Inventory

Inventory is the IP addresses of all the workloads on your network, annotated with labels and other data that describes them. Your inventory includes workloads running on bare metal or virtual machines, in containers, and in the cloud. If applicable, it may also include workloads running on partner networks.

Collecting inventory data is an iterative process. Data from different sources for a single IP address can be merged, and new and changed IP addresses can be updated. Over time, management of your inventory should become increasingly dynamic.

You will work with and group your inventory using searches, filters, and scopes, based on the labels and annotations that are associated with each inventory item. Policies are applied to groups of workloads that are defined by the filters and scopes you define for your inventory.

Options for working with inventory vary depending on your role but may include **Search**, **Filters**, and **Upload**.

Workload Labels

Labels (sometimes called tags, annotations, attributes, metadata, or context, though these terms are not necessarily always completely synonymous) are key to the power of Secure Workload.

Human-readable labels describe your workloads in terms of their function, location, and other criteria.

Secure Workload supports the following methods for adding user labels:

- Discovery by Secure Workload agents running on inventory items
- Manual import from uploading Comma Separated Value (CSV) files

- Manual assignment through the user interface
- Automated import through Connectors for Endpoints
- Automated import through Connectors for Inventory Enrichment
- Automated import of orchestrator generated and custom labels (See External Orchestrators)
- Automated import from cloud connectors (See Cloud Connectors)
- You can specify inventory labels when creating the installer script. All agents installed using the script are automatically tagged with such labels. Only Linux and Windows workload deployments support this feature.

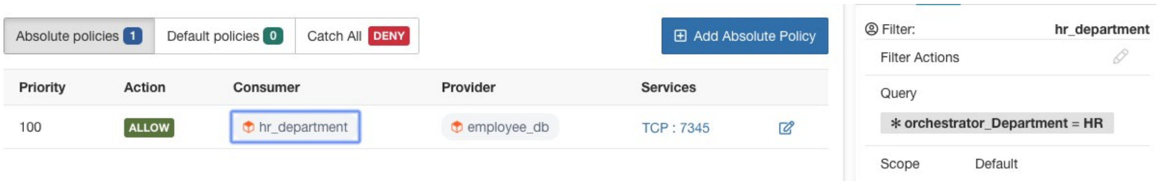
Importance of Labels

Labels allow you to define a logical policy. For example:

allow traffic from consumer hr_department to provider employee_db

Instead of specifying the members of the consumer and provider workload groups, we can define the logical policy using the labels as shown in the following figure. Note that this allows the membership of the consumer and provider groups to be dynamically modified without the need to modify the logical policy. As workloads are added and removed from the fleet, Secure Workload is notified by services you have configured, such as external orchestrators and cloud connectors. This enables Secure Workload to evaluate the membership of the consumer group *hr_department* and the provider group *employee_db*.

Figure 1: Example policy with labels



Priority	Action	Consumer	Provider	Services
100	ALLOW	hr_department	employee_db	TCP : 7345

Filter: hr_department

Query

orchestrator_Department = HR

Scope Default

Subnet-based Label Inheritance

Subnet-based label inheritance is supported. The smaller subnets and IP addresses inherit labels from larger subnets they fall under when one of the following conditions is satisfied:

- The label is missing from the list of labels for the smaller subnet/address.
- The label value for the smaller subnet/address is empty.

Consider the following example:

IP	Name	Purpose	Environment	Spirit-Animal
10.0.0.1	server-1	webtraffic	production	
10.0.0.2				frog
10.0.0.3				eagle

IP	Name	Purpose	Environment	Spirit-Animal
10.0.0.0/24	web-vlan		integration	
10.0.0.0/16		webtraffic		badger
10.0.0.0/8			test	bear

The labels for IP address *10.0.0.3* are *{“name”: “web-vlan”, “purpose”: “webtraffic”, “environment”: “integra- tion”, “spirit-animal”: “eagle”}*.

Label Prefixes

Labels are automatically displayed with a prefix that identifies the source of the information.

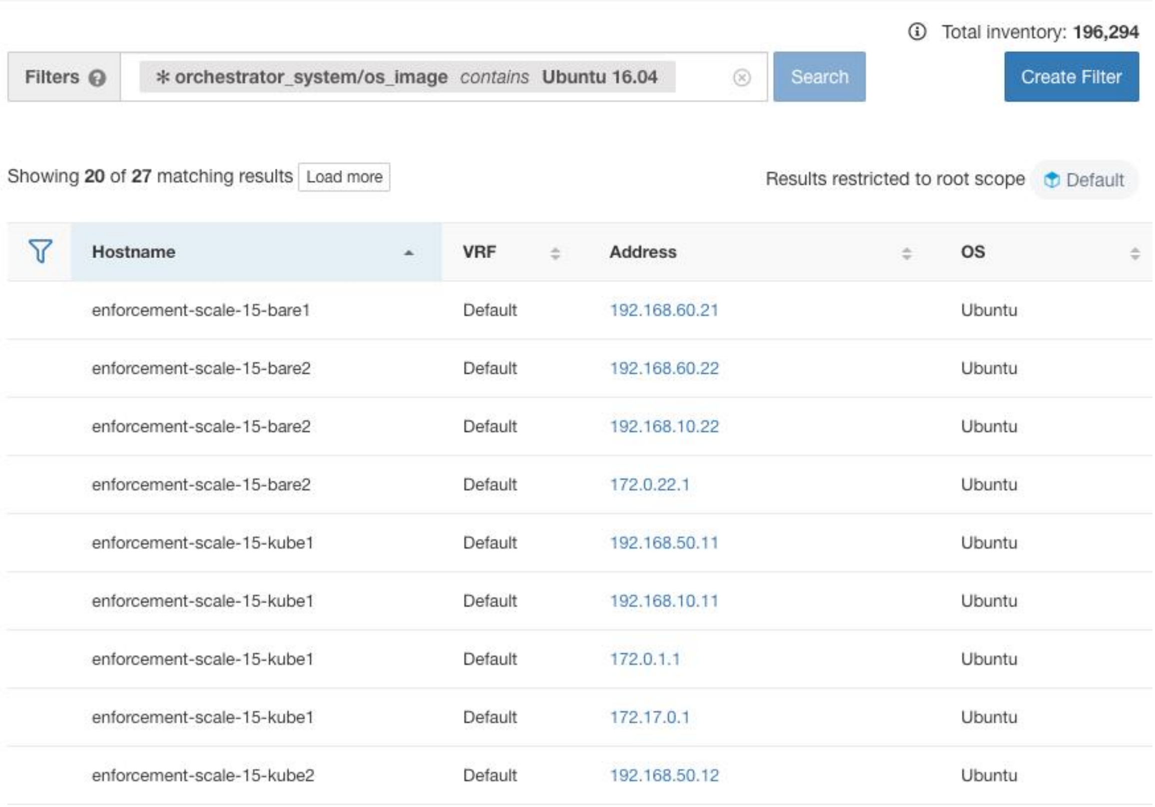
All user labels are prefixed by * in the UI (*user_* in OpenAPI). In addition, labels automatically imported from external orchestrators or from cloud connectors are prefixed with orchestrator_. For labels imported from endpoint connectors, see details in Connectors for Endpoints, but may include labels prefixed with *ldap_*.

