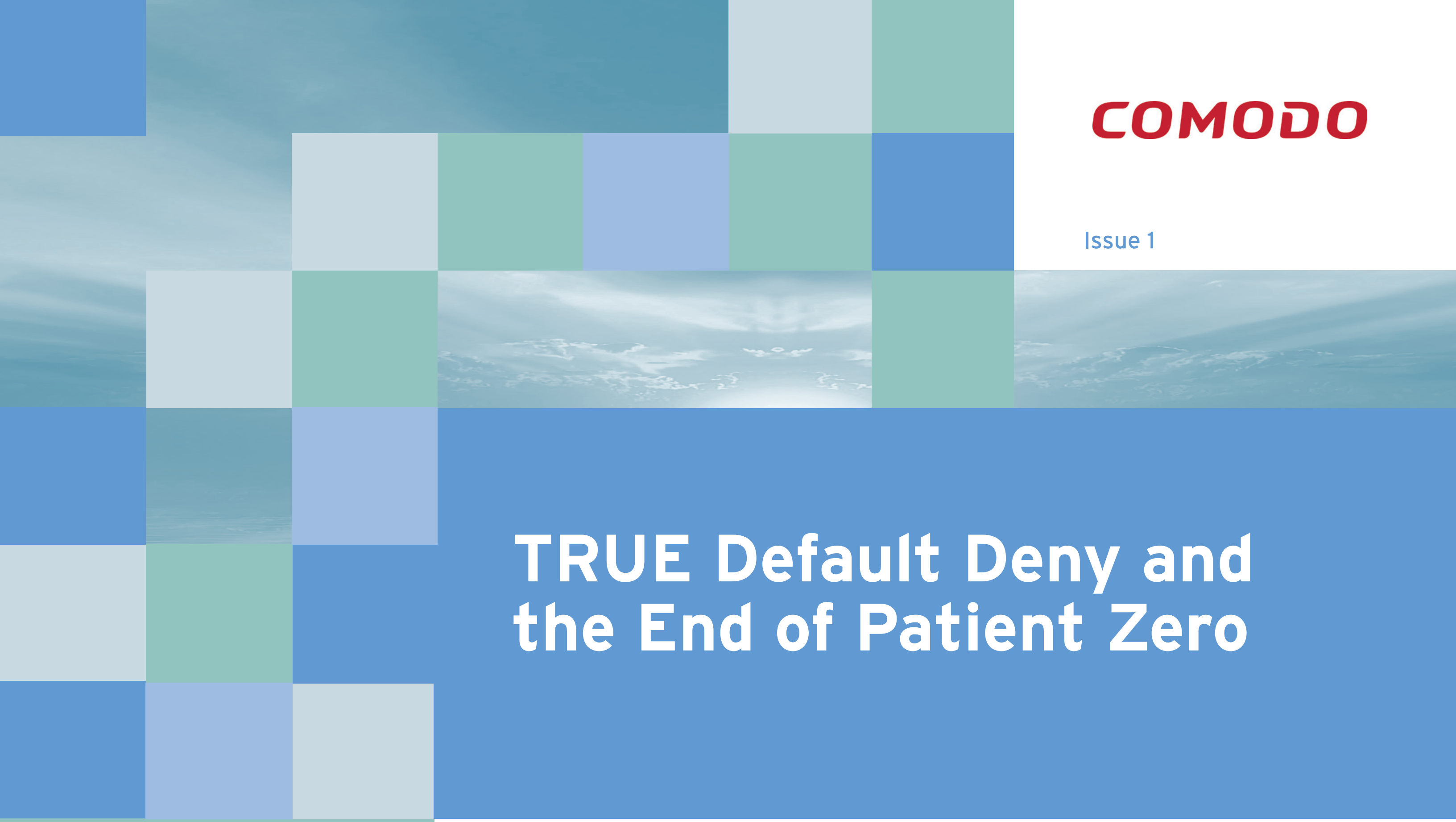

Issue 1

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The cybersecurity landscape is constantly changing. New threats and technologies are being developed and implemented at a blistering pace. And for those tasked with making critical decisions about information security and e-commerce for businesses and their customers, the stakes have never been higher. Yet despite sustained and significant investments in IT security solutions, the rolling thunder of breach disclosures and thriving cybercrime markets for stolen data in every sector are stark reminders that much hard work remains to be done.

Gartner Research Inc. states it bluntly in its latest 2016 research on endpoint protection platforms (EPPs). "When 44% of reference customers for EPP solutions have been successfully compromised, it is clear that the industry is failing in its primary goal: blocking malicious infections."[1]

The hard fact is that most breaches start with endpoints compromised by malware. Like the proverbial crack in the dam, hackers relentlessly attack to widen the smallest leak gleaned from an email, login or social media account until it is, for all intents and purposes, game over.

Unfortunately, customers, partners and employees are generally soft targets. According to the 2015 Verizon Data Breach Investigations Report[2], despite years of education efforts, 23% of recipients still open phishing messages and 11% click on unknown attachments. Further, the window to protect users from new threats is extremely short. Verizon's data showed that nearly 50% of users open emails and click on phishing links within an hour of receiving them.

[1] Firstbrook, Peter and Ouellet, Eric. "Magic Quadrant for Endpoint Protection Platforms."(February 1, 2016): Gartner Research Inc., 28.

[2] "Verizon 2015 Data Breach Investigations Report," (2015) Verizon Inc. Web.

Today, most endpoint protection is still based on an increasingly antiquated Default Allow approach, meaning that only applications or executables that are known to be bad are blocked from running. This is easy enough for hackers to overcome by creating new attacks, usually slight variants of existing malware, in overwhelming numbers using automated tools. These 'brand new' variants, not yet on any blacklist, pass through most endpoint protection and are thus allowed to wreak whatever havoc they've been designed to do.

All of these facts help explain why the current endpoint protection approaches are failing.

The good news, however, is that we've arrived at a major deflection point in the fight against the most potent weapon in the hacker's arsenal – endpoint malware.

New containment technology makes it both not only possible but also practical to implement a Default Deny security platform. This is a rare, transformational opportunity for organizations of any size.

In sharp contrast to the Default Allow approach, the true Default Deny Platform blocks all known malware and only allows known and trusted applications or executables through to run unchecked on the endpoint. All unknown or untrusted applications or executables are automatically wrapped in an isolated container which allows them to run (thus saving user productivity) but at the same time prevents any malware from gaining the access it needs to harm either the endpoint or its network, effectively blocking all new zero day threats and APTs.

Achieving this Default Deny approach requires further innovations in two emerging endpoint protection concepts identified by Gartner analysts in its report, "A Buyer's Guide to Endpoint Protection Platforms."[3] A copy of this research is included in this briefing document for your reference.

