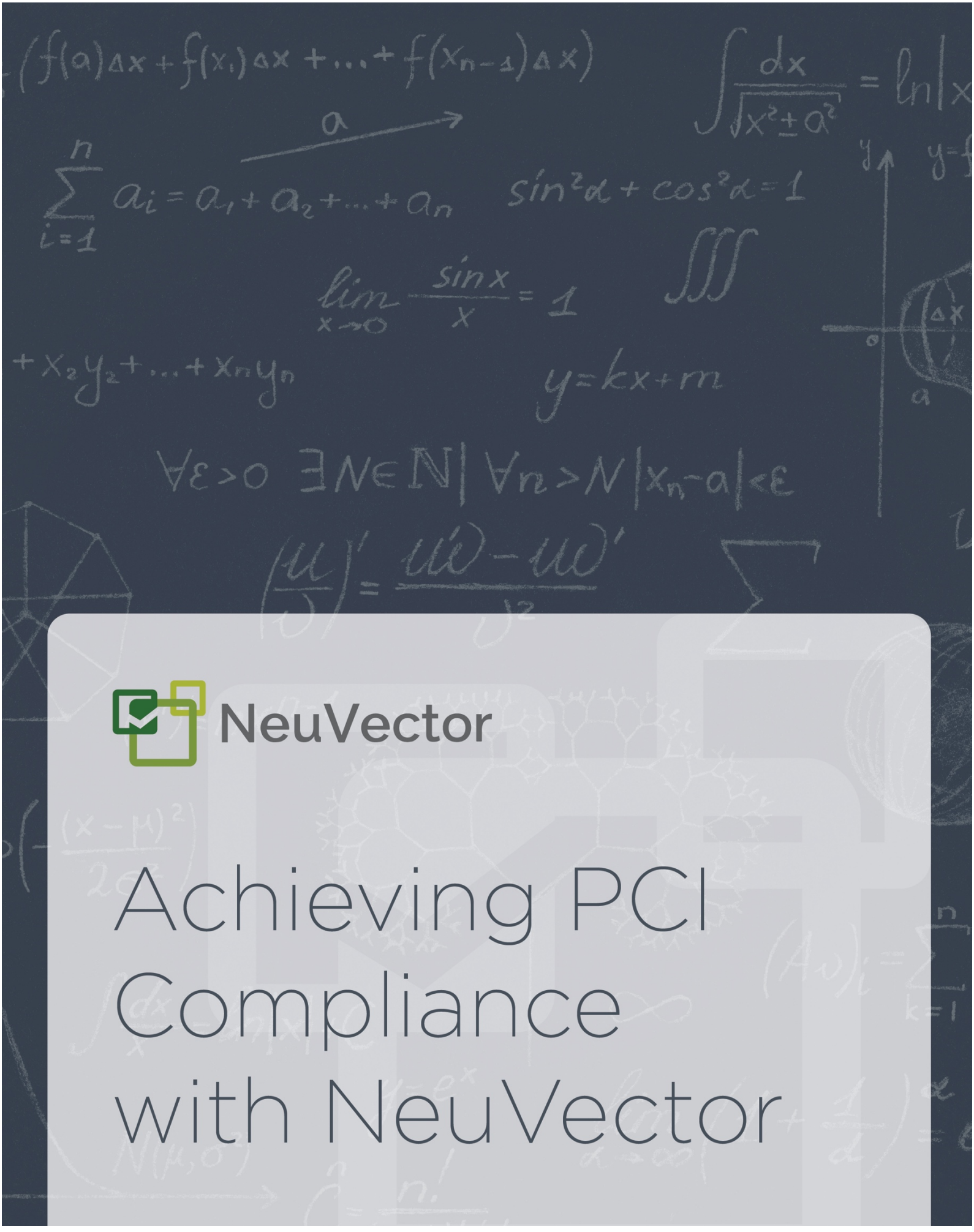


NeuVector

Achieving PCI Compliance with NeuVector

NeuVector PCI Compliance

This report describes how NeuVector helps organizations comply with the Payment Card Industry Data Security Standard (PCI-DSS) version 3.2.1, issued in May 2018. Though microservices and containers are not explicitly mentioned in PCI-DSS – yet – organizations implementing these technologies must focus carefully on monitoring, securing, and governance.

