Red Hat Advanced Cluster Security for Kubernetes 4.3

Architecture

System architecture

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Legal Notice

Abstract

Provides an overview and description of the Red Hat Advanced Cluster Security for Kubernetes architecture.

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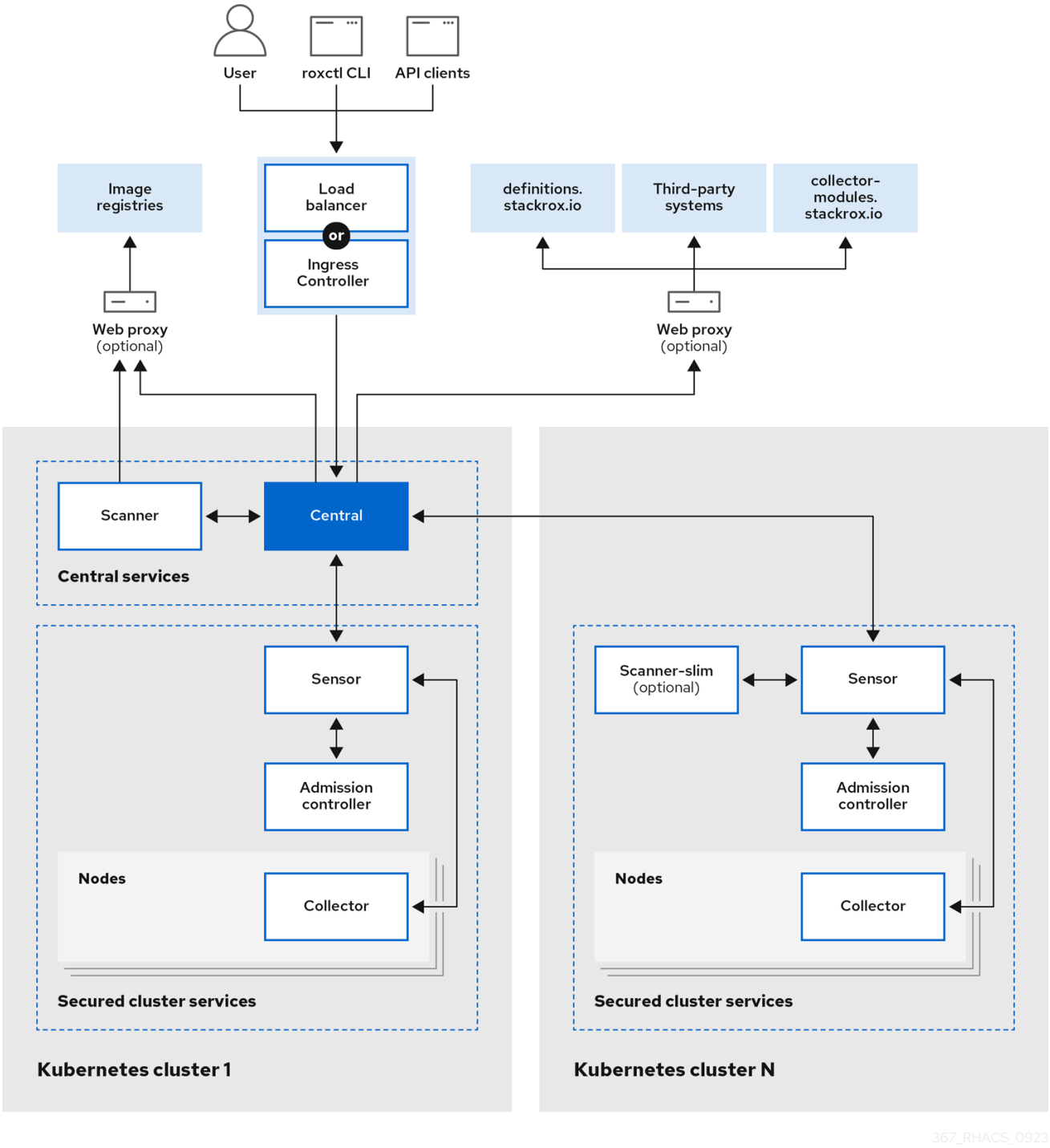
CHAPTER 1. RED HAT ADVANCED CLUSTER SECURITY FOR KUBERNETES ARCHITECTURE

Discover Red Hat Advanced Cluster Security for Kubernetes architecture and concepts.

1.1. RED HAT ADVANCED CLUSTER SECURITY FOR KUBERNETES ARCHITECTURE OVERVIEW

Red Hat Advanced Cluster Security for Kubernetes (RHACS) uses a distributed architecture that supports high-scale deployments and is optimized to minimize the impact on the underlying OpenShift Container Platform or Kubernetes nodes.