For example, a label with a key of *department* imported from user-uploaded CSV files appear in the UI as * *department*, and in OpenAPI as *user_department*. A label with a key of *location* imported from an external orchestrator appear in the UI as * *orchestrator_location*, and in OpenAPI as *user_orchestrator_location*.

The following figure shows an example of inventory search using the orchestrator-generated label using the prefix:

orchestrator_system/os_image:

Figure 2: Example inventory search with orchestrator generated labels



Total inventory: **196,294**

Filters | * orchestrator_system/os_image *contains* Ubuntu 16.04 | Search | Create Filter

Showing **20** of **27** matching results Load more

Results restricted to root scope Default

Hostname	VRF	Address	OS
enforcement-scale-15-bare1	Default	192.168.60.21	Ubuntu
enforcement-scale-15-bare2	Default	192.168.60.22	Ubuntu
enforcement-scale-15-bare2	Default	192.168.10.22	Ubuntu
enforcement-scale-15-bare2	Default	172.0.22.1	Ubuntu
enforcement-scale-15-kube1	Default	192.168.50.11	Ubuntu
enforcement-scale-15-kube1	Default	192.168.10.11	Ubuntu
enforcement-scale-15-kube1	Default	172.0.1.1	Ubuntu
enforcement-scale-15-kube1	Default	172.17.0.1	Ubuntu
enforcement-scale-15-kube2	Default	192.168.50.12	Ubuntu

Labels Generated by Cloud Connectors

These labels apply to data from AWS and Azure. The source for these labels is workloads and network interfaces of an AWS VPC or Azure VNet. The tags from the source are merged and displayed in Secure Workload. For example, if the workload tag is `env: prod` and the network interface tag is `env: test`, the label value in Secure Workload is `prod,test`, which is displayed under the **orchestrator_env** column on the respective connector page.

For labels specific to AKS, EKS, and GKE, see also Labels Related to Kubernetes Clusters.

Table 1: Labels added to all inventory gathered using a cloud connector

Key	Value
orchestrator_system/orch_type	aws or azure
orchestrator_system/cluster_name	*<Cluster_name is the name given by the user for this connector's configuration>*
orchestrator_system/name	*<Name of connector>*
orchestrator_system/cluster_id	*<Virtual network ID>*

Instance-specific labels

The following labels are specific to each node:

Key	Value
orchestrator_system/workload_type	vm
orchestrator_system/machine_id	*<InstanceID assigned by the platform>*
orchestrator_system/machine_name	<PublicDNS(FQDN) given to this node by AWS> –or– <InstanceName in Azure>
orchestrator_system/segmentation_enabled	*<Flag to determine if segmentation is enabled on the inventory>*
orchestrator_system/virtual_network_id	*<ID of virtual network the inventory belongs to>*
orchestrator_system/virtual_network_name	*<Name of virtual network the inventory belongs to>*
orchestrator_system/interface_id	<Identifier of elastic network interface attached to this inventory>
orchestrator_system/region	<Region the inventory belongs to>
orchestrator_system/resource_group	(This tag applies to Azure inventory only)
orchestrator_'<Tag Key>'	<Tag Value> Key-value pair for any number of custom tags assigned to inventory in the cloud portal.

Labels Related to Kubernetes Clusters

The following information applies to plain-vanilla Kubernetes, OpenShift, and to Kubernetes running on supported cloud platforms (EKS, AKS, and GKE).

For each object type, Secure Workload imports inventory live from a Kubernetes cluster, including labels associated with the object. Label keys and values are imported as-is.

In addition to importing the labels defined for the Kubernetes objects, Secure Workload also generates labels that facilitate the use of these objects in inventory filters. These additional labels are especially useful in defining scopes and policies.

Generated labels for all resources

Secure Workload adds the following labels to all the nodes, pods and services retrieved from the Kubernetes/OpenShift/EKS/AKS/GKE API server.

Key	Value
orchestrator_system/orch_type	kubernetes
orchestrator_system/cluster_id	*<UUID of the cluster's configuration in |product|>*
orchestrator_system/cluster_name	*<Name of kubernetes cluster>*
orchestrator_system/name	*<Name of connector>*

Key	Value
orchestrator_system/namespace	*<The Kubernetes/OpenShift/EKS/AKS/GKE namespace of this item>*

Node-specific labels

The following labels are generated for nodes only.

Key	Value
orchestrator_system/workload_type	machine
orchestrator_system/machine_id	*<UUID assigned by Kubernetes/OpenShift>*
orchestrator_system/machine_name	*<Name given to this node>*
orchestrator_system/kubelet_version	*<Version of the kubelet running on this node>*
orchestrator_system/container_runtime_version	*<The container runtime version running on this node>*

Pod-specific labels

The following labels are generated for pods only.

Key	Value
orchestrator_system/workload_type	pod
orchestrator_system/pod_id	*<UUID assigned by Kubernetes/OpenShift>*
orchestrator_system/pod_name	*<Name given to this pod>*
orchestrator_system/hostnetwork	*<true|false> reflecting whether the pod is running in the host network*
orchestrator_system/machine_name	*<Name of the node the pod is running on>*
orchestrator_system/service_endpoint	*[List of service names this pod is providing]*

Service-specific labels

The following labels are generated for services only.

Key	Value
orchestrator_system/workload_type	service
orchestrator_system/service_name	*<Name given to this service>*

- (For cloud-managed Kubernetes only) Services of ServiceType: LoadBalancer are supported only for gathering metadata, not for collecting flow data or for policy enforcement.

Tip Filtering items using **orchestrator_system/service_name** is not the same as using **orchestrator_system/service_endpoint**.

For example, using the filter **orchestrator_system/service_name = web** selects all *services* with the name **web** while **orchestrator_system/service_endpoint = web** selects all *pods* that provide a service with the name **web**.