Microservices and containers offer some unique characteristics that support PCI-DSS. For example, microservices emphasize an architecture with one function per service/container. This aligns well with PCI-DSS 2.2.1, implementing only one primary function per server. Similarly, containers by design offer reduced functionality, aligning with PCI-DSS 2.2.2, enabling only necessary protocols and services.

At the same time, other aspects of microservices and containers make PCI-DSS compliance a significant challenge. For example, the ephemeral nature of containers – potentially only "living" for a few minutes – means monitoring must be real-time and embedded to monitor and enforce all container activity. Plus, most container traffic is east-west in nature – versus north-south – meaning traditional security controls never see most container activity. Finally, as containers come and go, so too does the scope of the Cardholder Data Environment (CDE). A continually changing CDE scope may be one of the most significant impacts of containers on monitoring and maintaining PCI-DSS compliance. As shown in Figure 1, organizations must have visibility and control to define the in-scope CDE tightly. Without an advanced deep packet inspection (DPI) container firewall like NeuVector's MultiVector container firewall, organizations implementing containers may have to consider the entire microservices environment in-scope!

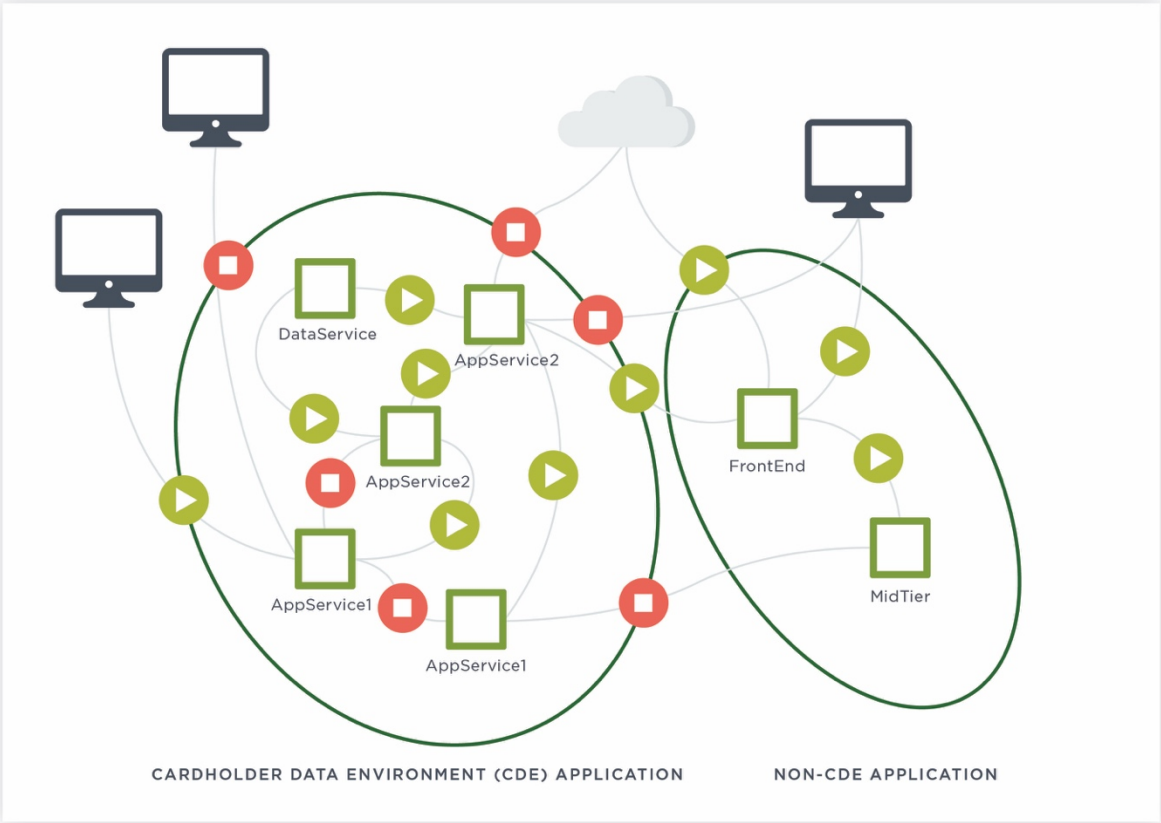


FIGURE 1 - *Containing the Container CDE*

As described in this document, the NeuVector MultiVector firewall provides the monitoring, control, enforcement, and granularity necessary to support PCI-DSS in the dynamic continuous integration/continuous deployment (CI/CD) container infrastructure.