First, the Gartner analysts identified an emerging malware protection technique called Application Control and explained how it creates the opportunity for Default Deny:

> "Application Control describes the ability to restrict application execution to a list of known and trusted applications. The 'trusted application' list can be as restrictive as the applications already installed (aka lockdown) or as loose as the known universe of cataloged trusted applications – or anything in between. Application control shifts the paradigm from 'default allow' (allowing all applications as long as they are not known malware) to 'Default Deny' (not allowing any applications to run unfettered unless their providence and reputation are known) thereby automatically blocking new or targeted malware."[4]

The analysts note that making Default Deny a reality using application control at the endpoint, however, raises many questions. How do security vendors establish what to trust? How are unknown or untrusted applications prevented from executing? And how are unknown applications automatically evaluated?

Early Default Deny attempts tried to achieve isolation by putting entire applications into virtual machines. This approach proved impractical, however, due to the heavy impact on user productivity and high demands on endpoint resources that hijacked CPUs and crushed performance.

But what truly marks this moment as a turning point in the fight against cybercrime is that, for the first time, the Default Deny approach can be made practical at the endpoint using new, lightweight virtualization technology called containers, explained further in this paper.

[3] Firstbrook, Peter and Ouellet, Eric. "A Buyer's Guide to Endpoint Protection Platforms." (January 29, 2015): Gartner Research Inc. Copy attached.
[4] Firstbrook and Ouellet, "Buyer's Guide." 5-6.

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Using containment at the endpoint is the key breakthrough making it possible to implement a Default Deny Platform without impacting user productivity or taxing endpoint computing resources.

Of course, there is no single silver bullet, and effective endpoint protection requires integration with a multi-layered IT security stack. Fortunately, the same Default Deny technologies can be applied to every layer, making the entire security ecosystem exponentially more capable of stopping unknown attacks.

The disruptive effect of this advance cannot be overstated. We are poised on the threshold of a new era of unprecedented effectiveness in blocking malware and all cyberthreats at the endpoint, inside the infrastructure, and at the network boundary.

Containment Breakthrough Leads to Default Deny Protection

From breach disclosures to news headlines, to industry research, it's all too clear that current endpoint protection platforms are failing, and on a large scale.

The many reasons why can be summarized into one overarching weakness: most current solutions have Default Allow architectures that fail to stop applications and executables that contain new, unknown threats.

Put another way, the sad fact is that malware signatures still rule as the de facto standard for security. As a result, most enterprise endpoints today rely on an increasingly archaic and overmatched Default Allow policy, meaning if an application or executable is not known to be bad, it's allowed to run.

Gartner estimates that signature based malware engines are only 30% accurate at detecting new threats.[5] And with inexpensive and readily available malware toolkits that can spew out unique new zero day attacks with unknown signatures in the tens of thousands every day with minimal effort … well, you start to understand why we're still seeing so many patient zeros.

Some years ago, malware sandboxing – a technology that opens every email attachment or executable in an isolated virtual machine to see what happens – emerged as a new hope. While sandboxing clearly helped, five years later it remains primarily a centralized resource used to reduce the vulnerability window. Every email, attachment and executable coming in a phishing or spam email is sent to a sandbox for evaluation. This is inefficient to say the least, draining much needed CPU resources while achieving dubious ROI.

The problem is that in order to maintain user productivity, this sandboxing evaluation has to be done in parallel to the presentation of the unknown files to end users. In essence, this is a default allow approach. The result is that while the gap between malware birth to detection and remediation shrinks, it is not eliminated. The zero day threat remains. And patient zero keeps occurring.

Meanwhile, hackers are laughing all the way to the bank. Literally. And to hospitals, and large enterprises. Their automatic malware tools are creating new unknown malware variants with minimal effort at a simply overwhelming rate.

Early attempts to evolve sandboxing to provide application control and block execution of everything unknown at the endpoint have met with disappointing results, but for different reasons.

First generation endpoint sandboxing relied on traditional virtualization technology that isolated entire applications in separate virtual machines. In practice, this approach proved far too resource intensive. Traditional virtualization requires that each isolated application run in its own virtual machine, complete with its own full copy of the operating system and its partition of the endpoint hardware. With so much computational overhead, this approach to endpoint sandboxing crushed desktop performance.

Recent advances in virtualization technology in the form of lightweight containers, however, have created the opportunity to solve these problems and introduce the next generation of endpoint protection.

Containment is the key technology that enables three emerging endpoint protection techniques identified by Gartner analysts to come together into a new combination that re-defines the category. The first is what they call "full software attestation," which involves classifying all running processes as good, bad or unknown. The second is application control and the associated paradigm shift from default allow to Default Deny. And the third is unknown file sandboxing at the endpoint.[6]

One important advantage is that containers require much less computing resources than traditional virtualization, so malware sandboxing can be efficiently implemented at the endpoint without negatively impacting user experience, productivity, CPU resources or IT budget.

[5] Firstbrook and Ouellet, "Buyer's Guide." 3.
[6] Firstbrook and Ouellet, "Buyer's Guide." 37.

Even more importantly, container technology makes it possible to safely contain unknown executables at the process level instead of at the entire application level. For example, you can be running a trusted Web browser outside of a container, but if suddenly an unknown plugin tries to execute, it will automatically be isolated in a container until a trust verdict is made. This not only improves performance, it also enables the combination of what Gartner calls full software attestation with application control, so that only trusted executables are allowed to run normally.

Taken together, these advanced techniques make it possible to evolve from today's Default Allow approach that leaves endpoints vulnerable, to a Default Deny Platform that can stop even unknown threats. In a Default Deny Platform, any unknown process or executable that is not known good or known bad is considered unknown, and automatically contained. This results in limited access to what may be unknown good, while preventing unknown malware the resources it needs to infect the endpoint and give attackers a 'pivot' point for network breach.

In their endpoint protection research, Gartner's analysts provide an excellent checklist of points to investigate when evaluating solutions for Application Control and Default Deny.[7] For example, keeping users maximally productive also requires that unknown files and executables are quickly evaluated and added to the whitelist so they can be moved out of the container as soon as possible, or to the blacklist, and deleted from the environment. This implies that other essential elements to a Default Deny Platform include ways to effectively evaluate and manage trust as well as to rapidly create a trust verdict on anything unknown that goes into containment. It's essential that these and many other capabilities be included to implement a fully effective Default Deny endpoint protection solution.

Yes, the next real IT security breakthrough is at hand. Using lightweight but robust containment makes it possible to move to a Default Deny Platform that for the first time can effectively block all new and unknown threats such as zero day malware and APTs.

Comodo Advanced Endpoint Protection Blocks Zero Day Attacks and Unknown Malware

Comodo's new Advanced Endpoint Protection represents the vanguard of next generation solutions that mark a major milestone in the fight against endpoint malware.

In its Endpoint Protection Buyer's Guide, the Gartner analysts' top recommendation is, "Give primary consideration to the malware effectiveness of a solution and the breadth and depth of non-signature based techniques used, especially application control, malware sandboxing, vulnerability detection and full software attestation."[8]

Built upon a layered Default Deny Platform, Comodo Advanced Endpoint Protection completely fulfills this recommendation. It uses advanced proprietary containment technology to combine application control, malware sandboxing and full software attestation in a novel approach that effectively blocks and isolates unknown, zero day attacks threats such as Cryptolocker, Cryptowall, SamSam, and TeslaCrypt style Ransomware, as well as newly emerging 'Fileless' malware such as Powerware. Comodo renders those attacks useless against its protected endpoints and networks.