Labels Example for Kubernetes Clusters

The following example shows a partial YAML representation of a Kubernetes node and the corresponding labels imported by Secure Workload.

```
- apiVersion: v1
kind: Node
metadata:
  annotations:
    node.alpha.kubernetes.io/ttl: "0"
    volumes.kubernetes.io/controller-managed-attach-detach: "true"
  labels:
    beta.kubernetes.io/arch: amd64
    beta.kubernetes.io/os: linux
    kubernetes.io/hostname: k8s-controller
```

Table 2: Label Keys Imported from Kubernetes

Imported label keys
orchestrator_beta.kubernetes.io/arch
orchestrator_beta.kubernetes.io/os
orchestrator_kubernetes.io/hostname
orchestrator_annotation/node.alpha.kubernetes.io/ttl
orchestrator_annotation/volumes.kubernetes.io/controller-managed-attach-detach
orchestrator_system/orch_type
orchestrator_system/cluster_id
orchestrator_system/cluster_name
orchestrator_system/namespace
orchestrator_system/workload_type
orchestrator_system/machine_id
orchestrator_system/machine_name
orchestrator_system/kubelet_version
orchestrator_system/container_runtime_version

Importing Custom Labels

You can upload or manually assign custom labels to associate user-defined data with specific hosts. This user-defined data is used to annotate associated flows and inventory.

There are limits on the number of IPv4/IPv6 addresses/subnets that can be labeled across all root scopes, regardless of label source (whether manually entered or uploaded, ingested using connectors or external orchestrators, and so on) For details, see Label Limits.

Guidelines for Uploading Label Files

Procedure

Step 1 To view a sample file, in the left pane, select **Organize** > **Label Management** > **User Defined Label Upload**, and then click **Download a Sample**.

Step 2 The CSV files used to upload the user labels must include a label key (IP address).

Step 3 To use non-English characters in labels, the CSV file must be in UTF-8 format.

Step 4 Ensure the CSV files meet the guidelines described in the Label Key Schema section.

Step 5 All uploaded files must follow the same schema.

Label Key Schema

Guidelines governing column names

- There must be one column with a header “IP” in the label key schema. Additionally, there must be at least one other column with attributes for the IP address.
- The column “VRF” has special significance in the label schema. If provided, it should match the root scope to which you upload the labels. It’s mandatory when uploading the CSV file using the scope independent API.
- Column names may contain only the following characters: Letters, numbers, space, hyphen, underscore, and slash.
- Column names cannot exceed 200 characters.
- Column names cannot be prefixed with “orchestrator_”, “TA_”, “ISE_”, “SNOW_”, nor “LDAP_” since these can conflict with labels from internal applications.
- The CSV file should not contain duplicate column names.

Guidelines governing column values

- Values are limited to 255 characters. However, they should be as short as possible while still being clear, distinctive, and meaningful to users.
- Keys and values are not case sensitive. However, consistency is recommended.
- Addresses appearing under the “IP” column should conform to the following format:

- IPv4 addresses can be of the format “x.x.x.x” and “x.x.x.x/32”.
- IPv4 subnets should be of the format “x.x.x.x/<netmask>”, where netmask is an integer from 0 to 31.
- IPv6 addresses in the Long format (“x:x:x:x:x:x:x:x” or “x:x:x:x:x:x:x:x/128”) and the Canonical format (“x:x::x” or “x:x::x/128”) are supported.
- IPv6 subnets in the Long format (“x:x:x:x:x:x:x:x/<netmask>”) and the Canonical format (“x:x::x/<netmask>”) are supported. Netmask must be an integer from 0 to 127.

The order of the columns does not matter. The first 32 user-defined columns will automatically be enabled for label. If more than 32 columns are uploaded, up to 32 can be enabled using the checkboxes on the right-side of the page.

Upload Custom Labels

The following steps explain how users with **Site Admin**, **Customer Support** or a root **scope owner** role can upload labels.

Before you begin

To upload the custom labels, create a CSV file according to the ‘Guidelines for Uploading Label Files’ section.

Procedure

Step 1 In the left pane, select **Organize** > **User Defined Label Upload** > **CSV Upload**, and then under **Upload New Labels**, click **Select File**.

Step 2 In the left pane, select **Organize** > **Label Management**, and then under **Upload New Labels**, click **Select File**.

Step 3 Select the operation-Add, Merge, or Delete.

- **Add:** Appends labels to new and existing addresses/subnets. Resolves conflicts by selecting newer labels over existing ones. For example, if labels for an address in the database are *{"foo": "1", "bar": "2"}* and the CSV file contains *{"z": "1", "bar": "3"}*, add` sets labels for this address to *{"foo": "1", "z": "1", "bar": "3"}*.
- **Merge:** Merges labels to existing addresses/subnets. Resolves conflicts by selecting non-empty values over empty values. For example, if labels for an address in the database are *{"foo": "1", "bar": "2", "qux": "", "corge": "4"}* and the CSV file contains *{"z": "1", "bar": "", "qux": "3", "corge": "4-updated"}*, merge` sets labels for this address to *{"foo": "1", "z": "1", "bar": "2", "qux": "3", "corge": "4-updated"}*.

  Note Value of “bar” in not reset to “”(empty), instead existing value of “bar”=”2” is preserved.

- **Delete:** This option removes labels for an address/subnet, which can significantly impact scopes, filters, policies, and enforced behavior. For important details, see *Delete Labels*.

Important: The Delete function, while uploading the custom labels, will remove ALL labels associated with the specified IP addresses/subnets, and is not limited to the columns listed in the CSV file. Therefore, the Delete operation must be used with caution.

Step 4 Click **Upload**.

Search Labels

Users with **Site Admin**, **Customer Support** or a root **scope owner** role can search for, view, and edit labels assigned to an IP address or subnet.

Procedure

Step 1 On the **Label Management** page, click **Search and Assign**.

Step 2 In the **IP or Subnet** field, enter the IP address or subnet and click **Next**.

On the Assign Labels page, the existing labels for the entered IP address or subnet are displayed.

Manually Assign or Edit Custom Labels

Users with **Site Admin**, **Customer Support**, or a root **scope owner** role can manually assign labels to a given IP address or subnet.

Procedure

Step 1 On the **Label Management** page, click **Search and Assign**.

Step 2 In the **IP or Subnet** field, enter the IP address or subnet and click **Next**.

The Assign Labels page is displayed. Note that the existing labels will be displayed and can be edited.