PCI-DSS REQUIREMENT	NEUVECTOR
Build and Maintain Secure Networks	
1.0 – Install and maintain a firewall configuration to protect cardholder data	
1.1 – Establish and implement firewall and router configuration standards that include the following:	
1.1.2 – Current network diagram that identifies all connections between the cardholder data environment and other networks, including any wireless networks	*NeuVector provides automatic discovery of containers, nodes, and services, with a graphical, interactive, network diagram showing all containers (CDE and non-CDE). NeuVector monitors all connections in real-time and will discover any new connections to or from containers immediately.*

		1.1.3 – Current diagram that shows all cardholder data flows across systems and networks	*NeuVector provides automatic discovery of flows between containers and services. Operators may flag specific flows as CDE and non-CDE based on customized container labeling.*
		1.1.4 – Requirements for a firewall at each Internet connection and between any demilitarized zone (DMZ) and the internal network zone	*NeuVector provides a Layer 7 multi-vector firewall, discovering, monitoring, and protecting via micro-segmentation of all containers, including at each Internet connection, and between DMZ and internal zones.*
		1.1.5 - Description of groups, roles, and responsibilities for management of network components	*NeuVector provides full LDAP integration to manage groups, roles, and responsibilities for NeuVector firewall containers.*
	1.2 – Build firewall and router configurations that restrict connections between untrusted networks and any system components in the cardholder data environment.		NeuVector delivers micro-segmentation and firewall policies to restrict connections within CDE and between CDE and external networks.
		1.2.1 – Restrict inbound and outbound traffic to that which is necessary for the cardholder data environment, and specifically deny all other traffic.	*NeuVector automatically establishes whitelist rules to enforce and restrict inbound/outbound traffic to/from the CDE. Operators may add custom whitelist and blacklist rules. Rules & filtering are based on Layer 7 protocols by default, but Layer 3 & 4 rules may be added.*
		1.2.3 – Install perimeter firewalls between all wireless networks and the cardholder data environment, and configure these firewalls to deny or, if traffic is necessary for business purposes, permit only authorized traffic between the wireless environment and the CDE.	*Groups and rules can be established to monitor and enforce traffic between CDE containers and wireless networks through proper labeling of wireless environments. Whitelist rules will deny unauthorized connections and permit authorized ones.*
	1.3 - Prohibit direct public access between the Internet and any system component in the cardholder data environment.		In Protect mode, NeuVector prohibits direct access between the Internet and any container in the CDE. NeuVector restricts access based on Groups (DNS name, IP address/address range), protocols, and ports.
		1.3.1 – Implement a DMZ to limit inbound traffic to only system components that provide authorized publicly accessible services, protocols, and ports.	*NeuVector may be used to implement a DMZ, limiting inbound traffic based on Groups (DNS name, IP address/address range), protocols, and ports. NeuVector can implement and enforce ingress and egress control, to and from the containerized workloads.*

		1.3.2 – Limit inbound Internet traffic to IP addresses within the DMZ.	*NeuVector may be used to limit inbound traffic based on Groups (DNS name, IP address/address range), protocols, and ports. NeuVector can implement and enforce ingress and egress control, to and from the containerized workloads.*
		1.3.3 – Implement anti-spoofing measures to detect and block forged source IP addresses from entering the network.	*NeuVector will enforce stateful ingress and egress network connection control to prevent forged source IP address traffic. NeuVector limits inbound traffic based on 192, 168, 10.0 and 172.16 based on both whitelist and blacklists.*
		1.3.4 – Do not allow unauthorized outbound traffic from the cardholder data environment to the Internet.	*NeuVector automatically limits/prevents outbound traffic based on whitelist rules based on Groups (DNS name, IP address/address range), protocols, and ports.*
		1.3.5 – Permit only "established" connections into the network	*NeuVector continuously discovers and monitors all containers, implementing and enforcing stateful ingress and egress network control to only established network connections. Any new connections into the network will automatically trigger alerts and if configured, automatic blocking.*
		1.3.6 – Place system components that store cardholder data (such as a database) in an internal network zone, segregated from the DMZ and other untrusted networks	*NeuVector can create an internal network zone of CDE containers, segregating this zone from the DMZ and other untrusted networks. Based on image and container labeling, NeuVector can detect CDE components requiring segregation from other networks.*
		1.3.7 – Do not disclose private IP address and routing information to unauthorized parties	*NeuVector may be used to restrict any outbound traffic with private IP address to services providing NAT or Proxy or FW services to hide internal IP addresses.*
2.0 – Do not use vendor-supplied defaults for system passwords and other security parameters			
	2.1 – Always change vendor-supplied defaults and remove or disable unnecessary default accounts before installing a system on the network.	The NeuVector Console has a default password and documentation indicates a process for updating the default password. NeuVector detects if the default password is being used, alerts users, and logs these alerts.	
	2.2 – Develop configuration standards for all system components. Assure that these standards address all known security vulnerabilities and are consistent with industry-accepted system hardening standards.	NeuVector automatically runs Docker Bench security report and Kubernetes CIS Benchmarks to achieve configuration standards enforcement.	