Comodo Advanced Endpoint Protection is comprised of Comodo Client, which includes antivirus, firewall, Web URL filtering, host intrusion prevention, containment and file reputation, and Comodo IT and Security Manager (ITSM). ITSM allows for the configuration of the security policies and visibility into the security infrastructure of enterprise endpoints through solutions such as Mobile Device Management and Remote Monitoring and Management. Modular, lightweight and supported on virtually all Windows systems and servers, the Comodo Client requires no specialized hardware and also includes a full endpoint protection (EPP) suite with host firewall, IPS and more while ITSM provides tightly integrated MDM, MAM and MSM, as well as Remote Monitoring and Management (RMM), and Patch Management at no additional cost.

Gartner states that providing a fast way to make a trust verdict on unknown executables is an essential component of a Default Deny application control solution.[9] Comodo Advanced Endpoint Protection achieves this and ensures the highest usability through two layers of Specialized Threat Analysis and Protection (STAP), implementing VirusScope on premises and Comodo Valkyrie in the cloud to assess all unknown files through static, dynamic and, if needed, human analysis, leading to a verdict, on average, within 45 seconds - five to ten times faster than competing solutions. The unknown then becomes known to all Comodo users and won't need to be contained again. As such, Comodo AEP keeps files in containment for the shortest amount of time of any vendor in the industry.

Traditional attempts to isolate malware at the endpoint use Default Allow thinking and virtualization or sandboxing technologies that are too resource intensive and crush endpoint performance. Comodo's approach is completely different. Applying its patent pending containment technology to fight the malware problem allows all

[7] Firstbrook and Ouellet, "Buyer's Guide." 6.
[8] Firstbrook and Ouellet, "Buyer's Guide." 1.
[9] Firstbrook and Ouellet, "Buyer's Guide." 6.

unknown executables – good or bad – to operate in a safe container. Comodo then rapidly analyzes each executable and either allows it to pass (if good) out of containment or kills it (if bad), so performance isn't impacted and, most importantly, the endpoint and network always remain protected and secure.

How Comodo Solves the Malware Problem

Comodo's Default Deny Platform emphasizes allowing known good applications while denying everything else free reign to client's endpoints until a verdict on those unknowns is reached. In order to execute on this strategy, identifying known good and known bad applications becomes critical. As the largest certificate authority in the world[10], Comodo is uniquely positioned to identify known good signed applications and application publishers (whitelisting) while Comodo's installed base of over 85 million users provides the Comodo Threat Research Labs (CTRL) with one of the largest caches of known bad files (blacklisting). Gartner identifies the size and quality of the catalog of known "good" applications and the capability to automatically allow sources of trusted certificates as essential features of application control[11]. All unknown files are automatically run in containment, while an accelerated verdict is reached, both increasing usability and protecting the endpoint from being compromised. Additionally, Comodo's global product development and malware research team has security professionals working 24x7x365 worldwide to ensure that unknown files are rapidly identified and integrated onto their whitelist if judged good, or deleted and added to their blacklist before they are able to cause any damage elsewhere in the Comodo ecosystem.

The Engineering Behind Comodo Advanced Endpoint Protection

Automatic Containment

IT teams implementing Comodo AEP can be confident knowing that only safe applications will be running on their network with Comodo's automated containment technology built on the company's Default Deny Platform. As endpoint users introduce new unknown and possibly malicious applications externally from their devices, those unknown applications are forced to run in containment, never risking infection, or compromising corporate data, and never impacting performance. Comodo's automated containment technology is extremely lightweight, has no CPU dependencies, and is application agnostic, unlike other containment solutions in the market.

Behavioral Analysis

Through Comodo's technology, unknown software applications quickly move to a verdict of known good or known bad with Comodo's local and cloud based Specialized Threat Analysis and Protection (STAP) engine utilizing a combination of static, dynamic and human analysis. Comodo's local STAP layer, VirusScope, first analyzes application behavior and actions running inside or outside of containment, and leverages multiple techniques to determine any malicious intent. Valkyrie, Comodo's cloud based STAP layer, correlates VirusScope's local view of the file's activity with a global view and can pass particularly stubborn unknowns to advanced human analysis if needed for a final verdict. This reduces both false positives and false negatives and provides an accelerated verdict of malware at the endpoint. The result is that unknown files stay in containment for the shortest time of any solution on the market.

Application Visibility and Control

IT Directors and System Administrators can gain enterprise visibility and control into what applications users are installing across Windows enabled endpoints with the new device management capabilities built into Comodo ITSM. This allows customers to set mobile application policies based on groups such as productivity apps, utility apps, and gaming apps. Applications can also be permitted, blocked or allowed to run inside a secure container, and productivity can also be increased by allowing non-critical business applications to run only during a specific time or day. ITSM ensures the security of corporate data through comprehensive application management.

Through application visibility and control, automatic containment, and behavioral analysis, Comodo solves the malware problem, keeping endpoints and networks infection free for businesses of any size.

Other Features of Comodo Advanced Endpoint Protection

Some of the new and improved features in Comodo Advanced Endpoint Protection include:

- ✓ Patent pending Automated Containment, enabling usability while preventing unknown, zero day and APT malware
- ✓ Comodo VirusScope AI/Machine Learning, providing a local verdict of unknowns
- ✓ Comodo Valkyrie, a verdict driven malware analysis platform, that provides an Accelerated Verdict using static, dynamic and expert human analysis in seconds

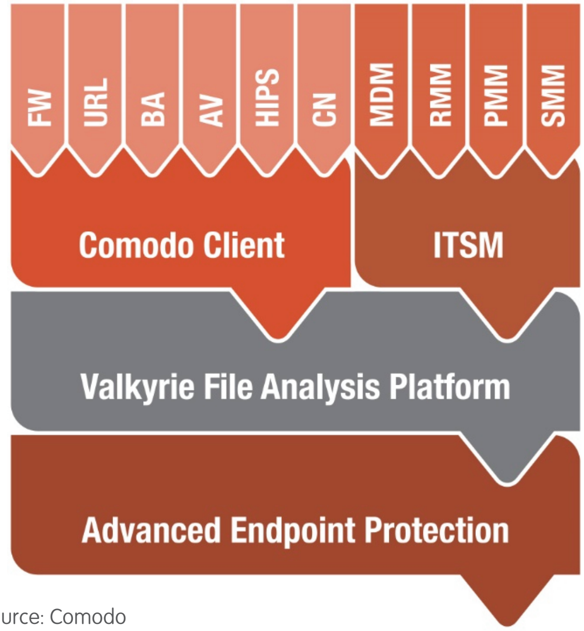
[10] "Market share trends for SSL certificate authorities for websites." W3Techs.com. Feb. 15, 2016. http://w3techs.com/technologies/history_overview/ssl_certificate.
[11] Firstbrook and Ouellet, "Buyer's Guide." 6.