Step 3 To add a new label, in the **Labels for <IP address/subnet>** section, enter the label name and value, and then click **Confirm**. Click **Next**.

Step 4 Review the changes and click **Assign** to commit them.

Download Labels

Users with **Site Admin**, **Customer Support**, or a root **scope owner** role can download previously defined labels belonging to a root scope.

Procedure

Step 1 On the **Label Management** page, click **User Defined Label Upload**.

Step 2 Under the **Download Existing Labels** section, click **Download Labels**.

The labels used by Secure Workload are downloaded as a CSV file.

Change Labels

Warning If you need to change a label, do so cautiously, as doing so changes the membership in and effects of existing queries, filters, scopes, clusters, policies, and enforced behavior that are based on that label.

Procedure

Step 1 On the **Label Management** page, click the **Search and Assign** tab.

Step 2 In the **IP or Subnet** field, enter the IP address or subnet and click **Next**.

The labels used by Secure Workload for the entered IP address/subnet are displayed.

Step 3 Under the **Actions** column, click the **Edit** icon to change the name and value of the required label.

Step 4 Click **Confirm**, and then click **Next**.

Step 5 Review the changes and click **Assign**.

Disable Labels

One way to change the schema is to disable the labels. *Proceed with caution*.

Procedure

Step 1 Navigate to the **Label Management** page.

Step 2 For the required label, under the **Actions** column, select **Disable** and confirm to remove the label from the inventory by clicking **Yes**.

If you decide to enable the label at a later time, click **Enable** to use the label.

Delete Labels

Warning One way to change the schema is to disable the labels and delete them. Proceed with caution. This action deletes the selected label which impacts all dependent **Filters** and **Scopes**. Ensure that these labels are not used. This action cannot be undone.

Procedure

Step 1 Disable the labels. See disable_lables.

Step 2 Click the **TrashCan** icon and confirm by clicking **Yes** to delete the label.

View Labels Usage

The IP addresses/subnet inventory gets updated with the custom labels uploaded using CSV files or manually assigned by users. The labels are then used in defining the scopes and filters, and the application policies are created based on these filters. Therefore, understanding the usage of labels is critical as any modifications to the labels directly impacts the scopes, filters, and policies in Secure Workload.

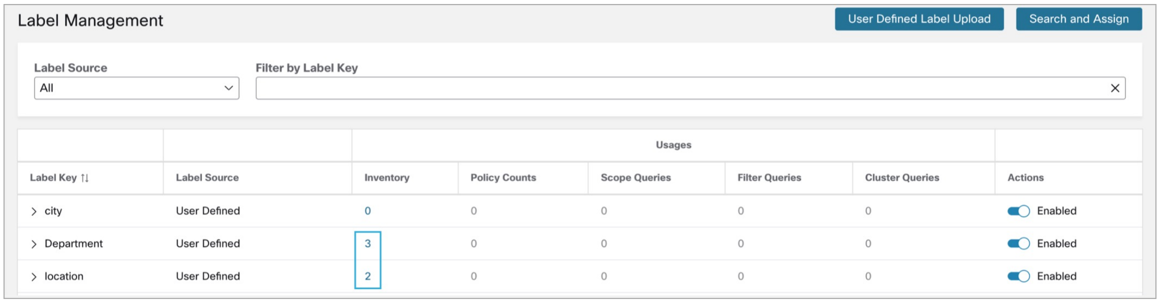
To view the usage of labels:

Procedure

Step 1 On the **Label Management** page, the label keys, top five values of the labels in use, inventory, scopes, filters, and clusters using the custom labels are displayed.

Step 2 Under the Usages column, click the count values against the inventory, scopes, or filters. For example, to view the scopes using the "Location" label, click the scope queries count.

Figure 3: View scopes of selected label



Label Source: All

Filter by Label Key:

		Usages					
Label Key ↑↓	Label Source	Inventory	Policy Counts	Scope Queries	Filter Queries	Cluster Queries	Actions
› city	User Defined	0	0	0	0	0	Enabled
› Department	User Defined	3	0	0	0	0	Enabled
› location	User Defined	2	0	0	0	0	Enabled

The Scopes and Inventory page is displayed, and the query automatically filters the scopes with the selected label.

Note You can only view the usage of labels either uploaded using CSV files or those manually assigned to the IP address/subnet.

Create a Process for Maintaining Labels

Your network and inventory will change, and you must plan to update labels to reflect those changes.

For example, if a workload is retired and its IP address is reassigned to a workload with a different purpose, you need to update the labels associated with that workload. This is true for both manually uploaded labels and for labels maintained in and ingested from other systems such as a configuration management database (CMDB.)

Create a process to ensure that your labels are updated on a regular, ongoing basis, and add this process to your network-maintenance routine.

Scopes and Inventory

Scopes and Inventory Overview

This section provides visibility of the scope hierarchy, along with all the inventory it contains. Scopes categorize all of the inventory using a hierarchical structure. See Inventory, on page 1. On the left is the scope directory user interface. Here, you can traverse down your scope hierarchy. Each scope is displayed in a scope card. It displays the name of the scope, the number of children scopes, the inventory count, and uncategorized inventory if applicable. Clicking on a scope card updates the pane to the right to show details about that scope as well as a filterable list of all its inventory.

Scope Design Principles

1. Inventory is matched to scope tree according to dynamic query match.
    - Queries may match against IP/Subnet or Label (preferred)
    - Tree is formed through conjunctive query at each layer.
2. Scope structure may be location specific if appropriate.
    - Combined Cloud vs Data Center and Cloud Specific vs Geographic location
3. Each layer of the scope tree should represent an anchor point for:
    - Policy control
    - Role Based Access Control (RBAC)
4. Every child scope should be a subset of its parent scope.
    - Ensure non-overlapping sibling scopes, see Scope Overlap

Note Every organization is structured differently, and depending on your industry, require different approaches. Choose one focus in designing your scope hierarchy; location, environment, or application.

Note Do not use IP address or subnet to define scopes that involve Kubernetes inventory. You must use labels to define scopes and policy for these workloads. IP address alone is not sufficient to identify pod services; using IP address for scope definition will produce unreliable results.

Key Features

Filtering feature for both scopes and inventory provides you with the ability to quickly traverse down the scope tree or filter the scope hierarchy and filter the inventory items of the selected scope.

Inventory count is displayed in the scopes card, providing a quick view into the number of workloads in the scope.