Figure 1.1. Red Hat Advanced Cluster Security for Kubernetes architecture for Kubernetes



NOTE

The architecture is slightly different when you install RHACS on Kubernetes and in OpenShift Container Platform. However, the underlying components and the interactions between them remain the same.

You install RHACS as a set of containers in your OpenShift Container Platform or Kubernetes cluster. RHACS includes:

- Central services you install on one cluster.
- Secured cluster services you install on each cluster you want to secure by RHACS.

In addition to these primary services, RHACS also interacts with other external components to enhance your clusters' security.

Additional resources

- Architectural differences between installation on OpenShift Container Platform and Kubernetes
- External components

1.2. CENTRAL SERVICES

You install Central services on a single cluster. These services include three main components, Central, Central DB and Scanner.

- **Central**: Central is the RHACS application management interface and services. It handles API interactions and user interface (RHACS Portal) access. You can use the same Central instance to secure multiple OpenShift Container Platform or Kubernetes clusters.
- **Central DB**: Central DB is the database for RHACS and handles all data persistence. It is currently based on PostgreSQL 13.
- **Scanner**: Scanner is a Red Hat-developed and certified vulnerability scanner for scanning container images. Scanner performs the following functions:
    - It analyzes all image layers and checks for known vulnerabilities from the Common Vulnerabilities and Exposures (CVEs) list.
    - It identifies vulnerabilities in installed packages and dependencies for multiple programming languages. In addition to scanning container images, Scanner identifies vulnerabilities in the node's operating system and orchestrators. For example, it scans nodes to identify Kubernetes, OpenShift Container Platform, and Istio vulnerabilities.

1.3. SECURED CLUSTER SERVICES

You install the secured cluster services on each cluster that you want to secure by using the RHACS Cloud Service. Secured cluster services include the following components:

- **Sensor**: Sensor is the service responsible for analyzing and monitoring the cluster. Sensor listens to the OpenShift Container Platform or Kubernetes API and Collector events to report the current state of the cluster. Sensor also triggers deploy-time and runtime violations based on RHACS Cloud Service policies. In addition, Sensor is responsible for all cluster interactions, such as applying network policies, initiating reprocessing of RHACS Cloud Service policies, and interacting with the Admission controller.
- **Admission controller**: The Admission controller prevents users from creating workloads that violate security policies in RHACS Cloud Service.
- **Collector**: Collector analyzes and monitors container activity on cluster nodes. It collects container runtime and network activity information and sends the collected data to Sensor.
- **Scanner**: In Kubernetes, the secured cluster services include Scanner-slim as an optional component. However, on OpenShift Container Platform, RHACS Cloud Service installs a Scanner-slim version on each secured cluster to scan images in the OpenShift Container Platform integrated registry and optionally other registries.

1.4. EXTERNAL COMPONENTS

Red Hat Advanced Cluster Security for Kubernetes (RHACS) interacts with the following external components:

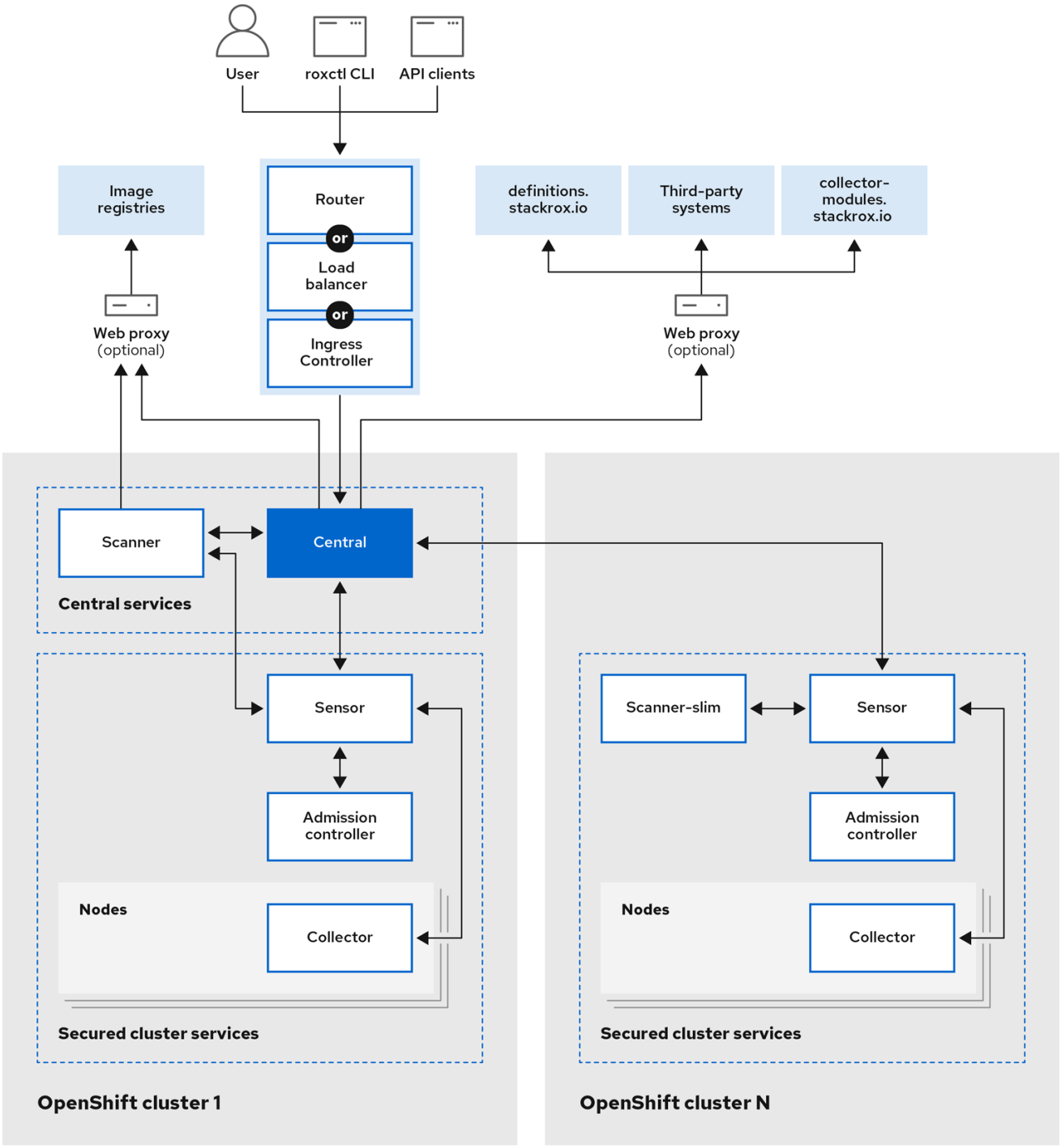
- **Third-party systems**: You can integrate RHACS with other systems such as CI/CD pipelines, event management (SIEM) systems, logging, email, and more.
- **roxctl**: **roxctl** is a command-line interface (CLI) for running commands on RHACS.
- **Image registries**: You can integrate RHACS with various image registries and use RHACS to scan and view images. RHACS automatically configures registry integrations for active images by using the image pull secrets discovered in secured clusters. However, for scanning inactive images, you must manually configure registry integrations.
- **definitions.stackrox.io**: RHACS aggregates the data from various vulnerability feeds at the **definitions.stackrox.io** endpoint and passes this information to Central. The feeds include general, National Vulnerability Database (NVD) data, and distribution-specific data, such as Alpine, Debian, and Ubuntu.
- **collector-modules.stackrox.io**: Central reaches out to **collector-modules.stackrox.io** to obtain supported kernel modules and passes on these modules to Collector.

1.5. ARCHITECTURAL DIFFERENCES BETWEEN INSTALLATION ON OPENSHIFT CONTAINER PLATFORM AND KUBERNETES

When you install RHACS on the OpenShift Container Platform, there are only two architectural differences:

1. RHACS installs a lightweight version of Scanner on every secured cluster when you install RHACS on the OpenShift Container Platform using the Operator or the Helm install method. The lightweight Scanner enables the scanning of images in the integrated OpenShift Container Registry (OCR).
2. Sensor communicates with Scanner in the cluster where you have installed Central. This connection allows accessing internal registries attached to the cluster.

Figure 1.2. Red Hat Advanced Cluster Security for Kubernetes architecture for OpenShift Container Platform



1.6. INTERACTION BETWEEN THE SERVICES

This section explains how RHACS services interact with each other.

