



Palo Alto Prisma Cloud Compute and Red Hat OpenShift

Lab Guide



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Overview

In this lab, you will use Prisma Cloud Compute to secure runtime aspects of a Red Hat® OpenShift® Cluster.

This lab will cover:

- An overview of Prisma Cloud Compute features and architecture
 - Accessing the Prisma Cloud Compute Console
 - Going through a real world use case using a demo application and Prisma Cloud Compute
-

Prerequisites

In order to participate in the lab, you will need access to the Red Hat Product Demo System (RHPDS) Prisma Cloud Compute for OpenShift cluster [OpenShift CLI client \("oc"\)](#) installed on your local machine.

Prisma Cloud Compute – at a glance

Prisma™ Cloud Compute (PCC) Edition delivers a cloud workload protection platform (CWPP) for modern enterprises, providing holistic protection across hosts, containers, and serverless deployments in any cloud, throughout the software lifecycle. Prisma Cloud Compute Edition is cloud native and API-enabled, protecting all your workloads regardless of their underlying compute technology or the cloud in which they run.

Features

Rounding out its holistic protection, Prisma Cloud Compute Edition offers:

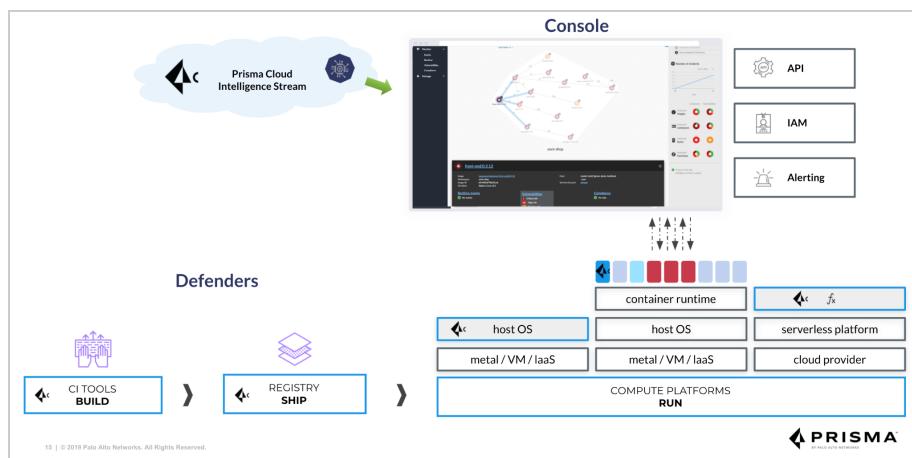
- **Vulnerability management.** Enjoy security from development through production with unmatched vulnerability detection, understanding, and prevention at every stage of the application lifecycle.
- **Compliance.** Easily implement and maintain compliance for Docker, Kubernetes, and Linux CIS Benchmarks as well as external compliance regimes and custom requirements, including the industry's first compliance checks for the Istio® service mesh.
- **CI/CD security.** Integrate security directly into the continuous integration (CI) process to find and fix problems before they ever make it into production.
- **Runtime defense.** Secure your environments at scale with machine learning that automatically creates least-privileged, allow-list-based runtime models for every version of every application.
- **Web application and API security.** Protect against Layer 7 and OWASP Top 10 threats in any public or private cloud.
- **Access control.** Establish and monitor access control measures for cloud workloads and cloud native applications across underlying hosts, Docker, and Kubernetes while integrating with identity and access management (IAM) and secrets management tools, along with other core technologies.

How it works

Prisma Cloud Compute Edition (PCC) provides flexible deployment options to protect your workloads and applications wherever you choose to deploy them. Defenders, agents deployed within your environments, protect standalone VMs, Docker containers, Kubernetes clusters, CaaS, PaaS apps on Red Hat® Openshift® Container Platform, and serverless applications. Defenders protect by allow-listing application behavior and preventing anomalous actions from occurring. Defense in depth combines core cloud native firewalling with runtime defense to protect east-west traffic flows and leverage machine learning for known application behavior.

PCC provides vulnerability management and compliance for the full software lifecycle by integrating with any CI process, Docker registry, code repository, or production environment to continuously monitor risk with powerful risk factors and prioritization. Enterprise-grade access control capabilities govern all cloud resources across compute infrastructure, secrets, Kubernetes audits, and IAM tooling.

Prisma Cloud Compute Architecture



Module 1: Access Prisma Cloud Compute Console

For the RHPDS installation of Prisma Cloud Compute, the console and defenders are installed through automation. You will not be required to enter a license.

You will be provided a link and login credentials from your lab instructor to the OpenShift and Prisma Cloud Compute consoles. Let's get started.