- ✓ Comprehensive Device and Security management for Windows desktops and servers, iOS, Android, OS X and Linux desktops and servers
- ✓ Enterprise wide, real time visibility into all unknowns automatically contained and their status, as well as quarantined malware, trusted applications and more
- ✓ Tightly integrated device management, application management and device security
- ✓ Remote Monitoring and Management (RMM), with full device takeover capability
- ✓ Patch Management and vulnerability management
- ✓ Enterprise wide quick, full and removable media scans for malware
- ✓ Cloud based, unified IT and security management, provisioned in about one minute
- ✓ Complete suite of endpoint protection (EPP) such as Host firewall, HIPS, Web URL filtering, file reputation, certificate-based whitelisting, persistent VPN and BYOD at no additional charge

Comodo Advanced Endpoint Protection is now available. Contact sales@comodo.com or visit us online for more information at https://www.enterprise.comodo.com/.

FIGURE 1

The Technolgies and Platform That Make Up Comodo Advanced Endpoint Protection



Source: Comodo

Source: Comodo

Research from Gartner

A Buyer's Guide to Endpoint Protection Platforms

Endpoint protection platforms offer a diverse array of features. This guide lists the most advanced features to help buyers differentiate solutions.

Key Findings

- A wide array of endpoint protection platform (EPP) solutions are available with significant differentiation among vendors. No single vendor leads in all functional areas, so buyers need to prioritize their requirements to address the needs of their specific business, technical and regulatory environments.

Recommendations

- Give primary consideration to the malware effectiveness of a solution and the breadth and depth of non-signature-based techniques used, especially application control, malware sandboxing, vulnerability detection and full software attestation.

- Look for vendors that are investing in endpoint detection and remediation tools that have high value in detecting stealthy attacks and recovering from incidents.

- Seek out vendors that are expanding management capability and protection to alternative platforms such as Mac, Linux, virtual desktops/servers, tablets and mobile devices.

- Consider the needs of data protection when considering endpoint protection. Encryption and data loss prevention (DLP) are core functions for data protection and often provided by endpoint protection vendors. The ability to simplify client-side agents with a common management framework is an advantage, but broader enterprise DLP and encryption requirements could outweigh these advantages.

- Resist vendor packaging that includes gateway protection with endpoint protection unless there is a clear link between these products that improves overall security effectiveness. Focus on client and server as one domain and gateways as a separate domain. Resource-constrained small and midsize businesses (SMBs) may want to consider the advantages of centralized management of both domains, but must put a higher priority on the unique requirements of each domain.

Analysis

The most fundamental component of EPP suites is a collection of technical features to prevent malware infection. These tools typically include antivirus, anti-spyware, rootkit detection, host-based intrusion prevention, memory protection, behavior monitoring, port/device protection and a personal firewall. Advanced EPP suites may also include application control, and malware sandboxing capability to restrict applications to known or tested applications. The demanding management needs of large enterprises and the desire to proactively reduce the attack surface are also forcing EPP suites to replicate some PC operations infrastructure, such as security configuration management, patching and vulnerability management. Advanced solutions are starting to add capabilities to perform more ad hoc investigations. EPP vendors also offer data protection technologies, such as DLP and encryption.

As the form factor of endpoints expands beyond the traditional Wintel machines to virtual servers and desktops, tablets, Mac and mobile devices, the need to provide appropriate security utilities for these diverse operating systems is expanding.

By combining multiple technologies into a single management framework, EPPs have the promise of increasing security, while lowering complexity, cost and administrative overhead. More Integrated systems will also enable the conveyance of context from between different elements in the suite providing better security.

Organizations should initially evaluate their needs across five critical capabilities:

1 Malware effectiveness – Does the solution have full security life cycle capabilities from hardening and isolation techniques to detecting and recovering from malware incidents?

2 Manageability – How adequate is the management capability for the organization? Smaller organizations may be looking for simple set-and-forget functionality with limited options, while larger organizations may be looking for more complete capability that will be more agile.

3 Solution completeness – Does the candidate solution have the appropriate components and endpoint and server platform coverage to satisfy current and future needs?

4 Support and service – What is the ability of the vendor to provide the adequate level of support?

5 Strategic vendor status – What is the vendor's ability to service other security needs to reduce vendor management and provide future opportunities for integration and cost savings?

The major functionality components of EPP suites are listed below, with a review of the advanced capabilities of each. Organizations should use these features to build RFPs and/or scorecards to differentiate products under evaluation. No product will have all these features, so buyers must focus on features they deem valuable for their enterprise. This list is not intended to be comprehensive. It is intended to be representative of advanced functions which, when investigated, will help identify more-sophisticated solutions.

Malware Detection

As the anchor solution in EPP suites, the quality of the malware scan engine should be a major consideration in any RFP. The ability of most organizations to accurately test malware engines in real-world situations is limited at best. Moreover, none of the signature-based malware engines are ever 100% effective at detecting known threats, and accuracy at detecting new threats is only 30%. Low distribution/targeted threats are even more elusive to signature techniques:

- Test results from organizations such as AV-Comparitives.org, and AV-Test Institute are useful guides on malware detection accuracy, false positives rates and scanning speeds. In the absence of other information, good test scores are better than poor results, but buyers should beware that sample malware used in tests may not accurately reflect malware encountered in the real world, and do not test all proactive techniques for blocking malware. Such application control, vulnerability detection and configuration management and solutions are tested with out-of-the-box configurations.

- Traditional antivirus systems only classify "known bad." An emerging technique we call "full software attestation" provides a classification of the entire process inventory. That is, it classifies all running processes as "good" or "bad" and provides metadata about the applications such as author, function, malware traits and prevalence. This is a valuable service because it removes the lingering doubt that an unknown malicious file is lurking on the system, by inspecting and reporting on all executable files.

- Real-time, cloud-based look-up mechanisms should provide extensive two-way communications that share computing objects, such as files and URLs, and include metadata about these objects to improve the ability to detect and respond to new events. Vendors that offer real-time cloud-based interactions are better positioned to spot new trends and respond quicker than vendors that rely on traditional one-way database synchronization schemes.

- The capability to detect rootkits and other low-level malware once they are resident is a significant consideration. Some solutions are limited to catching only known rootkits as they install, while others have the ability to inspect raw PC resources seeking discrepancies that will indicate the presence of rootkits.

- As more malware shifts to Web distribution methods, EPP solutions should include client-based URL filtering to block clients from visiting websites that are security risks.