		2.2.1 – Implement only one primary function per server to prevent functions that require different security levels from co-existing on the same server. (For example, web servers, database servers, and DNS should be implemented on separate servers.)	*NeuVector tracks each container and all ingress/egress from the container. NeuVector can automatically flag containers running multiple services. NeuVector deep packet inspection (DPI) tracks all container protocols and services. Any new service or protocol may be automatically flagged as an indication of potentially malicious activity.*
		2.2.2 – Enable only necessary services, protocols, daemons, etc., as required for the function of the system.	*NeuVector automatically identifies services running in containers. Based on manifests and runtime data, workloads may be automatically grouped into services. Operators may configure NeuVector in Detect, Monitor, or Protect mode, based on the type of applications/services running. This approach provides fine-grained control over what services, protocols, daemons, etc. are running in each container.*
		2.2.3 – Implement additional security features for any required services, protocols, or daemons that are considered to be insecure.	*NeuVector has built-in detection for common insecure protocols to detect DNS attacks, DNS and ICMP tunneling, and other protocols. NeuVector provides built-in detection for suspicious process and file system activity such as reverse shells, Nmap/port scanning, and suspicious file system changes.*
		2.2.5 – Remove all unnecessary functionality, such as scripts, drivers, features, subsystems, file systems, and unnecessary web servers.	*NeuVector identifies all processes running in containers, creating a baseline with allowed processes whitelisted. NeuVector can assist in the audit process by alerting on unnecessary processes.*
	2.3 – Encrypt all non-console administrative access using strong cryptography.		NeuVector helps identify non-encrypted network connections and can restrict only encrypted connections for in-scope connections. This includes blocking non-encrypted traffic to ports, protocols, and services typically used for non-console administrative access. Specific to the NeuVector solution, NeuVector supports secured mutual TLS channel or VPN for encrypting remote non-console admin access including CLI and REST API.
	2.4 – Maintain an inventory of system components that are in scope for PCI DSS.		NeuVector automatically discovers every system component in the CDE.

			Administrators receive real-time updates via an advanced GUI dashboard. The event log captures all hosts, containers, and other elements including results of vulnerability scanning for hosts and containers.
Protect Cardholder Data			
3.0 – Protect stored cardholder data			
	3.5 – Document and implement procedures to protect keys used to secure stored cardholder data against disclosure and misuse:		NeuVector recommends the key management and secrets management features and capabilities provided by NeuVector orchestration platform partners, including Kubernetes, Docker EE, Red Hat OpenShift, etc.
		3.5.2 – Restrict access to cryptographic keys to the fewest number of custodians necessary.	*NeuVector recommends the key management and secrets management features and capabilities provided by NeuVector orchestration platform partners, including Kubernetes, Docker EE, Red Hat OpenShift, etc.*
		3.5.3 - Store secret and private keys used to encrypt/decrypt cardholder data in one (or more) of the following forms at all times: · *Encrypted with a key-encrypting key that is at least as strong as the data-encrypting key, and that is stored separately from the data-encrypting key* · *Within a secure cryptographic device (such as a hardware (host) security module (HSM) or PTS-approved point-of-interaction device)* · *As at least two full-length key components or key shares, in accordance with an industry-accepted method*	*NeuVector recommends the key management and secrets management features and capabilities provided by NeuVector orchestration platform partners, including Kubernetes, Docker EE, Red Hat OpenShift, etc.*
	3.6 – Fully document and implement all key- management processes and procedures for cryptographic keys used for encryption of cardholder data, including the following:		
		3.6.1 – Generation of strong cryptographic keys	*NeuVector recommends the key management and secrets management features and capabilities provided by NeuVector orchestration platform partners, including Kubernetes, Docker EE, Red Hat OpenShift, etc.*
		3.6.2 – Secure cryptographic key distribution	*NeuVector recommends the key management and secrets management features and capabilities provided by NeuVector orchestration platform partners,*