Scopes

Scopes are a foundational element to configuration and policy in Secure Workload. Scopes are a collection of workloads arranged in a hierarchy. Workloads labelled to serve as attributes that build a model about where it is, its role, and its function in your environment. Scopes provide a structure to support dynamic mechanisms like identification and attributes associated with an IP that may change over time.

Scopes are used to group datacenter applications and, along with Roles, enable fine grained control of their management. For example, Scopes are used throughout the product to define access to Policies, Flows and Filters.

Scopes are defined hierarchically as sets of trees with the root corresponding to a **VRF**. As a result, each Scope tree hierarchy represents disjoint data that does not overlap with another Scope tree, see Scope Overlap.

Scope Definition

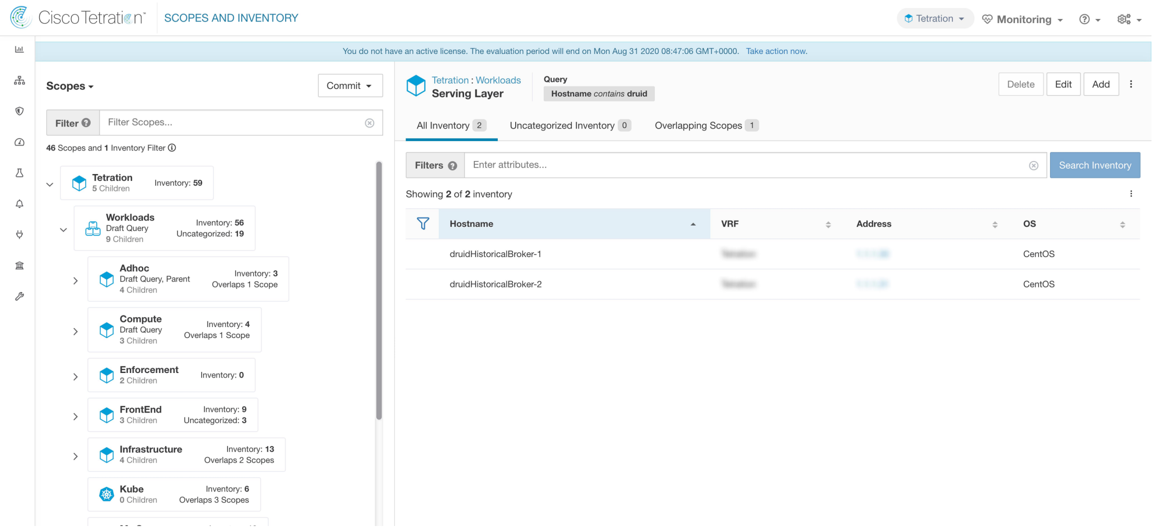
Each individual Scope is defined with the attributes below:

Attribute	Description
Parent Scope	The parent of the new scope defines the tree hierarchy structure.
Name	The name to identify the scope.
Type	This is used to specify different categories of inventory. If none are applicable, or the scope contains a mix, it can be left blank.
Query	The Query defining the individual scope.

Note Scopes should be defined in a hierarchy that mimics the application ownership hierarchy of the organization.

Note Query may match against IP/Subnet or other Inventory attributes.

Figure 4: Example of Traversing through Scope Hierarchy



You do not have an active license. The evaluation period will end on Mon Aug 31 2020 08:47:06 GMT+0000. Take action now.

46 Scopes and 1 Inventory Filter

- Tetration — 5 Children — Inventory: 59
  - Workloads — Draft Query — 9 Children — Inventory: 56, Uncategorized: 19
    - Adhoc — Draft Query, Parent — 4 Children — Inventory: 3, Overlaps 1 Scope
    - Compute — Draft Query — 3 Children — Inventory: 4, Overlaps 1 Scope
    - Enforcement — 2 Children — Inventory: 0
    - FrontEnd — 3 Children — Inventory: 9, Uncategorized: 3
    - Infrastructure — 4 Children — Inventory: 13, Overlaps 2 Scopes
    - Kube — 0 Children — Inventory: 6, Overlaps 3 Scopes

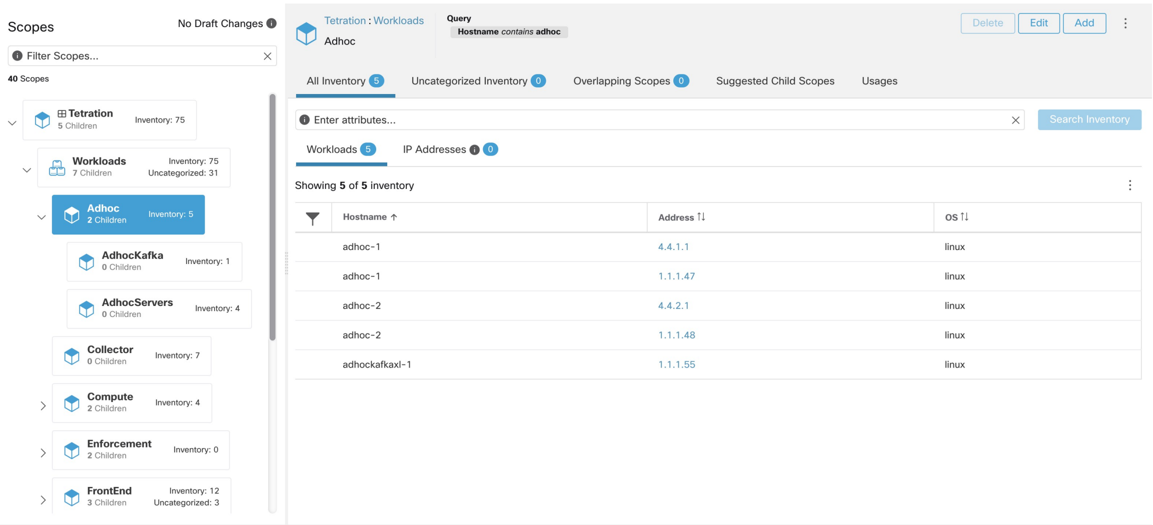
Tetration : Workloads
Serving Layer
Query: Hostname *contains* druid

Showing 2 of 2 inventory

Hostname	VRF	Address	OS
druidHistoricalBroker-1	[redacted]	[redacted]	CentOS
druidHistoricalBroker-2	[redacted]	[redacted]	CentOS

The scope directory displays the scope hierarchy and some details of each scope (for example, Inventory Count, number of child scopes, Workspaces). Clicking on a scope selects that scope and the details pane to the right updates with more information about that scope and that scope’s inventory.