Advanced Malware Protection

As previously mentioned, antivirus/anti-spyware databases are 90% to 99% effective at detecting well-known, widely circulating threats. However, they are only 20% to 50% effective at detecting new or low-volume threats. Security effectiveness is significantly enhanced by non-signature-based techniques, collectively categorized as host-based intrusion prevention systems (HIPSs), but there is no generally accepted method of testing the HIPS effectiveness of different solutions:

- HIPS techniques have no standard terminology. Consequently, it is essential for buyers to ask vendors to list and describe HIPS techniques so they can normalize the list of techniques and compare the breadth and depth of HIPS techniques across vendors. Buyers should also understand which techniques are included in the base client and those that are optional, and what, if any, additional charges are required for additional HIPS techniques. Vendors are adept at spinning minor HIPS techniques into invincible solutions. Buyers must pressure vendors to provide statistical information to illustrate the frequency at which these techniques detect unknown malware.

- Memory protection to prevent malicious code injection to common process is a critical HIPS technique. Buyers must press vendors to explain which types of memory injection attack are blocked and what application are protected from such attacks.

- Malware engines should also continuously monitor file objects and system resources for changes that might indicate the presence of suspicious code. Increasingly, malware solutions will store this history to perform retrospective malware encounter analysis and for malware investigations and remediation. There is an emerging endpoint detection and remediation market delivered by specialized providers. However, this technology is being adopted by leading EPP vendors.

- Journaling changes (that is backing up files) that are generated from a low reputation or unknown process is a critical capability for recovering from damaging malware such as cryptolocking malware.

- One very effective HIPS technique is "vulnerability shielding" (also known as "virtual patching") – that is, the ability to inspect and drop attacks based on knowledge of specific vulnerabilities they are exploiting. This technique allows protection against attacks against known vulnerabilities before the vendor releases a patch, and to buy time for patches to propagate out to all endpoints. Of particular value is a list of the actual common vulnerabilities and exposure IDs that are shielded, such that administrators know when a patch can be safely delayed.

- The simulation of unknown code before the code is executed to determine malicious intent without requiring end-user interaction with the unknown code (e.g., using static analysis, simulation or reverse compilation techniques) is another deterministic technique, but can be very resource-intensive and should be selectively used for suspicious or unknown code (see Malware Sandbox section for off-endpoint techniques).

- Behavior-based protection is a useful tool, but can be prone to false positive unless known applications are excluded. The integration of an application control (see Application Control section) database of known good applications with HIPS can help automatically tune HIPS features to avoid false positives and to reserve more intense inspection to unknown code.

- A core principle is that the HIPS solution must enable the administrator to choose and tune the styles of protection he or she needs based on the requirements and resources of the endpoint, and configure protection to reflect the organization's overall tolerance for risk and administrative overhead.

- Notwithstanding the previous point, the best solutions will provide preconfigured out-of-the-box templates for common application and system configurations, as well as a learning mode for enterprise environments and the ability to test policy in a log-only mode.

- Some vendors only offer binary control over HIPSs, allowing administrators to turn them on or off only. Although we do not expect IT organizations to agonize over each setting, it is important to have granular control that enables them to turn off certain rules for specific applications to accommodate false positives.

Malware Removal

Modern malware is significantly more complex than that of previous generations, often involving multiple components with sophisticated keep-alive routines. Malware removal services and support assistance can be beneficial. However, the wisest course is often to simply reimage machines. Increasingly, the use of event recording will enable better event investigation and improved malware removal.

Cryptolocker and other ransom or destructive malware (for example BKDR_WIPALL used in the Sony hack) represent a unique new form of malware that is not recoverable from. Some solutions offer journaling and file backup capabilities to prevent malware from performing unrecoverable changes.

Application Control

Application control describes the ability to restrict application execution to a list of known and trusted applications. The "trusted application" list can be as restrictive as the applications already installed (aka lockdown) or as loose as the known universe of cataloged trusted applications or anything in between. Application control shifts the paradigm from "default allow" (allow any applications as long as it is not a known malware) to "Default Deny" (do not allow any application unless its providence and reputation are known) thereby automatically blocking new or targeted malware. Even in "monitor only" mode, application control provides excellent early detection of potential malware.

Application control features to investigate include:

- The size and quality of the catalog of known "good" applications.

- How applications are identified and how they are prevented from executing (e.g., whether they block the installation of applications or just the execution).

- The ability to automatically allow sources of trusted applications (i.e., certificates, locations, processes or administrators), so that even applications not yet cataloged by the vendor can be allowed if they come from a trusted source.

- Application control should extend to the execution of browser helper objects/ controls within the context of Internet Explorer or other browsers and Java applets and other scriptable objects.

- Application control should be integrated with malware signature and HIPS engines such that the verdict of each system can be relayed to others. For example, applications that are known good or trusted should not be blocked by HIPS, while applications that are not known may execute but with elevated HIPS protection.

- Unknown applications should be able to be automatically submitted to a cloud or local malware sandboxes for malware analysis.

- The workflow for users requesting the use of an unknown application should be integrated into the help desk ticketing system and provide sufficient context for the help desk to make an educated decision.

- Support for Windows endpoints at a minimum including XP and 2002 as well as optional support for Macintosh and Linux.

Malware Sandbox

A malware sandbox is a centralized resource that can execute suspect code in a virtual environment and make an automatic determination of whether it is malicious. Sandboxes are an early stage optional component of an EPP, but are rapidly gaining mainstream adoption. Features to look for in a malware sandbox include:

- Centralized deployment or cloud-based deployment is preferable to deployments that must be in tap mode on specific network segments

- Ability to store multiple customizable virtual images to match enterprise gold image and the ability to maintain images in synch with enterprise patch activities

- Ability to inspect multiple executable file types including documents and interpreted code such as Java

- Automated and manual methods to submit code to the malware sandbox, that is the ability for endpoints or network agents to automatically submit unknown code to the sandbox, and administrators to manually submit code

- Evasion detection techniques are important to detect malicious code that does not exhibit malicious behaviors if it suspects it is running in a sandbox

- Integration with object reputation databases (that is a "good" application and malware databases) help conserve resource by eliminating known good or known malicious programs from the behavior analysis system

- Comprehensive reporting that describes the actions and metadata of sample and why it reached the verdict

- Queue management functions that enable administrators to set wait times before allowing local endpoint execution and user display functions that help users understand what is happening while they wait for local execution

Vulnerability Management

We know that unpatched vulnerabilities are the most common attack technique. Detecting and patching known vulnerabilities is the most effective method of blocking known malware. Larger organizations often use dedicated vulnerability assessment tools. However, EPP features that provide insight into known vulnerable applications, particularly those that are frequently exploited by malware, is a useful tool to understand the security state of the endpoints and overseeing operations teams that may have a different agenda than security. Organizations that do not have a dedicated vulnerability assessment tool will find EPP solutions to be adequate for the purpose of deflecting endpoint malware. Vulnerability assessment features should:

- Address, at a minimum, the most commonly exploited applications and not just Microsoft patches

- Provide insight into the number and the severity of vulnerabilities as well as provide a prioritized list of software to patch to provide the maximum impact on security

- Be combined with patch capability to remediate endpoints or at a minimum a link to the appropriate patch

- Cross-reference unpatched vulnerabilities with shields (for those that include vulnerability shields) so administrators know which vulnerabilities are actually shielded

Manageability and Scalability

Reduced administration overhead is one of the top concerns of EPP administrators. An effective task-oriented graphical user interface (GUI) and comprehensive management interface will offer lower total cost of ownership. Gartner recommends creating a list of the top 10 to 20 most common or critical tasks (see Note 1), and using this list as a guideline for comparison testing and demonstration of solutions. Required management capabilities will depend heavily on the enterprise's specific needs and available technical skill sets. Advanced capabilities will include:

- Level of integration between components, which is of critical consideration when selecting suites: Integration at a reporting layer is easy to achieve, integration of policy is harder but most important is the ability to share context between components. Look for concrete examples of components enhancing the security state by operating together rather than independently. For example, the integration of an application control database with HIPS behavior monitoring enables more restrictive behavior-based policies for unknown applications.