			including Kubernetes, Docker EE, Red Hat OpenShift, etc.
		3.6.3 – Secure cryptographic key storage	*NeuVector recommends the key management and secrets management features and capabilities provided by NeuVector orchestration platform partners, including Kubernetes, Docker EE, Red Hat OpenShift, etc.*
4.0 – Encrypt transmission of cardholder data across open, public networks			
	4.1 – Use strong cryptography and security protocols to safeguard sensitive cardholder data during transmission over open, public networks, including the following: · Only trusted keys and certificates are accepted. · The protocol in use only supports secure versions or configurations. · The encryption strength is appropriate for the encryption methodology in use.	NeuVector can detect encrypted connections and automatically whitelist required SSL/TLS connections. NeuVector can block any connection not encrypted and automatically trigger an alert.
	4.2 – Never send unprotected PANs by end-user messaging technologies (for example, e-mail, instant messaging, SMS, chat, etc.).	NeuVector will detect any unauthorized connection from container workloads including those using end-user messaging technologies.
Maintain Vulnerability Management Program			
5.0 – Protect all systems against malware and regularly update anti-virus software or programs			
	5.1 – Deploy anti-virus software on all systems commonly affected by malicious software (particularly personal computers and servers).	NeuVector will alert on any unauthorized communication channels or process used by malware. This virtual patching function is a feature of the NeuVector container firewall. Suspicious file system activity in containers and hosts also trigger alerts. This includes downloads of executables and modifications to any packages/libraries or sensitive directories.
	5.2 – Ensure that all anti-virus mechanisms are maintained	NeuVector will alert on any unauthorized communication channels or process used by malware. This virtual patching function is a feature of the NeuVector container firewall. Suspicious file system activity in containers and hosts also trigger alerts. This includes downloads of executables and modifications to any packages/libraries or sensitive directories.

	5.3 – Ensure that anti-virus mechanisms are actively running and cannot be disabled or altered by users, unless specifically authorized by management on a case-by-case basis for a limited time period.	The NeuVector Controller monitors the NeuVector Enforcer containers. Alerts are automatically issued for any process issue or network connectivity problems. Orchestration tools manage the deployment of NeuVector to ensure the security containers are always running.
6.0 – Develop/Maintain Secure Systems and Applications		
	6.1 – Establish a process to identify security vulnerabilities, using reputable outside sources for security vulnerability information, and assign a risk ranking (for example, as “high,” “medium,” or “low”) to newly discovered security vulnerabilities.	NeuVector automatically scans running containers and hosts for both common vulnerabilities (CVE) and application specific vulnerabilities. NeuVector integrates into the continuous integration/continuous deployment (CI/CD) environment with scanning at multiple points in the development cycle, with registry scanning and a Jenkins plug-in for build-time scanning. Vulnerabilities discovered are assigned a risk ranking such as high or medium.
	6.2 – Ensure that all system components and software are protected from known vulnerabilities by installing applicable vendor-supplied security patches. Install critical security patches within one month of release.	NeuVector identifies the fix versions required and rescans updated containers and hosts to verify the application of patches. NeuVector enables auto-response rules to identify any un-remediated vulnerabilities found in production systems.
	6.3 – Develop internal and external software applications (including web-based administrative access to applications) securely, as follows:	
	6.3.1 – Remove development, test and/or customer application accounts, user IDs, and passwords before applications become active or are released to customers	*NeuVector recommends using the secrets management capabilities of orchestration platforms to protect sensitive data through the full continuous integration/continuous deployment (CI/CD) cycle.*
	6.3.2 – Review custom code prior to release to production or customers in order to identify any potential coding vulnerability (using either manual or automated processes)	*NeuVector partners with and integrates with code scanning tools such as Black Duck software and JFrog Artifactory to provide additional capabilities for dynamic and static code testing.*
	6.4 – Follow change control processes and procedures for all changes to system components. The processes must include the following:	