Figure 5: Inventory count



40 Scopes

- Tetration — 5 Children — Inventory: 75
  - Workloads — 7 Children — Inventory: 75, Uncategorized: 31
    - Adhoc — 2 Children — Inventory: 5
      - AdhocKafka — 0 Children — Inventory: 1
      - AdhocServers — 0 Children — Inventory: 4
    - Collector — 0 Children — Inventory: 7
    - Compute — 2 Children — Inventory: 4
    - Enforcement — 2 Children — Inventory: 0
    - FrontEnd — 3 Children — Inventory: 12, Uncategorized: 3

Tetration : Workloads
Adhoc
Query: Hostname *contains* adhoc

Showing 5 of 5 inventory

Hostname	Address	OS
adhoc-1	4.4.1.1	linux
adhoc-1	1.1.1.47	linux
adhoc-2	4.4.2.1	linux
adhoc-2	1.1.1.48	linux
adhockafkaxl-1	1.1.1.55	linux

Scope Filter

Users can use the Scope filter to quickly identify different scope details such as overlapping scopes and query. The filter feature is also helpful in identifying query changes, parent changes, etc.

Field	Description
Name	Filter by the name of the Scope or Inventory Filter.
Description	Filter by text appearing in the description of a scope.

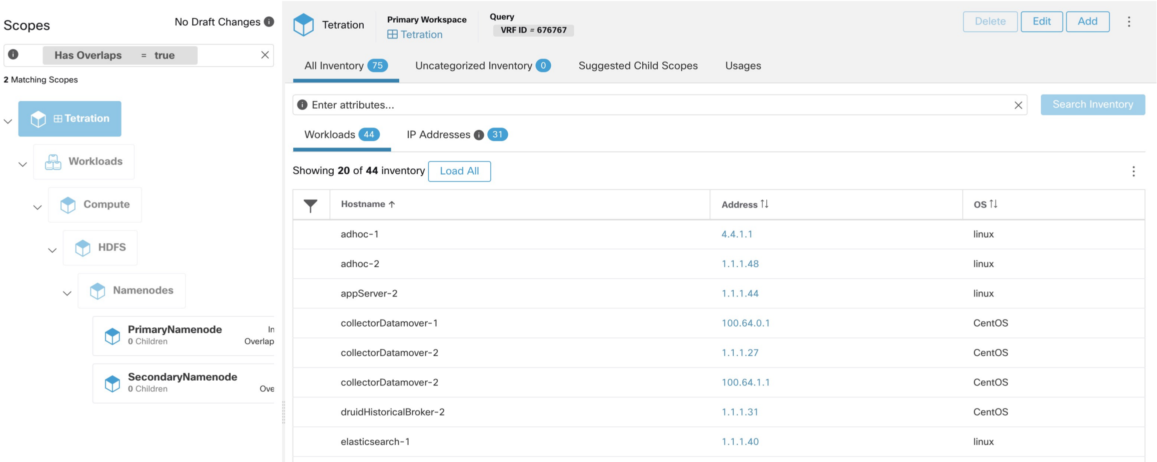
Field	Description
Query	Filter by fields or values used in the query.
Query Change	Filter by scopes that have an uncommitted query.
Parent Change	Filter by scopes that have been moved in the draft but not committed.
Is Inventory Filter	Show Inventory Filters that are restricted to their ownership scope.
Has Workspace	Filter by scopes that have a primary workspace.
Has Enforced Workspace	Filter by scopes that have a primary workspace that is enforced.
Has Overlaps	Filter by scopes that have inventory in common with a sibling scope.
Has Invalid Query	Filter by scopes that have a query that uses invalid or unknown labels.

Examples:

Has Overlaps

Example of Scope Overlap

Figure 6: Has Overlaps



Scopes

No Draft Changes

Has Overlaps = true

2 Matching Scopes

Query

VRF ID = 676767

Showing 20 of 44 inventory

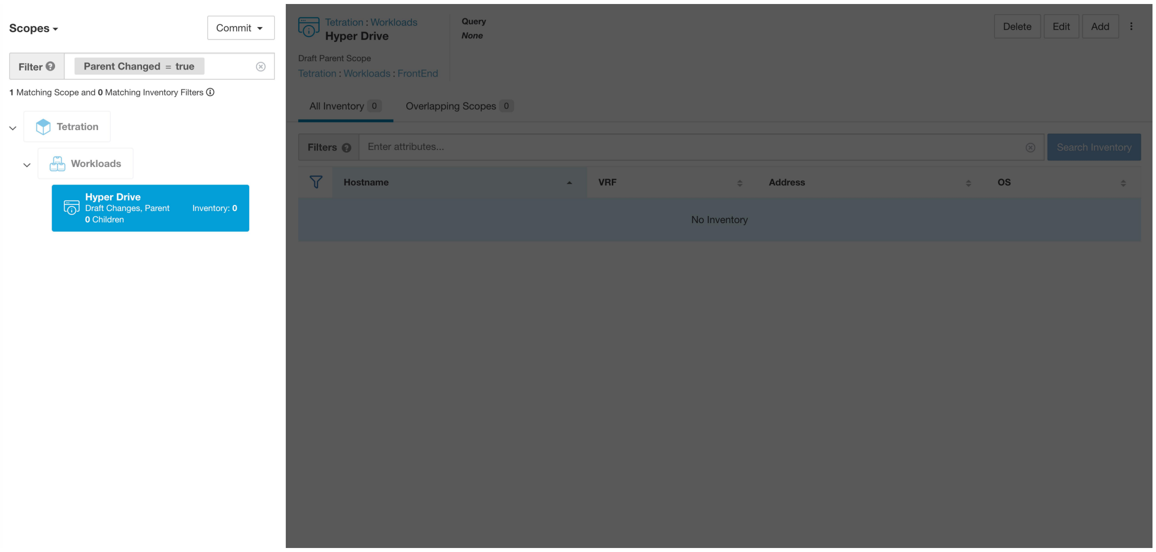
Hostname ↑	Address ⇅	OS ⇅
adhoc-1	4.4.1.1	linux
adhoc-2	1.1.1.48	linux
appServer-2	1.1.1.44	linux
collectorDatamover-1	100.64.0.1	CentOS
collectorDatamover-2	1.1.1.27	CentOS
collectorDatamover-2	100.64.1.1	CentOS
druidHistoricalBroker-2	1.1.1.31	CentOS
elasticsearch-1	1.1.1.40	linux