- Varied degrees of management and reporting integration into a common centralized management console: Consider the look and feel of management pages and the ability to transition from dashboards to the configuration or remediation of indicated problems.

- A home page dashboard of real-time events and trending information that enables rapid troubleshooting of event or server issues: Ideally, dashboard elements should be actionable so that clicking on an event or graph will initiate steps to better understanding the issues. More-advanced management interfaces allow for easily clicking through from the dashboard to more detail and problem resolution options (see below for more dashboard features).

- Range of client information, which can be collected and reported to the management server and is a growing differentiator: Most EPP suites will collect information only about the status of the EPP suite. However, as endpoint hygiene becomes more critical, the status of patch levels, configuration information software inventory and vulnerability information is becoming more important. Event information storage that enables better investigation and remediation capabilities will be a critical differentiator as EPP vendors integrate endpoint detection and remediation capabilities.

- Reporting that enables multiple devices to be linked to a particular user: This is a good indication of the degree of integration of mobile device management (MDM)/enterprise mobility management (EMM) functionality.

- Multiple directory integration options (i.e., Microsoft active directory [AD], Lightweight Directory Access Protocol [LDAP]) and the ability to integrate with multiple directories and traverse directories to find users groups and authentication information.

- Methods to combine directory, device and event information to create dynamic groups are very useful for creating flexible policy: Dynamic tags allow for alert prioritization and automatic policy implementation when event thresholds are exceeded.

- A "wizard"-type installation mechanism that provides optimal default settings for different-sized environments and different types of endpoints as well as those that automatically add licensed entitlements is very useful for reducing the implementation overhead.

- Ability to automatically and natively distribute the full client agent and remove competing products is a differentiator: Some solutions simply provide an .msi file for manual distribution by other software distribution tools.

- Task-based (not feature-based) management GUI that simplifies management by hiding complexity, but also gives more technically skilled users the ability to drill down into granular detail for more-technical users (see Note 2).

- Solutions that provide native management server redundancy: For example, load-balancing, active/active clustering within and across LANs, or automatic active/standby failover – without a single point of failure.

- Centralized management with automatic configuration and policy synchronization among management servers in large deployments.

- Threshold alerting capabilities – including email, SMS and Simple Network Management Protocol (SNMP) – and threshold alerts for dashboard statistics and policy thresholds alerts: Ideally threshold alerts should be proportional as well as deterministic, that is alert when a parameter exceeds normal by X percentage rather than when it reaches a numeric value of X.

- Granular, role-based administration, ideally with both predefined roles and the capability to customize and add and remove options: It should be possible to limit data visibility to only groups that the role is managing.

- Ability to create different management GUI workspace views (for example, administrator or help desk view), with the ability for users to adjust their default views a plus.

- A task/context-based help function, with recommendation settings for Web configuration options.

- Configuration backup and configuration preservation between version upgrades.

- Policy (see Note 3) in a single view with intelligent drop-down pick lists and fields that change based on previous optional selections: Avoid solutions that have multiple popup windows or require visiting several tabs to create a single policy.

- Policy creation that is object-oriented so that policy elements can be created once and used in multiple policy instances (see Note 4): For example, the definition of off-LAN can be created once and reused in multiple policies such as firewall/Wi-Fi policy and update server location. Policies should also be able to inherit the attributes of higher-level policy without recreating the higher-level policy, as well as the ability to break this inheritance when necessary. This makes exceptions easer to create and manage.

- Solutions that offer a human-readable printable policy summary for audit and troubleshooting purposes.

- EPP solutions with a complete audit log of policy changes, especially those with extensive role-based administration and delegated end-user administration.

- A customizable toolbox element that allows the consolidation of common tasks into a single user-defined menu.

- Globalization: In addition to global support and centralized management and reporting, look for local language support for the management interface and end-user interface.

- Management server that can collect client status information in real time, rather than in scheduled delta updates: The ability to collect information from mobile endpoints that are not connected to the network that hosts the management server is a significant differentiator.

- Management system that can automatically detect new/rogue endpoints that do not have an EPP client installed: This function may be integrated into network access control (NAC). However, it should not be dependent on NAC and should be able to detect clients that have already joined the domain.

- Some solutions that offer a software-as-a-service (SaaS)-based managed console to eliminate the need for a dedicated server for managing endpoints: This feature is more useful for SMBs and regional offices. Ensure that vendors are clear on the level of integration between the SaaS management and on-premises management servers. Also, insist on a list of the functional difference between SaaS-based consoles and on-premises-based ones. For example, SaaS consoles cannot typically find rogue machines that do not have the client installed.

- The typical ratio of management servers to clients in practice and the factors that affect this ratio are important considerations for large enterprise and will impact the total cost of ownership (TCO): For smaller organizations, the management server should work on a shared server or a virtualized server.
- Ability to stage and phase the rollout of signatures or policies and to roll back changes quickly is important: Fewer users test signatures before deploying them.
- Number of required clients, the client disk and memory footprint are good indicators of the level of integration between EPP components, as well as the efficiency of the client: Ideal solutions will provide a single consolidated agent that has component parts that can be remotely enabled and disabled.
- Client interface that is adaptable to enable a full range of delegated control for end users: Advanced solutions allow administrators to delegate or restrict any client option.
- Options to limit the client impact of scheduled scans are a significant differentiator: Scheduled scans are one of the most annoying aspects of signature-based anti-malware. Advanced features include the ability to delay scans based on battery life or running process or CPU utilization. More rare is the ability to "wake and scan" PCs in off hours. Scheduled memory scans should be independent of disk scans.
- Administration that is simplified when solutions include protection for a broad range of platforms, including Macintosh, Android and Linux, and specialized servers, such as SharePoint, Exchange and virtual servers from a single management console.