1. In OpenShift, select the **twistlock** project, and navigate to **Networking > Routes**. Click the twistlock-console route to browse and login to Prisma Cloud Compute:



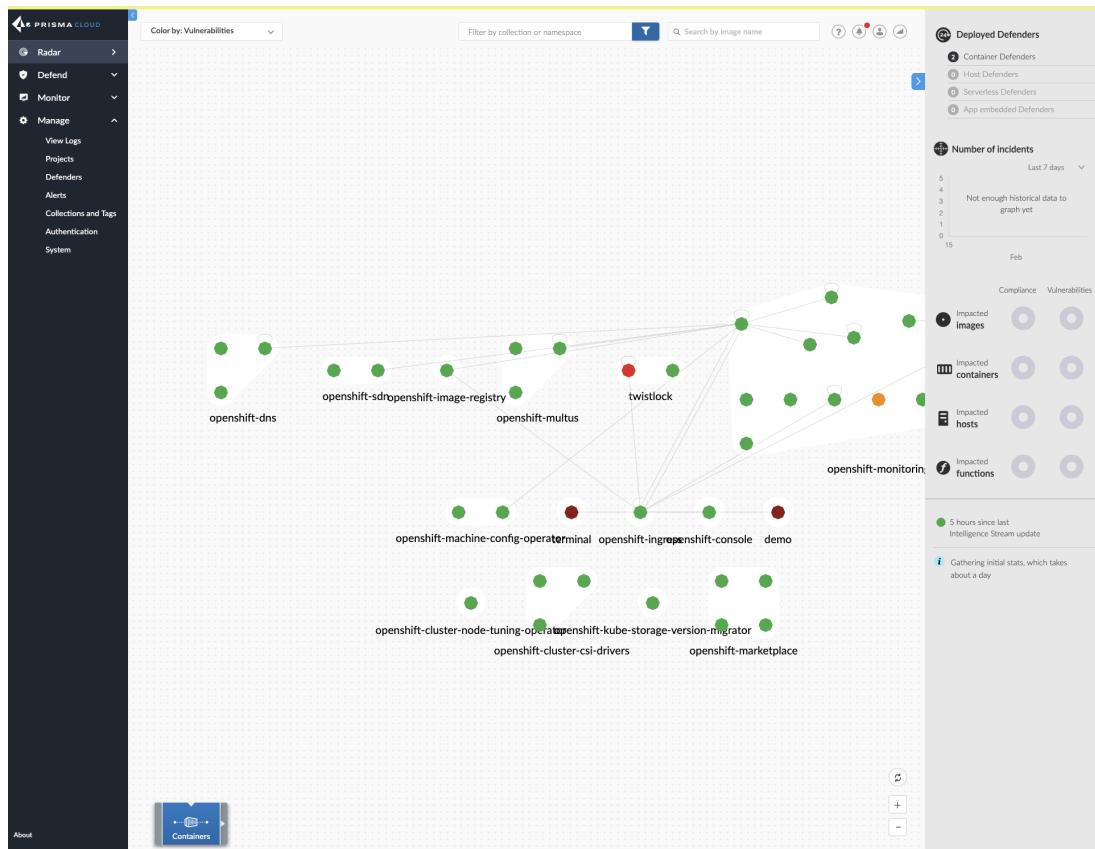
Note: The password is autogenerated via the RHPDS deployment process and provided to the RHPDS admin via email once the deployment is complete.

2. In the Prisma Cloud Console, navigate to **Manage > Defenders > Manage** to see a list of deployed defenders, you will see something similar to the following:

The screenshot shows the 'Manage / Defenders' section of the Prisma Cloud Compute interface. The left sidebar has 'Manage' selected under 'Defenders'. The main area is titled 'Manage deployed Defenders' and includes a note: 'Defenders enforce the policies created in Console. Install Defender on each host you want Prisma Cloud to defend.' Below this is a table with two entries:

Host	Version	Cluster	Type	Listener type	Status	Collections	Actions
ip-10-0-156-114	21.04.439	cluster-ffdzw	Daemon Set CRI on Linux	None	Connected for 1 hour	■	...
ip-10-0-184-100	21.04.439	cluster-ffdzw	Daemon Set CRI on Linux	None	Connected for 1 hour	■	...

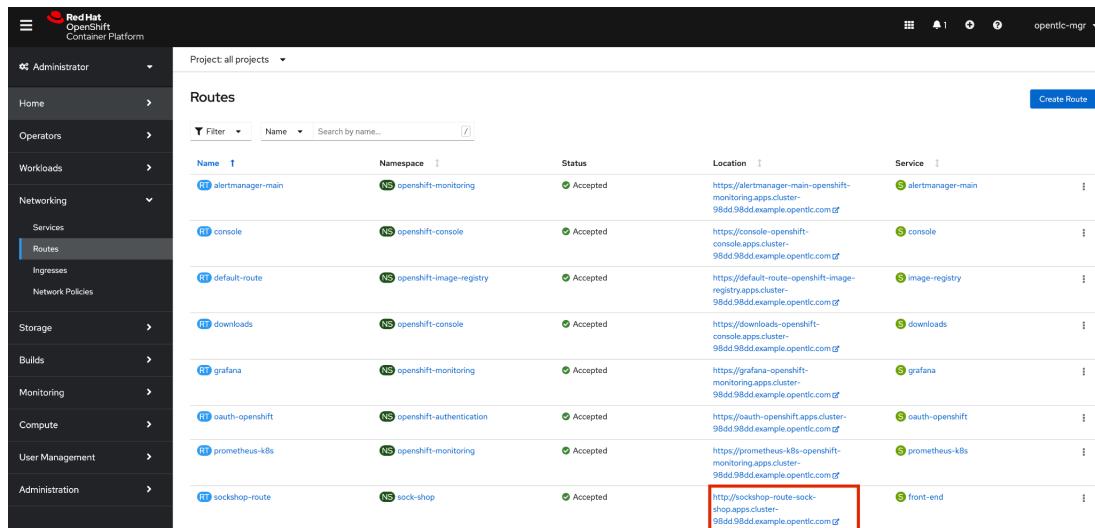
3. Navigate to the **Radar** View on the left menu and select **Container** from the bottom menu option. You will see the defender has begun to scan the existing environment and populate the Console with information.