For more information see Scope Overlap

Parent Change

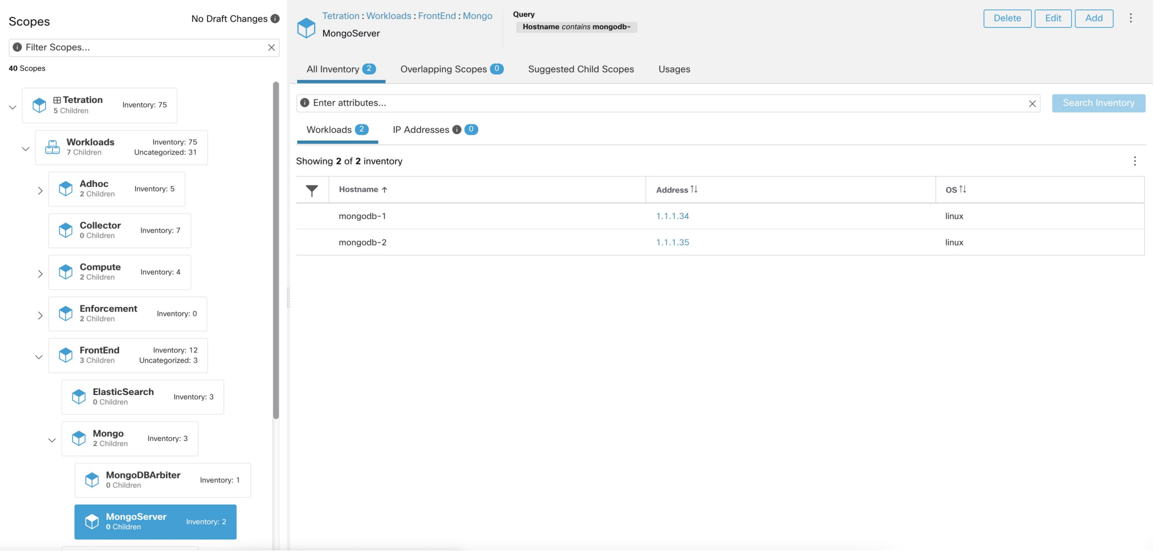
Scopes that are moved in the draft but not yet committed.

Figure 7: Parent Change



Full Scope Queries

Figure 8: Example of Scope Hierarchy



Showing 2 of 2 inventory

Hostname ↑	Address ⇅	OS ⇅
mongodb-1	1.1.1.34	linux
mongodb-2	1.1.1.35	linux

Scopes are defined hierarchically, the full query of the scope is defined as the logical ‘and’ of the scope along with all of its parents. Using the example above, assets assigned to the `Workloads:FrontEnd:Mongo`

Scope would match:

```
vrf_id = 676767 and (ip in 1.1.1.0/24) and (Hostname contains mongo).
```

Where vrf_id = 676767 comes from the root scope query and ip in 1.1.1.0/24 comes from the parent scope query.

Note It is a best practice to not have overlapping queries at the same level. This removes the importance of ordering and reduces confusion. See Scope Overlap

Providing Access to Scopes

You can grant Read, Write, Execute, Enforce, and Owner abilities on Scopes. An overview is provided below, for more information see Roles.

A User is given access to a "sub-tree". That is, the given Scope and all its children. Using the preceding example, you have the Read access to the `Workloads:FrontEnd` scope would, by inheritance, have read access to all the scopes under `Workloads:FrontEnd` including:

- `Workloads:FrontEnd:Mongo`
- `Workloads:FrontEnd:ElasticSearch`
- `Workloads:FrontEnd:Redis`
- `etc. . .`

It's possible to define Roles with access to multiple Scopes. For example, an "Mongo Admin" role might have Owner access to the Scopes:

- `Workloads:FrontEnd:Mongo:MongoServer`
- `Workloads:FrontEnd:Mongo:MongoDBArbiter`

Roles and Capabilities allow you to have horizontal access to the Scope hierarchy.

Scope Abilities are also inherited. For example, having the Write ability on a Scope allows one to also Read that information.

Viewing Scope

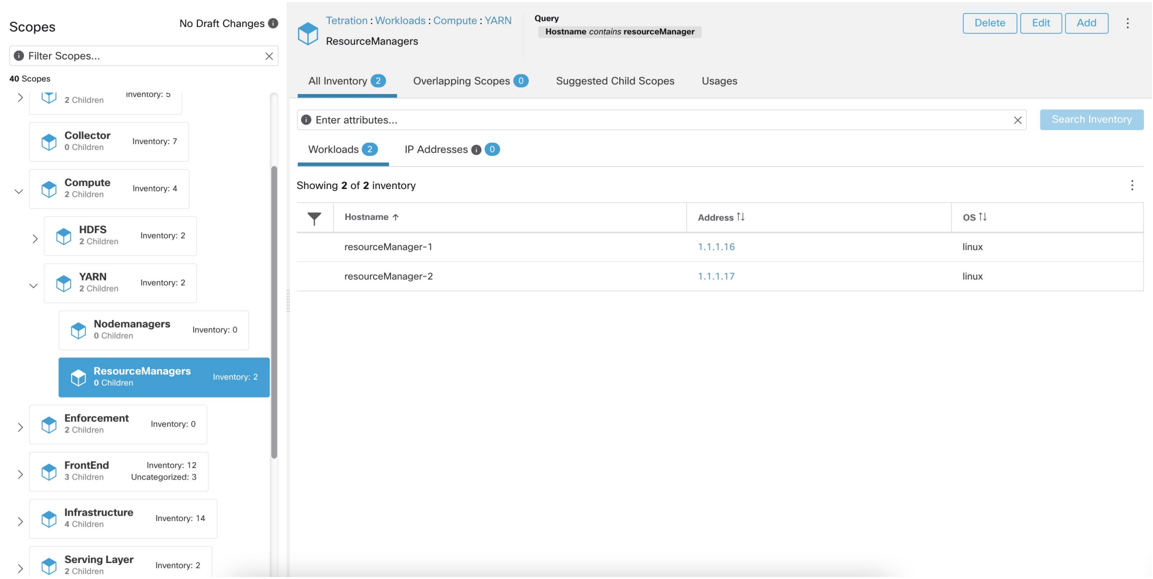
Every user can view the scope tree they have access to. Users who have the Owner ability on the root scope have the ability to create, edit and delete scope in that tree. To access this view:

In the navigation bar on the left, click **Organize** > **Scopes and Inventory**.

You can traverse through the complete scope hierarchy (up to the root) for any Scopes you have access to. This complete traversal provides context as users can create policies to any Scope. Several actions can be performed on this page:

- Click the chevron in the scope hierarchy to show that scope's children.
- Clicking on a scope card will update the pane to the right to show details about that scope as well as a filterable list of all of its inventory.