Dashboard and Reporting Capabilities

Real-time dashboard and analytics capabilities are a key differentiator of current EPP solutions and will become increasingly important in the shift to continuous monitoring and long-term data retention. For example:

- Dashboards should provide a real-time prioritized list of actions and alerts that need attention of security and operations administration – what we like to call the "cup of coffee" screen. At its most basic, it should provide a list of suggested actions and graphical views of anomalies worthy of investigation.
- Management dashboards should provide continuous display of key performance metrics, such as dwell time, vulnerabilities outstanding, time to containment, remediated infections, most dangerous users/groups, and threat type distribution as well as summary info of operations dashboard. Comparisons to global local and vertical industry norms would be beneficial.
- Dashboards should offer data feeds with relevant external news, such as global malware activity, Or additional context, such as malware family, relevant URLs and IP addresses, etc. vulnerability information or other events, are desirable. External trending information enables administrators to better understand internal activity levels and compare them to global events.
- Dashboards should be administrator-customizable, so that information that is most relevant can move up to the top of the page, and display options (such as pie charts, bar charts and tables) should be configurable so that information can be displayed in the format that specific administrators need.
- Reports and dashboards should include trending information against customizable parameters. For example, create a dashboard view or report that shows percentage compliance against a specific configuration policy over time.
- Dashboard information should always offer one-click detail to enable administrators to quickly drill down into detail, rather than forcing them to switch to the reporting application and manually select the appropriate report and recreate the parameters that include the condition they are interested in investigating.
- Dashboards should also offer quick links to remediation actions (i.e., clean, quarantine, patch or distribute software), as well as quick links to other resources, such as malware wikis, to resolve alerts.
- Solutions should include the ability to import or export data and alerts with security information management systems or other reporting systems.
- Reporting engines should be capable of running on-box for smaller solutions or moving to a centralized reporting server for consolidation and storage of multiple management servers' log information without changing the look and feel of the reports.
- Dashboards should have the ability to create custom reports – in HTML, XML, CSV and PDF output types – save them and schedule them for distribution via

email or FTP, or move them to the network directory. The ability to put multiple reports together in a report package and schedule for distribution is a more advanced feature.

- Databases must enable rapid report queries and the ability to store historical data for long-term storage in a standard format. Bonus points for natural language queries capabilities.

- Latency of the data should be customizable (i.e., faster refresh rate) with minimal network impact. Real-time queries against live data will be increasingly critical.

- Reporting engines should include a facility for creation of completely ad hoc reports similar to SQL queries, rather than just modification of the parameters of predeveloped reports.

- More-advanced solution will include analytics cubes that enable very complex queries that answer specific questions – for example; "show number of users in active directory group 'finance' that have an unencrypted laptop that have had more than three infections in the last two years."

Virtualization Support

Virtualization has become ubiquitous in modern data centers (desktop and server) and nearly every EPP vendor offers some form of support for running their solution in a virtualized environment. However, there are some key differences and before looking at vendor solutions, buyers must understand their organization's approach and use of virtual servers.

The first consideration is whether it is a full virtualization solution, where each system gets its own virtual machine (VM) and its own copy of an OS, or is it the older terminal services model, where a single copy of Windows is used in a multitenant fashion to support multiple simultaneous sessions. The distinction is important because while most vendors support their EPP agents running in a full VM, they may or may not have redesigned their offering to run in a terminal services environment.

Most new virtualization deployments today use a model where server or desktop has its own full copy of an OS. Because the guest is essentially identical to the OS that runs on a physical device, most vendors will state they support running their agent in a VM. However, the reality is that there are substantial differences between different EPP vendor's supports of virtual environments. Simply running unmodified EPP agents in virtual machines can create significant resource contention issues. For example, if all the signature files of an agent are updated at once across hundreds of VMs, or if anti-malware scanning of the file system kicks in all at the same time. The impact on network bandwidth, CPU utilization and storage input/output can be significant. Because of this, a poorly implemented EPP solution can reduce VM density and negatively affect the overall TCO of the virtualization project.

At an absolute minimum, EPP solutions should support:

- Randomized scanning in which the scheduled scanning is "randomized" so that all scans do not kick off at the same time.

- Signature files (commonly referred to as DAT files), which should not all update at the same time; ideally, these can be delivered once and shared either directly or copied in a peer-to-peer fashion among VMs, reducing bandwidth requirements during updates.

- Gold image files, which ideally should be cached so they are not rescanned if unchanged.

- Configuration testing for organizations implementing "thin provisioning" where the VM images are reset back to known good state on each reboot. The configuration should be tested to understand how the signature files will be updated on each machine reboot and subsequent regeneration. This process can create issues if all users login at the same time in the morning and a new session is generated, requiring an update of the DAT file if it is provisioned from an out-of-date source.

More advanced solutions will offer centralized scanning by exploiting the hypervisor-level application programming interfaces (APIs) opened up by VMware to perform "agentless" scanning (the term agentless is somewhat of a misnomer as there is stub code placed into each VM by VMware's tools). Using this approach, the file-based anti-malware scanning can be offloaded to a "security VM" that coordinates the anti-malware scanning on all virtual hosts.

Additional features to look for in agentless scanning include:

- Support for agentless anti-malware scanning using the VMware hypervisor APIs

- Agentless file integrity monitoring and agentless access to network streams for firewalling and IPS exploiting VMware APIs

In a Microsoft Hyper-V environment, Microsoft has not delivered equivalent APIs for agentless malware scanning, but one of Microsoft's partners, 5nine Software, has implemented this using licensed signatures.

Using hypervisor-specific APIs has its pros and cons. On the positive side, resource contention can be greatly reduced. However, on the negative side you are creating lock-in to the vendor's hypervisor platform. Another negative is that your capabilities are limited as to what is exposed by the APIs. For example, behavioral and memory protection as well as application control aren't yet exposed via the VMware APIs, so the EPP solution loses these capabilities unless an additional agent is introduced.

For this reason, some of the EPP vendors have implemented "Hybrid" architectures where a small agent in each VM coordinates with a master "security VM" running separately. This combination can centralize anti-malware scanning, but keep a small local agent for behavioral and memory protection. This hybrid approach has several benefits:

- The small local agent can perform inspection not possible using the hypervisor APIs

- The EPP solution can be architected to be hypervisor-neutral and therefore run in VMware, Hyper-V, KVM and other virtualization environments. Likewise, the EPP solution can be run in public clouds where VMs are used, but where none of the leading infrastructure-as-a-service (IaaS) providers offer hypervisor-level API access due to security concerns.

Even if hypervisor-specific APIs are used locally and agent-based protection is used in public clouds, the agent and management infrastructure should be architected to provide a single pane of glass for managing agents seamlessly across hybrid physical, virtual and cloud-based infrastructure without requiring different consoles for configuring policy and viewing security events.

Finally, licensing models should favor simplicity. In most cases, the EPP provider will charge the same amount for all endpoints, physical or virtual, easing the complexity of licensing for enterprises. Cloud virtual deployments that auto scale should be capable of accounting for utilization bursts without excessive auditing requirements or over capacity buying (see Note 5 for additional checklist for virtualization protection solutions).