Module 2: Sock Shop – Microservices Demo Application

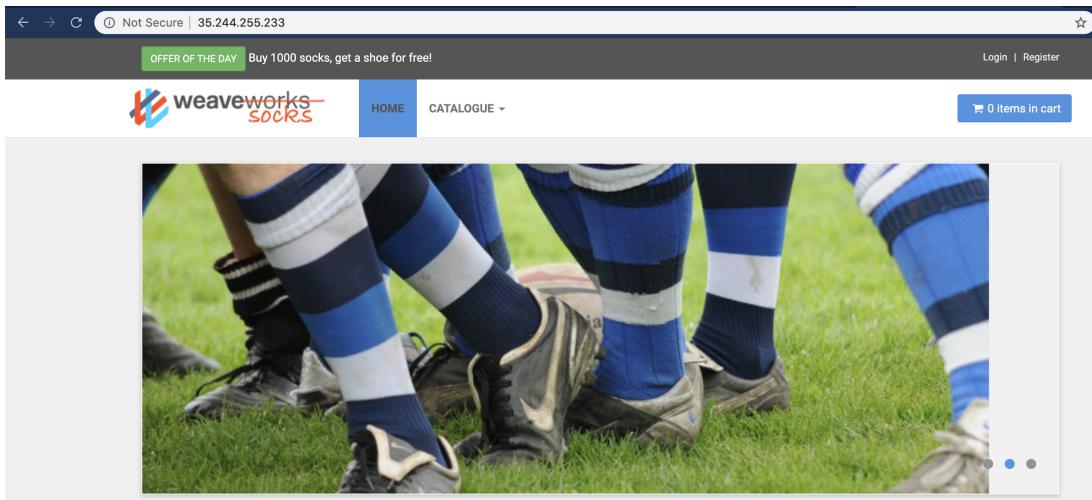
Now we're ready to deploy some applications on our cluster. We will use Sock Shop which emulates a typical service we would see on the internet. For this lab we have installed Sock Shop for your use.

- Verify the **sockshop-route** location is available via the OpenShift console, navigate to **Networking > Routes** to see a list of routes available, you will see something similar to the following:



Name	Namespace	Status	Location	Service
alertmanager-main	openshift-monitoring	Accepted	https://alertmanager-main.openshift-monitoring.apps.cluster-98dd98dd.example.openitic.com:8443	alertmanager-main
console	openshift-console	Accepted	https://console-openshift-console.apps.cluster-98dd98dd.example.openitic.com:8443	console
default-route	openshift-image-registry	Accepted	https://default-route-openshift-image-registry.apps.cluster-98dd98dd.example.openitic.com:8443	image-registry
downloads	openshift-console	Accepted	https://downloads-openshift-console.apps.cluster-98dd98dd.example.openitic.com:8443	downloads
grafana	openshift-monitoring	Accepted	https://grafana-openshift-monitoring.apps.cluster-98dd98dd.example.openitic.com:8443	grafana
sauth-openshift	openshift-authentication	Accepted	https://sauth-openshift.apps.cluster-98dd98dd.example.openitic.com:8443	oauth-openshift
prometheus-k8s	openshift-monitoring	Accepted	https://prometheus-k8s-openshift-monitoring.apps.cluster-98dd98dd.example.openitic.com:8443	prometheus-k8s
sockshop-route	sock-shop	Accepted	http://sockshop-route-sock-shop.apps.cluster-98dd98dd.example.openitic.com:80	front-end

- Click on the **sockshop-route** Location URL. A new window will pop-up and you should see the following:

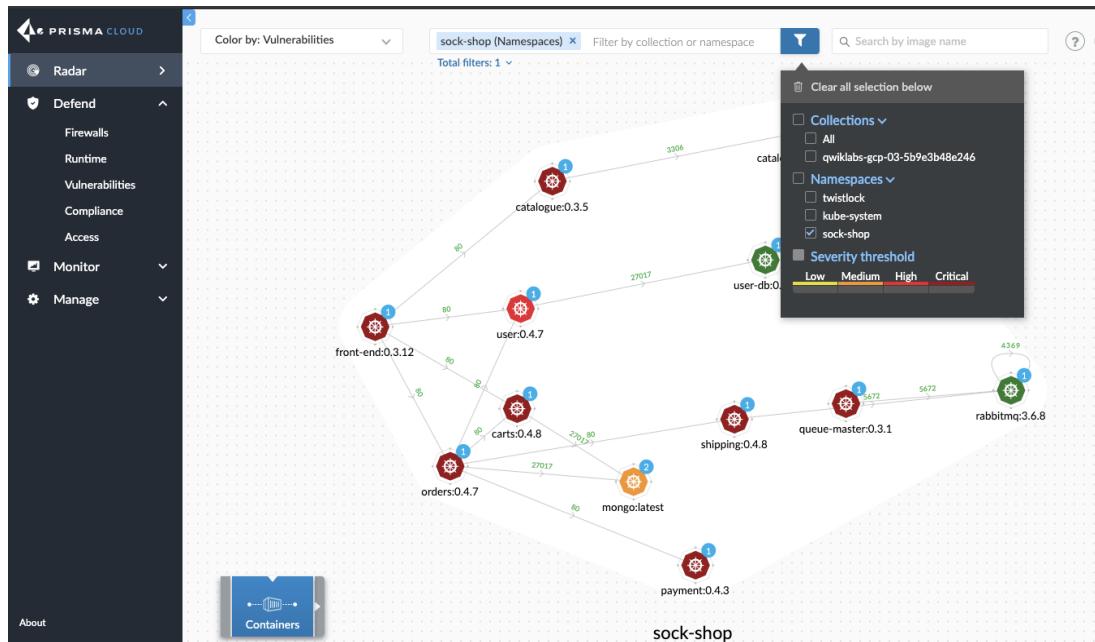


6. Register on the SockShop website with the fake credentials (*All information including email, names, address, credit card info should be fake*):
Username: user
Password : password
7. Browse around the site and purchase some items. Create a fake credit card account (*use at least 5 digits for the card number*), and shipping address. By doing this you are generating communication traffic. This will allow Prisma Cloud Compute to learn communication paths between the containers.

Order	Date	Total	Status	Action
# 5f8db68ed56b1b00075d3b73	2020-10-19 15:53:50	\$ 37.99	Shipped	View
# 5f8db68fd56b1b00075d3b74	2020-10-19 15:53:51	\$ 4.99	Shipped	View

8. Go to **Radar** > **Setting** > **Container network monitoring**, and toggle the switch to Enable.

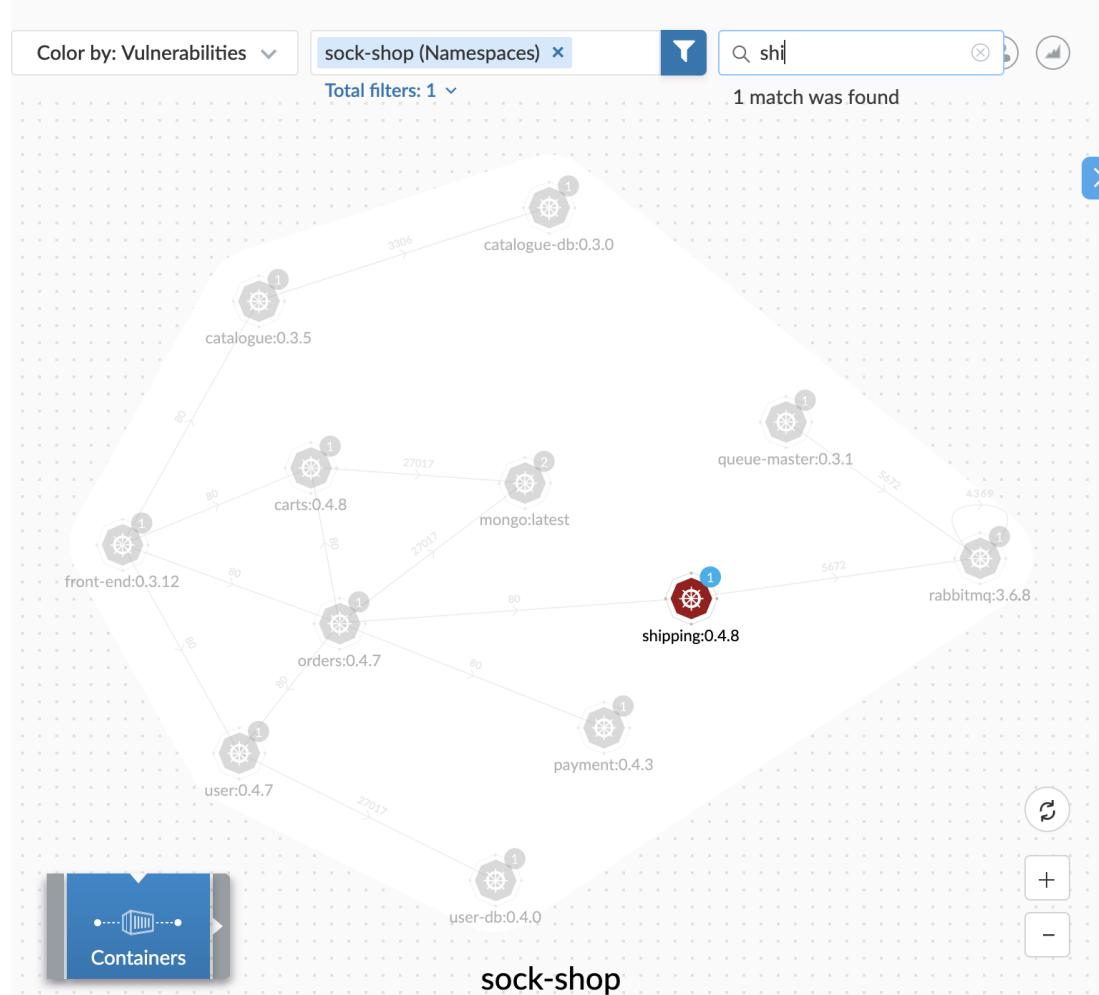
- Click on **Radar** > **Containers**, and check **sock-shop** in the filter, then refresh in the lower right-hand corner. Additional container services will be visible as well as the communication paths.