		6.4.1 – Separate development/test environments from production environments, and enforce the separation with access controls.	*NeuVector supports policy separation and import/export between development, test and production environments. If on the same network segments, the NeuVector Enforcer container will enforce separation of development/test from production environment containers based on establishing container groups. Group designations include images, nodes, instance names, services, labels, or addresses.*
		6.4.2 – Separation of duties between development/test and production environments	*NeuVector supports policy separation and import/export between development, test and production environments. If on the same network segments, the NeuVector Enforcer container will enforce separation of development/test from production environment containers based on establishing container groups. Group designations include images, nodes, instance names, services, labels, or addresses.*
		6.4.6 – Upon completion of significant change, all relevant PCI DSS requirements must be implemented on all new or changed systems and networks, and documentation updated as applicable	*NeuVector can detect when new components are installed in the system and automatically rescan changed containers or scan new containers. For all new or changed networks, NeuVector automatically compares all network activities with defined whitelist rules in real time, automatically triggering custom response rules to quarantine or alert until the change is verified and accepted.*
	6.5 – Address common coding vulnerabilities in software-development processes as follows:		
		6.5.1 – Injection flaws, particularly SQL injection. Also consider OS Command Injection, LDAP, and XPath injection flaws as well as other injection flaws.	*The NeuVector firewall has built-in detection for common attacks such as SQL injection, DDoS and DNS attacks and monitors all north-south and east-west traffic for such attacks.*
		6.5.4 – Insecure communications	*NeuVector automatically monitors all container communications, immediately flagging and blocking insecure communications.*
		6.5.6 – All "high risk" vulnerabilities identified in the vulnerability identification process (as defined in PCI DSS Requirement 6.1).	*NeuVector automatically scans running containers and hosts for both common vulnerabilities (CVE) and application specific vulnerabilities. High-risk vulnerabilities are flagged based on the CVSS score. Response rules can be triggered to alert based on CVE*

			levels, or on particular CVEs. These triggers can result in container quarantine.
		6.5.7 – Cross-site Scripting (XSS)	*NeuVector will detect any unauthorized connections or suspicious process generated by XSS attacks.*
	6.6 – For public-facing web applications, address new threats and vulnerabilities on an ongoing basis and ensure these applications are protected against known attacks.		NeuVector's virtual patching results in detecting and potentially blocking any unauthorized connections from new threats. The vulnerability (CVE) database is updated daily to incorporate new vulnerabilities. Customers may update their production database as often as desired.
Implement Strong Access Control Measures			
7.0 – Restrict access to cardholder data by business need to know			
	7.1 – Limit access to system components and cardholder data to only those individuals whose job requires such access.		NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.
		7.1.2 – Restrict access to privileged user IDs to least privileges necessary to perform job responsibilities.	*NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.*
		7.1.3 – Assign access based on individual personnel's job classification and function.	*NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.*
	7.2 – Establish an access control system(s) for systems components that restricts access based on a user's need to know, and is set to "deny all" unless specifically allowed.		NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.
		7.2.1 – Coverage of all system components	*NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.*
		7.2.2 – Assignment of privileges to individuals based on job classification and function	*NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.*
		7.2.3 – Default "deny-all" setting.	*NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.*
8.0 – Identify and Authenticate Access to System Components			
	8.1 – Define and implement policies and procedures to ensure proper user identification management for non-		

	consumer users and administrators on all system components	
	8.1.1 – Assign all users a unique ID before allowing them to access system components or cardholder data.	*All NeuVector users are assigned a unique ID initially. NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as enterprise LDAP/AD.*
	8.2 – In addition to assigning a unique ID, ensure proper user-authentication management for non-consumer users and administrators on all system components by employing at least one of the following methods to authenticate all users: know, have, are.	NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD.
	8.2.1 – Using strong cryptography, render all authentication credentials (such as passwords/phrases) unreadable during transmission and storage on all system components.	*NeuVector supports RBACs for access to NeuVector components and integrates with Kubernetes and OpenShift RBACs as well as LDAP/AD. NeuVector also supports SAML/SSO and Oauth.*
	8.3 - Secure all individual non-console administrative access and all remote access to the CDE using multi-factor authentication.	NeuVector supports SAML/SSO and integrates with MFA systems such as Okta.
Regularly Monitor and Test Networks		
10.0 – Track and Monitor All Access to Network Resources and Cardholder Data		
	10.1 – Implement audit trails to link all access to system components to each individual user	NeuVector maintains an event log of all user activity and any actions performed to establish an audit trail. This functionality integrates with SIEM systems.
	10.2 – Implement automated audit trails for all system components to reconstruct the following events:	NeuVector tracks all communications between containers. All new communications are automatically logged for later event reconstruction.
	10.2.2 – All actions taken by an individual with root or administrative privileges	*NeuVector maintains an event log of all user activity for the NeuVector components. This includes any operations performed to establish an audit trail. This functionality integrates with SIEM systems.*
	10.2.7 – Creation and deletion of system-level objects	*NeuVector tracks all active containers and will automatically log the creation or deletion of system-level objects.*
	10.3 – Record at least the following audit trail entries for all system components for each event:	NeuVector maintains an event log of all user activity for the NeuVector components and any actions performed to establish an audit trail. This functionality integrates with SIEM systems.