Data Encryption and DLP

As organizations become increasingly concerned about data loss, EPP vendors are advancing data protection through endpoint data encryption and DLP capability. Many EPP vendors are selling encryption in the related mobile data protection market and are successful in selling both stand-alone and suite installations. Some EPP DLP solutions are components of broader enterprise DLP solutions, while others are stand-alone endpoint-only solutions. Endpoint DLP that is integrated into the EPP suite offers the promise of more content-aware port/firewall and encryption policies, simplified agent management and distribution, and lower cost. Stand-alone EPP DLP will likely satisfy many businesses' early needs but may not be suitable for more-ambitious future data protection plans. Buyers should certainly evaluate prospective EPP DLP capabilities and the vendor's longer-term road maps to determine how well it aligns with business needs. Mobile data protection (encryption solutions) does not need to be tightly integrated with EPP solutions. However, there are administrative and cost savings when they are integrated. Moreover integration of port control to selectively enable removable storage with DLP and encryption enable policies based on the content of the files in use – for example, forcing encryption on a file transferred to a USB drive if it contains sensitive information.

Enterprise Mobility Management and Mobile Malware Protection

As more endpoints in organizations take the form of mobile devices and mobile operating systems, EPP vendors are responding with protection and management features for these platforms. Since the mobile OS (primarily Android and iOS) are more secure out of the box, protection typically takes the form of managing the protection features built into mobile OS, which is generally referred to as "mobile device management" and now "enterprise mobility management." EMM functionality is not well-integrated into EPP suites, although several vendors have made investments in solutions with plans to integrate this functionality. Consider the following when looking at EMM functionality:

- Proactive auditing and upward reporting of status of system encryption policies

- Policy support that takes advantage of all management capabilities in a given platform

- Proactive detection and countermeasures for "jailbreaking," rooting and data leakage prevention

- Support for three major mobile platforms (Android, iOS, Windows), realizing that this is not a monolithic challenge

In addition to EMM, EPP suites also offer antivirus protection for these platforms. The traditional approach of only identifying malicious applications is tempting at this early stage of the market; however, an application control approach that catalogs all aspects of both good and bad apps will have more long-term business value. Security risks will extend to applications that leak sensitive or private information, create back doors to corporate resources, have no business value or may increase legal risk. Vendors like Appthority have created the mobile application catalog; however, few EPP vendors have made the investment in creating a mobile application catalog or licensing one yet – but that is the desired direction.

Service and Support

Service and support are essential concerns for secure endpoint protection suites, as they are for any business-critical technology. Capabilities to consider include:

- Dedicated product engineers' resources or direct access to Level 2 support
- Global support presence with local language support engineers in necessary geographies
- Evidence of extended tenure of support staff
- Vendor willingness to agree to high service-level agreements for callback responses
- SLAs for the production of signatures for unique malware discovered in the enterprise network.
- Support resources, including user forums, best-practice guidance and white papers
- Installation assistance and training
- Clear and consistent escalation policies

Note 1
Sample Critical Tasks

Common tasks might include:

- Review home page dashboard, paying particular attention to the placement of indicators that illustrate negative changes in the security posture of endpoints. Look for direct links to more information, recommendations and action steps to resolve events.
- Identify patterns of noncompliance. Some users, workgroups or tasks may cause repeat occurrences of policy violations that can be recognized by historical event analysis.
- Tour the report center, create a custom report and schedule it for delivery to an email box or Web server/portal.
- Show alert configuration capability, and integrate an alert with an external subscriber identity module.
- Show real-time data that lists clients on a network that do not have an EPP agent installed.
- Create or edit the policy elements that can be delegated (or restricted) to end users.
- Create or edit the policy configuration for client update distribution and step-through policy creation.
- Create or edit the policy to automatically push the EPP client to an endpoint that does not have it installed.
- Configure scheduled scans for endpoints. Focus on the ability to limit CPU utilization, and delegate the ability for end users to delay scan execution.
- Create or edit the port (i.e., USB, CDs, infrared) control configuration. Pay particular attention to the granularity of the restrictions and the linkage to file types and encryption, if any.
- Create or edit VPN policy (i.e., deny split tunneling) for a specific active directory group.
- Create or edit location-based policy, and pay attention to the level of automation in selecting when a policy should be invoked.
- Create or edit a Wi-Fi-specific policy.
- Create or edit a whitelisting and/or lockdown configuration for a certain group of PCs. Add a new executable program to the whitelist. Autogenerate a whitelist from the installed applications on a PC. Authorize a software distribution method and directory as a whitelisted source of applications.
- Show a single-page summary of client configuration information, and print it for review.
- Review HIPS policy configuration and step through the false-positive-handling process, including deactivating a specific HIPS rule for a specific application.
- Edit role-based administration and hierarchical administration to add a new role.

Note 2
Evaluating a Task-Based System

A task-based system can be evaluated by creating a list of common tasks and comparing the number of steps required to complete each task.

Note 3
Choosing an Enterprise's Policy Interface

An enterprise's policy interface – like its policies – should be chosen fundamentally to address the needs of the business. Excessively complex and technical policy interfaces and reporting will force IT to interpret and implement business policy, increasing both workload and the potential for errors and miscommunication. A policy interface should be intuitive and usable by nontechnical business personnel – for example, HR and legal staff. A good way to test the usability of an interface is to give such personnel an opportunity to test it.

Note 4

Reusable Policy Objects

Reusable policy objects are critical to the creation of a scalable policy environment. Objects such as dictionaries should be separate referenced databases, files or subroutines, so that they can be reused in multiple policies but updated centrally. Policies that use hard-coded objects require administrators to update multiple policies to make a simple change.

Note 5

Checklist for Virtual System Support

- Which terminal services and virtualized environments are explicitly supported by the vendor?
- Does the support go beyond staggered scanning?
- How are DAT files updated across VMs?
- Is the agent architecture different than the one used for physical endpoints?
- Are hypervisor-specific APIs used and have you considered the pros/cons of this approach, including vendor lock-in?
- Does the EPP offer less functionality when running virtualized? What functionality is lost?
- Does the vendor offer a hypervisor-neutral option?
- Does the vendor offer a hybrid light agent/coordinating security VM option?
- Is the same management console used across physical/virtual?
- What is the EPP vendor's strategy for protecting workloads in public cloud IaaS?
- What public cloud IaaS providers are explicitly supported?
- For highly variable public cloud IaaS models, does the vendor offer usage-based licensing- per month or per hour?

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Neil MacDonald, 29 January 2015

About Comodo

Comodo is a global innovator of cybersecurity solutions, protecting critical information across the digital landscape. Building on its unique position as the world's largest certificate authority, Comodo authenticates, validates and secures networks and infrastructures from individuals, to mid-sized companies, to the world's largest enterprises. Comodo provides complete end-to-end security solutions across the boundary, internal network and endpoint with innovative technologies solving the most advanced malware threats, both known and unknown. With global headquarters in Clifton, New Jersey and branch offices in Silicon Valley, Comodo has international offices in China, India, the United Kingdom, throughout Europe, as well as Central and East Asia.

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