- In the Prisma Cloud Compute console, view all the services that are running in the deployments created so far: Click the **+** or **-** sign at lower right corner to adjust the view. This represents the Sock Shop website vulnerable containers.



11. Type “**shi**” in the search box to search for a container name starting with “**shi**”.



12. Click the container named **shipping:0.4.8** to see all the information and alerts Prisma Cloud Compute has found that are associated with this container:

The screenshot shows the Palo Alto Prisma Cloud interface. On the left, a sidebar navigation includes Radar, Defend (Firewalls, Runtime, Vulnerabilities, Compliance, Access), Monitor (Containers, Hosts, Workloads, Metrics, Events, Logs, Dashboards), and Manage (Clusters, Namespaces, Images, Services, Deployments, Events, Metrics, Logs). The main area displays a container named "shipping:0.4.8" in the "sock-shop" namespace. Key details shown include:

- Image:** weaveworksdemos/shipping:0.4.8
- Namespace:** sock-shop
- Image ID:** 4fc533e8180ac380
- OS distro:** Alpine Linux v3.4
- Host:** gke-k8-cluster-default-pool-0f8821d9-845g
- Service Account:** default

Runtime events: No events

Vulnerabilities:

- 23 Critical risk
- 37 High risk
- 23 Medium risk
- 0 Low risk

Compliance: No risks

Graph: A network diagram showing dependencies between catalogues: catalogue-0.3.5, catalogue-0.3.0, and catalogue-0.3.1.

Deployed Defenders:

- Container Defenders: 3
- Host Defenders: 0
- Serverless Defenders: 0
- App embedded Defenders: 0

Number of incidents: Last 7 days. Not enough historical data to graph yet.

Metrics:

- Impacted images: 0
- Impacted containers: 0

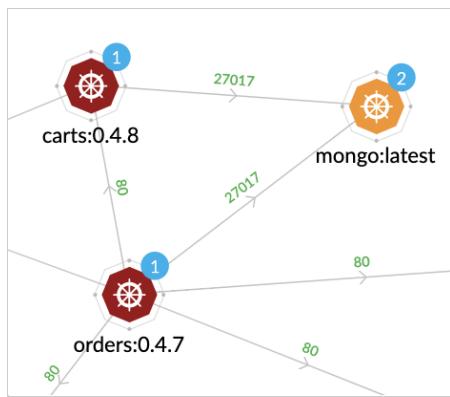
- Click **Vulnerabilities**. Click on one of the lists to expand it and list its associated CVE:

shipping:0.4.8

Image: weaveworksdemos/shipping:0.4.8
ID: sha256:4fc533e8180ac3805582d3b2a9f8008d54d346211894d6131d92a82d17ee5458
OS: Alpine Linux v3.4
distribution:
OS release: 3.4.6
Digest: sha256:983305c948fded487f4a4acdeab5f898e89d577b4bc1ca3de7750076469ccad4
Namespaces: sock-shop
Running in: 1 container

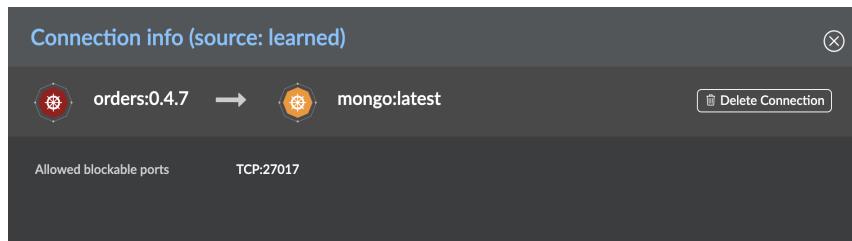
Type	Highest Severity	Description					
~ jar	critical	org.springframework.boot version 1.4.0.RELEASE has 2 vulnerabilities.					
	Severity	Package	CVE	Fix Status	Risk Factors	Description	Tags
	critical	org.springframewor	CVE-2017-8046	fixed	5	Impacted versions: <1.5.9 Discovered: Less than an hour ago Published: >2 weeks ago	Add Tags to CVE
		ework.boot		in			
		oot_spring-boot		1.5.9			

14. Close the container details, clear the search, and go back to Radar view. Now find the container **mongo:latest** and observe the network connections to the container from container **order:0.4.7**