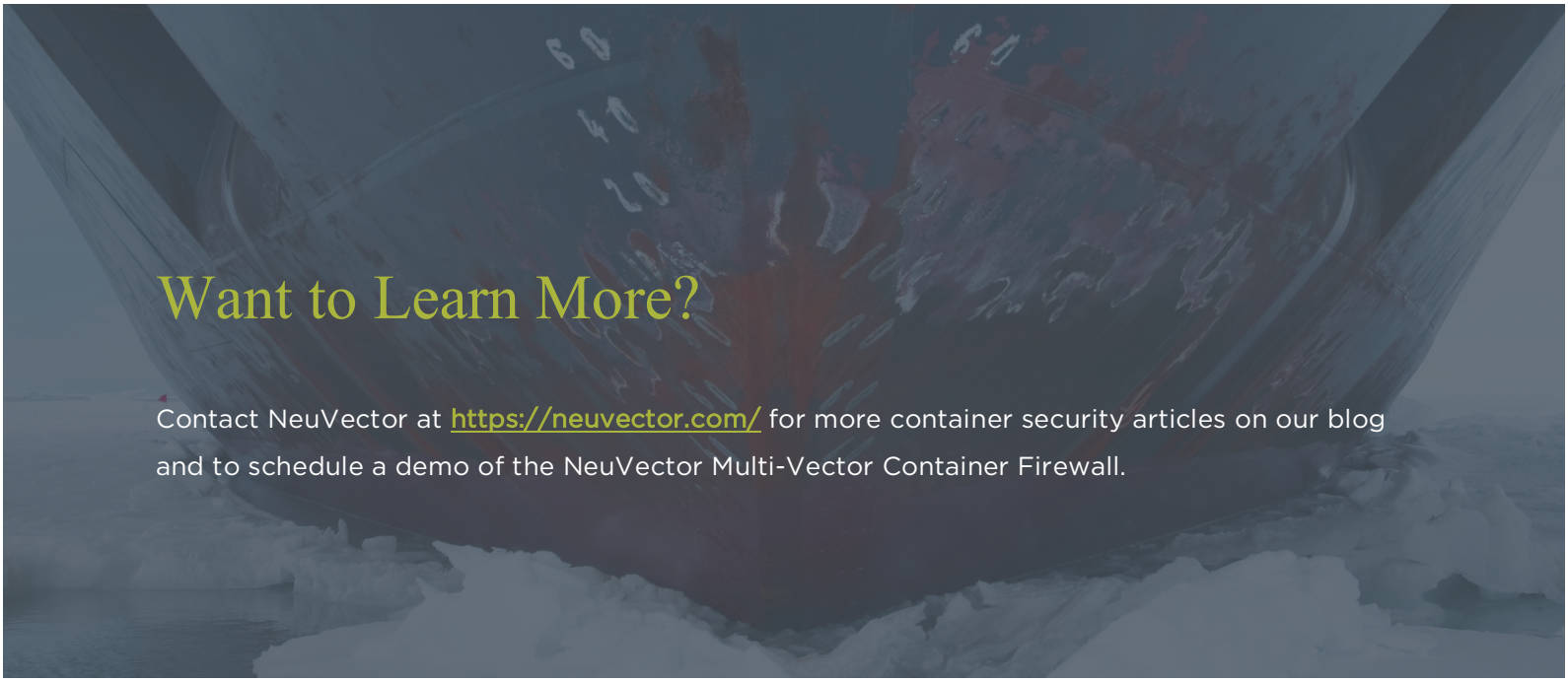
		10.3.1 – User identification	*NeuVector maintains an event log of all user activity for the NeuVector components and any actions performed to establish an audit trail. This functionality integrates with SIEM systems.*
		10.3.2 – Type of event	
		10.3.3 – Date and time	
		10.3.4 – Success or failure indication	
		10.3.5 – Origination of event	
		10.3.6 – Identify or name of affected data, system component, or resource	
	10.5 – Secure audit trails so they cannot be altered		
		10.5.1 – Limit view of audit trails to those with job-related need.	*Access to NeuVector logs is role-based and may be further restricted by SIEM systems.*
		10.5.2 – Protect audit trail files from unauthorized modifications.	*NeuVector recommends using the Linux security features and those of the orchestration tools to protect the NeuVector containers from unauthorized modifications.*
		10.5.3 – Promptly back up audit trail files to a centralized log server or media that is difficult to alter.	*NeuVector uses SYSLOG and webhooks to communicate all audit trail files and events to a central log server.*
	10.6 – Review logs and security events for all system components to identify anomalies or suspicious activity.		NeuVector continually monitors all container activity and communications to identify anomalies and suspicious activity.
11.0 – Regularly Test Security Systems and Processes			
	11.2 – Run internal and external network vulnerability scans at least quarterly and after any significant change in the network (such as new system component installations, changes in network topology, firewall rule modifications, product upgrades).		
		11.2.1 Perform quarterly internal vulnerability scans. Address vulnerabilities and perform rescans to verify all "high risk" vulnerabilities are resolved in accordance with the entity's vulnerability ranking (per Requirement 6.1).	*NeuVector automatically scans running containers and hosts for both common vulnerabilities (CVE) and application specific vulnerabilities. High-risk vulnerabilities are flagged based on the CVSS score. NeuVector can also perform regular registry image scans.*
	11.4 – Use intrusion-detection and/or intrusion-prevention techniques to detect and/or prevent intrusions into the network. Monitor all traffic at the perimeter of the cardholder data environment as well as at critical points in the cardholder data environment, and alert personnel to suspected compromises.		NeuVector uses advanced behavioral learning to immediately detect anomalous behaviors as a means to detecting/preventing intrusions. A whitelist-based security policy assumes all unauthorized connections are suspicious.

