product configurations as described here.

The configurations were applied together with the engineers of the respective vendors during setup. This configuration is typical in enterprises, which have their own teams of security staff looking after their defences. It is common for products of this kind that vendor experts assist companies on the deployment and configuration best suited for the type of enterprise.

Below we have listed relevant non-default settings (i.e. settings used by the vendor for this test).

paloalto "XDR Prevent Endpoints", "Dynamic Driver Protection", "Unpatched Vulnerabilities Protection" and "On-Write File Examination" were fully enabled. Under "Malware Profile", "Portable Executable and DLL examination", "JScript File Examination", "ASP & ASPX Files", "PowerShell Script Files", VB Scripts Examination" and "Ransomware Protection" were set to "Quarantine".

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