Component	Direction	Interacts with	Description

Component	Direction	Interacts with	Description
Central	▮	Scanner	There is bidirectional communication between Central and Scanner. Central requests image scans from Scanner, and Scanner requests updates to its CVE database from Central.
Central	→	**definitions.stackrox.io**	Central connects to the **definitions.stackrox.io** endpoint to receive the aggregated vulnerability information.
Central	→	**collector-modules.stackrox.io**	Central downloads supported kernel modules from **collector-modules.stackrox.io**.
Central	→	Image registries	Central queries the image registries to get image metadata. For example, to show Dockerfile instructions in the RHACS portal.
Scanner	→	Image registries	Scanner pulls images from the image registry to identify vulnerabilities.
Sensor	▮	Central	There is bidirectional communication between Central and Sensor. Sensor polls Central periodically for downloading updates for the sensor bundle configuration. It also sends events for the observed activity for the secured cluster and observed policy violations. Central communicates with Sensor to force reprocessing of all deployments against enabled policies.
Sensor	▮	Scanner	Only in OpenShift Container Platform, Sensor communicates with Scanner to access the local registry attached to the cluster. Scanner communicates with Sensor to request data from **definitions.stackrox.io**.

Component	Direction	Interacts with	Description
Collector	▌	Sensor	Collector communicates with Sensor and sends all of the events to the respective Sensor for the cluster. On supported OpenShift Container Platform clusters, Collector analyzes the software packages installed on the nodes and sends them to Sensor so that Scanner can later scan them for vulnerabilities. Collector also requests missing drivers from Sensor. Sensor requests compliance scan results from Collector. Additionally, Sensor receives external Classless Inter-Domain Routing information from Central and pushes it to the Collector.
Admission controller	▌	Sensor	Sensors send the list of security policies to enforce to the Admission controller. Admission controller sends security policy violation alerts to Sensor. Admission controller can also request image scans from Sensor when required.
Admission controller	→	Central	It is not common; however, Admission controller can communicate with Central directly if the Central endpoint is known and Sensor is unavailable.

CHAPTER 2. RED HAT ADVANCED CLUSTER SECURITY CLOUD SERVICE ARCHITECTURE

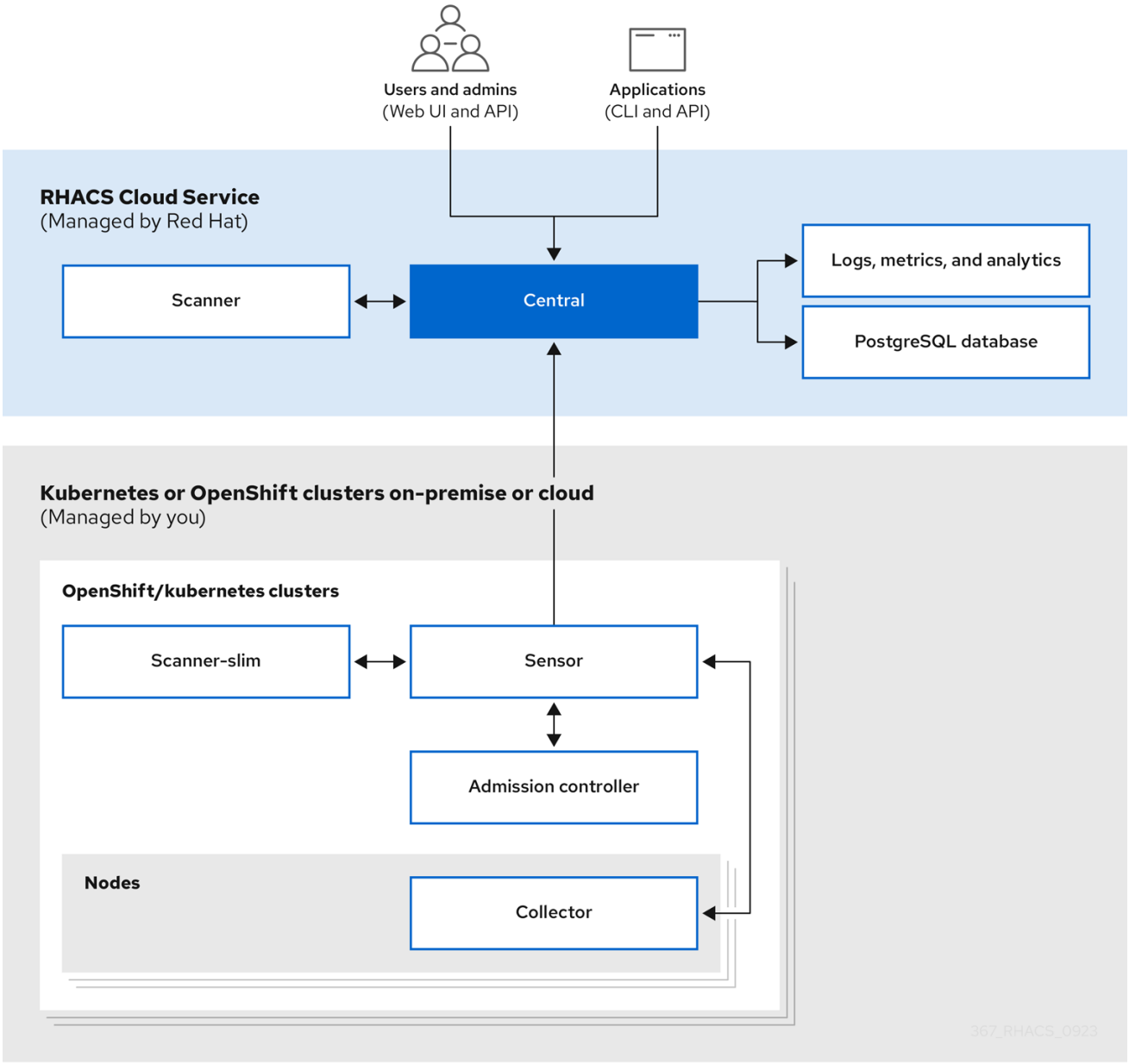
Discover Red Hat Advanced Cluster Security Cloud Service (RHACS Cloud Service) architecture and concepts.