	11.5 – Deploy a change-detection mechanism (for example, file-integrity monitoring tools) to alert personnel to unauthorized modification (including changes, additions, and deletions) of critical system files, configuration files, or content files; and configure the software to perform critical file comparisons at least weekly.		NeuVector monitors all container and hosts files systems in production to detect package/library updates, modifications of sensitive folders such as /etc., and downloads of any executables.
		11.5.1 – Implement a process to respond to any alerts generated by the change- detection solution.	*NeuVector provides response rules to respond to file system, process, network, and vulnerability scan events with specialized alerts and container quarantine. NeuVector integrates with SIEM and trouble ticketing systems.*
Maintain an Information Security Policy			
12 – Maintain a Policy That Addresses Information Security for All Personnel			

As shown in the table above, NeuVector provides advanced Multi-Vector container firewall capabilities to make a dynamic microservices/container environment compliant with PCI-DSS requirements. NeuVector accomplishes this through micro-segmentation, giving organizations fine-grain control to tightly manage CDE scope and secure the CDE environment.

There are multiple ways to achieve PCI DSS compliance, but if the solution is too intrusive on the application, networks, or container build processes, the end-result may not justify the means. It is imperative that organizations focus on PCI DSS compliance while at the same time maintaining the unique capabilities of microservices: instant scalability, immutability, flexibility, the speed of development; and, continuous integration/continuous deployment (CI/CD). NeuVector does this by deploying a cloud native layer-7 Firewall integral to the microservices/container infrastructure. In comparison, solutions that require modification of the application container or attributes such as iptables, env variables, cgroups/namespaces to achieve PCI DSS compliance create multiple dependencies and restrictions, limiting the functionality of the underlying microservices environment.

Not all container security solutions are alike, and a close comparison of NeuVector PCI-DSS capabilities will show that NeuVector provides more compliance capabilities than any of its competitors while enabling the benefits of microservices and containers.



Want to Learn More?

Contact NeuVector at https://neuvector.com/ for more container security articles on our blog and to schedule a demo of the NeuVector Multi-Vector Container Firewall.