15. Click on the link between **order:0.4.7** and **mongo:latest** and notice:
- The traffic is using TCP port 27017

- b. The direction is from **order:0.4.7** to **mongo:latest**



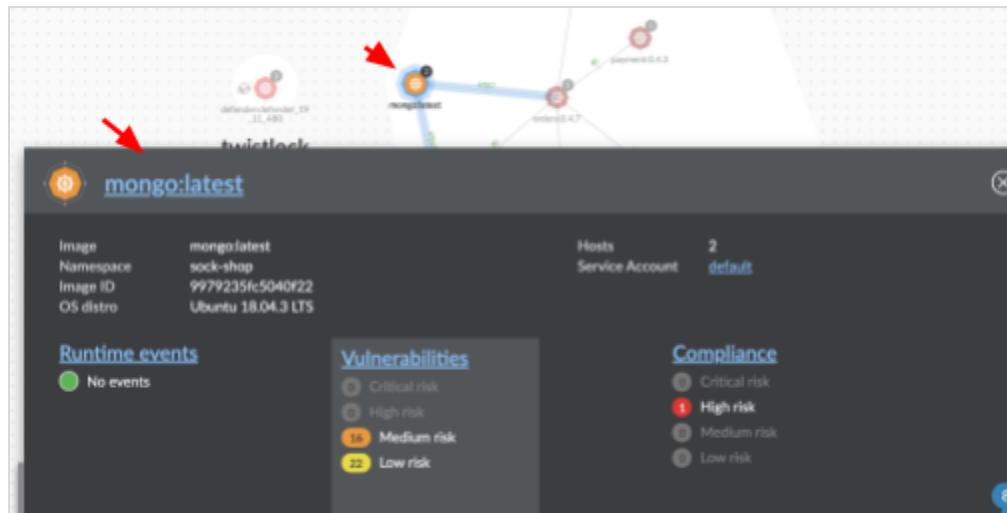
Module 3: Runtime Security and Container Runtime Model

Modern threats require layered runtime protection. When a new CVE (refer to [LINK](#) for the details on CVEs) is announced that affects a container image in your runtime environment, you need automated runtime protection that secures your entire environment. Prisma Cloud Compute is able to automatically learn and build a 4-dimension Container Model about your environment: network, file system, processes, and system calls.

Contain Models are the results of the autonomous learning that Prisma Cloud Compute performs every time it sees a new image in an environment. A model is the allow list for what a given image should be doing, across all runtime sensors. Models are automatically created and maintained by Prisma Cloud Compute. They provide an easy way for administrators to view and understand what Prisma Cloud Compute has learned about their images. Critically, models are built from both static analysis (such as building a hashed process map based on parsing an init script in a Dockerfile ENTRYPOINT) and dynamic behavioral analysis (such as observing actual process activity during early runtime of the container).

Next, let's review the Contain Model of a service in Sock Shop and what Prisma Cloud Compute has learned so far:

16. Select **Radar** tab in the left panel, then click on **mongo:latest** at Radar Map.
17. Click on **mongo:latest** hyperlink in the service details pop up to explore the details about the service **mongo:latest**.



18. Review the information under the **General** tab.

mongo:latest

General Processes Networking File System Capabilities History Service Account

State	Learning
Image	mongo:latest
ID	sha256:3f3daf8637573f4568ba35ee0f818aa25384f547b6e9cfa0c9bf39b92
Namespace	sock-shop
Created	Less than an hour ago

19. Click the **Process** tab to review all processes run by **mongo:latest**.

mongo:latest

General **Processes** Networking File System Capabilities History Service Account

Static	App	MD5
	/bin/echo	518882eba51b05a15463e6398...
	/bin/chmod	f1f0ca8ec9aac811733d1c9435e...
	/usr/bin/dpkg-divert	34648d4a53a8dd0373280cce26...
	/bin/cp	f7d53f25b67715fd4959eb7787...
	/bin/cat	2b11da758022d82-e5-71084ded

Behavioral	App	Parent	Detection Time
	There is no data to show		

Extended behavioral	App	Parent	Modified
	There is no data to show		

20. Click on the **Networking** tab to review the learned networking ports, internet connections, and domains that are used by **mongo:latest**. You can see there is no internet connection, and the internal listening port is 27017.

The screenshot shows the Prisma Cloud Compute interface for the mongo:latest container. The Networking tab is selected. The interface is divided into four sections:

- Static listening ports:** A table with columns App and Ports. One entry is shown: App /usr/bin/mongod and Ports 27017.
- Behaviorally learned listening ports:** A table with columns App and Ports. The message "There is no data to show" is displayed.
- Behaviorally learned outbound internet ports:** A table with column Port. The message "There is no data to show" is displayed.
- Behaviorally learned domains:** A table with columns Domain and Type. The message "There is no data to show" is displayed.

- Click on the **File System** tab to review learned file system mount points accessed by **mongo:latest**.

The screenshot shows the Prisma Cloud Compute interface for the mongo:latest container. The File System tab is selected. The interface is divided into two sections:

- Static:** A table with columns Process and Paths. One entry is shown: Process * and Paths /tmp.
- Behavioral:** A table with columns Process and Paths. One entry is shown: Process /usr/bin/mongod and Paths /data/db.