2.1. RED HAT ADVANCED CLUSTER SECURITY CLOUD SERVICE ARCHITECTURE OVERVIEW

Red Hat Advanced Cluster Security Cloud Service (RHACS Cloud Service) is a Red Hat managed Software-as-a-Service (SaaS) platform that lets you protect your Kubernetes and OpenShift Container Platform clusters and applications throughout the build, deploy, and runtime lifecycles.

RHACS Cloud Service includes many built-in DevOps enforcement controls and security-focused best practices based on industry standards such as the Center for Internet Security (CIS) benchmarks and the National Institute of Standards Technology (NIST) guidelines. You can also integrate it with your existing DevOps tools and workflows to improve security and compliance.

Figure 2.1. RHACS Cloud Service architecture



Central services include the user interface (UI), data storage, RHACS application programming interface (API), and image scanning capabilities. You deploy your Central service through the Red Hat Hybrid Cloud Console. When you create a new ACS instance, Red Hat creates your individual control plane for RHACS.

RHACS Cloud Service allows you to secure self-managed clusters that communicate with a Central instance. The clusters you secure, called Secured Clusters, are managed by you, and not by Red Hat. Secured Cluster services include optional vulnerability scanning services, admission control services, and data collection services used for runtime monitoring and compliance. You install Secured Cluster services on any OpenShift or Kubernetes cluster you want to secure.

2.2. CENTRAL

Red Hat manages Central, the control plane for RHACS Cloud Service. It includes three main components: Central, Central DB, and Scanner.

- **Central**: Central is the application management interface and services for RHACS Cloud Service. It manages API interactions and user interface access. You can use the same Central instance to secure multiple OpenShift Container Platform or Kubernetes clusters.
- **Central DB**: Central DB is the database for RHACS Cloud Service and handles all data persistence. It is currently based on PostgreSQL 13.
- **Scanner**: Scanner is a Red Hat-developed and certified vulnerability scanner for scanning container images. Scanner performs the following functions:
    - It analyzes all image layers and checks for known vulnerabilities from the Common Vulnerabilities and Exposures (CVEs) list.
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2.3. SECURED CLUSTER SERVICES

You install the secured cluster services on each cluster that you want to secure by using the RHACS Cloud Service. Secured cluster services include the following components:

- **Sensor**: Sensor is the service responsible for analyzing and monitoring the cluster. Sensor listens to the OpenShift Container Platform or Kubernetes API and Collector events to report the current state of the cluster. Sensor also triggers deploy-time and runtime violations based on RHACS Cloud Service policies. In addition, Sensor is responsible for all cluster interactions, such as applying network policies, initiating reprocessing of RHACS Cloud Service policies, and interacting with the Admission controller.
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Additional resources

- External components

2.4. DATA ACCESS AND PERMISSIONS

Red Hat does not have access to the clusters on which you install the secured cluster services. Also, RHACS Cloud Service does not need permission to access the secured clusters. For example, you do not need to create new IAM policies, access roles, or API tokens.

However, RHACS Cloud Service stores the data that secured cluster services send. All data is encrypted within RHACS Cloud Service. Encrypting the data within the RHACS Cloud Service platform helps to ensure the confidentiality and integrity of the data.

When you install secured cluster services on a cluster, it generates data and transmits it to the RHACS

Cloud Service. This data is kept secure within the RHACS Cloud Service platform, and only authorized SRE team members and systems can access this data. RHACS Cloud Service uses this data to monitor the security and compliance of your cluster and applications, and to provide valuable insights and analytics that can help you optimize your deployments.