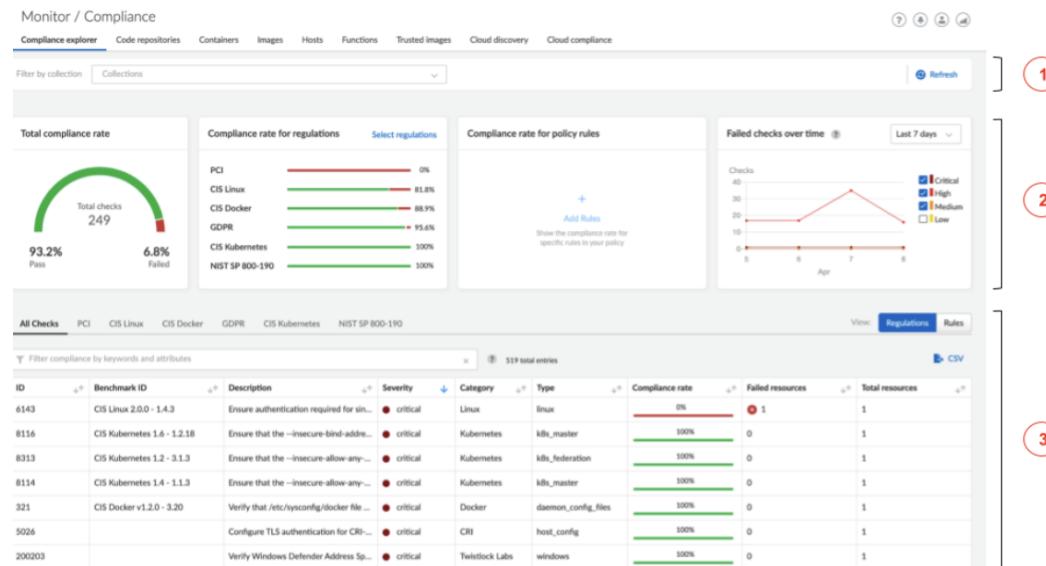
You have reviewed the container runtime model learned by Prisma Cloud Compute. After the learning period, any process, network activity, file system access, or system call beyond the Container Model can be detected as anomalous behavior. You have the option to set a policy to alert, prevent, or block the anomalous behavior.

Module 4: Compliance & Malware Scanning

Compliance Explorer is a reporting tool for compliance rate. Metrics present the compliance rate for resources in your environment on a per-check, per-rule, and per-regulation basis. Report data can be exported to CSV files for further investigation.

The key pivot for Compliance Explorer is failed compliance checks. Compliance Explorer tracks each failed check, and the resources impacted by each failed check. From there, you can further slice and dice the data by secondary facets, such as collection, benchmark, and issue severity.

Go to **Monitor > Compliance > Compliance Explorer**



- Collection filter.** Collections group related resources together. Use them to filter the data in Compliance Explorer. For example, you might want to see how all the entities in the sock-shop namespace in your production cluster comply with the checks in the PCI DSS template.
- Roll-up charts.** Configurable charts that summarize compliance data for the perspectives you care about. They report the following data:
 - Total compliance rate for your entire estate.
 - Compliance rate by regulation. Click Select regulations to configure which benchmarks and templates are shown on the page. Benchmarks are

industry-standard checklists, such as the CIS Docker Benchmark. Templates are Prisma Cloud-curated checklists. Checks are selected from the universe of checks provided in the product that pertain to directives in a regulatory regime, such as the Payment Card Industry Data Security Standard (PCI DSS).

- **Compliance rate by rule.** Provides another mechanism to surface specific segments of your environment when scrutinizing compliance. Click Add rule to configure the card.
- **Historical trend chart for compliance rate.** Shows how the compliance rate has changed over time.

The lists in the regulation and rule cards are sorted by compliance rate (the lowest compliance rate first).

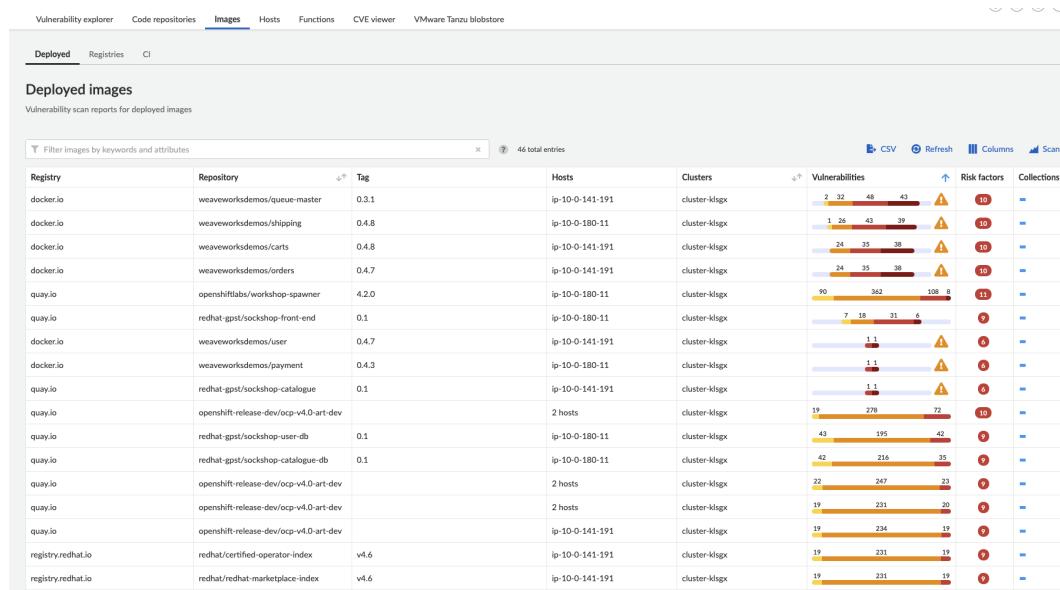
3. **Results table.** Shows the universe of compliance checks, and the compliance rate for each check, relative to:

- Your policies and the checks that are enabled. Every compliance check has an ID, and it's either enabled or disabled.
- The collection selected at the top of the page.
- The filters applied (e.g. show critical severity issues only.)

Besides detecting software vulnerabilities (CVEs) and compliance issues (such as images configured to run as root), Prisma Cloud also detects malware in your container images. No special configuration is required to enable this feature.

Malware data is sourced from commercial providers, Prisma Cloud Labs, and open source lists. The image scanner looks for malware in binaries in the image layers, including the base layer.

Go to **Monitor > Vulnerabilities > Images**



Click on an image to get a detailed report from the last image scan.

In the detailed report, click on the **Compliance** tab.

Issues with vulnerability ID 422 means that your image contains a file with an md5 signature of known malware.

NOTE: You may not have this malware listed for this lab.

Module 5: Runtime Defense - ATT&CK Explorer

Prisma Cloud's monitoring section includes an Att&CK Explorer dashboard, providing a framework that helps you to contextualize runtime audits, manage them, and generate risk reports.

ATT&CK Explorer is a knowledge base of tactics and techniques that adversaries use to attack applications and infrastructure. It's a useful framework for threat-informed defense, where a deep understanding of adversary tradecraft can help protect against attacks.

The ATT&CK framework has two key concepts:

- **Tactics.** An adversary's technical goals.
- **Techniques.** How those goals are achieved or What they achieve

Go to **Monitor > ATT&CK**

The screenshot shows the Prisma Cloud ATT&CK Explorer dashboard. The left sidebar navigation includes: Dashboard, Inventory, Investigate, Policies, Compliance, Alerts (258), Compute, Access, Custom Configs, MONITOR, ATTACK, Events, Runtime, Vulnerabilities, Compliance, WAAAS, MANAGE, Network Security, Settings, Alarms (15), Subscription (Trial), Harish Srinivasan, and All Applications. The main content area is titled "ATT&CK Explorer" and displays a grid of audit events. The grid columns represent ATT&CK tactics: Initial Access (119), Execution (238), Persistence (2), Privilege Escalation (34), Defense Evasion (0), Credential Access (0), Discovery (27), Lateral Movement (0), Collection (0), Command and Control (0), Exfiltration (0), and Impact (11). The rows represent specific audit events, such as "Exploit Public-Facing Application" (119 events), "Supply Chain Compromise", "Access the Kubelet Main API", "Abuse Elevation Control Mechanisms", "Obfuscated Files", "Cloud Instance Metadata API", "Access the Kubelet Main API", "Access the Kubelet Main API", "Man-in-the-Middle", "Command And Control/ General", "Exfiltration", "Account Access Removal", "Endpoint Denial-of-Service" (11 events), "Resource Hijacking", and various other techniques like "Exploit for Privilege Escalation", "Create Account", "Privileged Container", "Impair Defences", "Man-in-the-Middle", "Cloud Instance Metadata API", "Lateral Tool Transfer", "Foreign Binary Execution", "Event Triggered Execution", "Writable Volumes" (2 events), "Compile After Delivery", "Unsecured Credentials", "Network Service Scanning" (27 events), "Software Deployment Tools", "Native Binary Execution", "Hijack Execution Flow", "Hijack Execution Flow", "Masquerading", "Kubernetes Secrets", "Query the Kubelet Readonly API", "Exploitation of Remote Services", "Scheduled Task/Job", "Scheduled Task/Job", "Access the Kubernetes API Server", "System Network Configuration Discovery", and "Exploit Application". A search bar at the top says "Search techniques by attributes" and a filter says "Time: Last 7 days". A status bar at the bottom right says "310 total entries (filtered)" and "3 ?".

The ATT&CK dashboard serves as a portal to the raw events in the **Monitor > Events** view. All Prisma Cloud audits are mapped to the tactics and techniques in the ATT&CK framework. For example, when Defender detects a crypto miner in your environment, we map the audit to the Resource Hijacking technique under the Impact tactic.

The ATT&CK dashboard collates audits, maps them to the tactics and techniques, and presents the data visually in the ATT&CK matrix. Each card in the matrix shows a count of events. Higher counts represent higher severity issues. Filters let you slice and dice the data to inspect specific segments of your environment.

You may not show any count for this lab.

Module 6: Alerts

Prisma Cloud lets you surface critical policy breaches by sending alerts to any number of channels. Alerts ensure that significant events are put in front of the right audience at the right time. You can create any number of alert profiles, where each profile gives you granular control over which audience should receive which notifications.

Go to **Manage > Alerts**

- Alert mechanism
- AWS Security Hub
- Cortex XSOAR
- Email
- Google Cloud Pub/Sub
- Google Cloud SCC
- IBM Cloud Security Advisor
- JIRA
- PagerDuty
- ServiceNow Security Incident Response
- ServiceNow Vulnerability Response
- Slack
- Webhook

For this lab, we will not enable Alerts.

End of Workshop!

Learn more

- Prisma Cloud for Red Hat OpenShift
<https://www.paloaltonetworks.com/prisma/environments/red-hat-openshift>
- Prisma Cloud Compute on OpenShift (10 min demo video)
<https://www.youtube.com/watch?v=KLrwxGSr5g>
- Official Prisma Cloud marketing and technical documentation
<https://www.paloaltonetworks.com/prisma/cloud>
- Prisma Cloud Compute Edition Red Hat OpenShift Operator
<https://catalog.redhat.com/software/operators/detail/5e9877e83f398525a0ceb196>
- Webinar: DevSecOps for cloud-native applications with Prisma Cloud
<https://www.brighttalk.com/webinar/devsecops-for-cloud-native-applications-with-prisma-cloud/>