Figure 9: Example Non-Admin View



Query: Hostname *contains* resourceManager

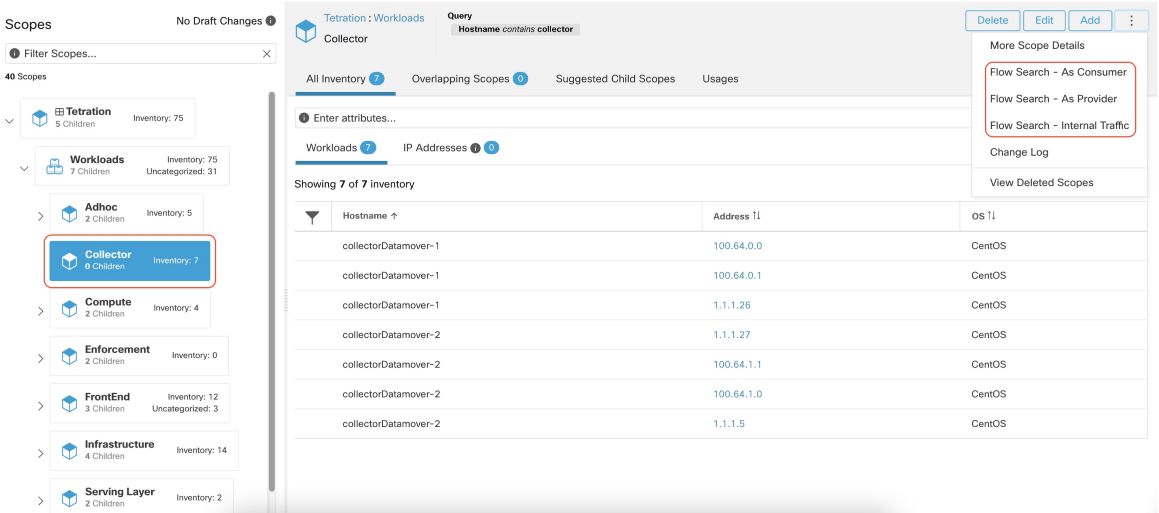
Showing **2** of **2** inventory

Hostname ↑	Address ⇅	OS ⇅
resourceManager-1	1.1.1.16	linux
resourceManager-2	1.1.1.17	linux

Searching for flows referencing a scope

There are some shortcuts provided on the scopes page to help the user in scenarios they need to search for flows where one or both endpoints of the flow fall within a provided scope.

Figure 10: Searching for flows for a scope



Query: Hostname *contains* collector

Showing **7** of **7** inventory

Hostname ↑	Address ⇅	OS ⇅
collectorDatamover-1	100.64.0.0	CentOS
collectorDatamover-1	100.64.0.1	CentOS
collectorDatamover-1	1.1.1.26	CentOS
collectorDatamover-2	1.1.1.27	CentOS
collectorDatamover-2	100.64.1.1	CentOS
collectorDatamover-2	100.64.1.0	CentOS
collectorDatamover-2	1.1.1.5	CentOS

After selecting desired scope in the scope tree (left side panel), as shown in the figure above, user can choose between the following three options:

1. *Flow Search - As Consumer* provides shortcut to the flow search page to help search for flows with selected scope as *Consumer Scope* for the flows. In other words, consumer or source endpoint in the flows belongs to the selected scope.

2. *Flow Search - As Provider* provides shortcut to the flow search page to help search for flows with selected scope as *Provider Scope* for the flows. In other words, provider or destination endpoint in the flows belongs to the selected scope.
3. *Flow Search - Internal Traffic* provides shortcut to the flow search page to help search for flows that are completely restricted to the selected scope. In other words, both endpoints of the flows (consumer and provider) belong to the selected scope.

Creating a New Scope

Child scopes are created on the **Scopes** admin page. This action requires the `SCOPE_OWNER` ability on the root scope. **Site Admins** are owners of all scopes.

Creating a child scope will impact the application inventory membership (member workloads) of the parent scope. As a result, the parent scope will be marked as having “draft changes”. The changes will need to be committed and dependent structures will need to be updated. See Commit Changes.

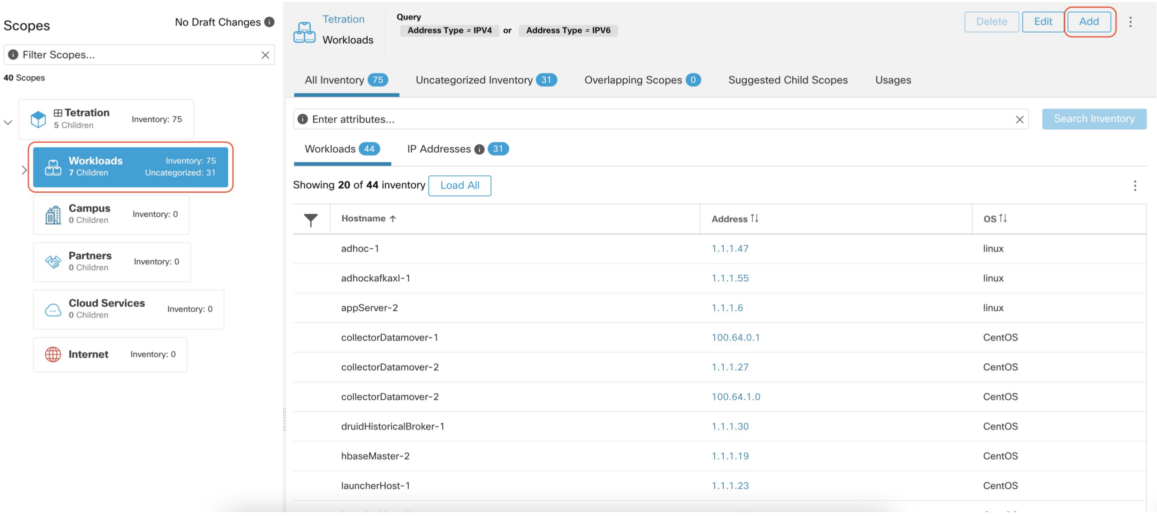
Procedure

Step 1 In the navigation bar on the left, click **Organize** > **Scopes and Inventory**. The page displays the root Scopes corresponding to Tenants+VRFs already created on the system.

Step 2 Select a child scope in the scope directory. You can filter the scopes first if necessary.

Step 3 Click the **Add** button.

Figure 11: Scope Add Button



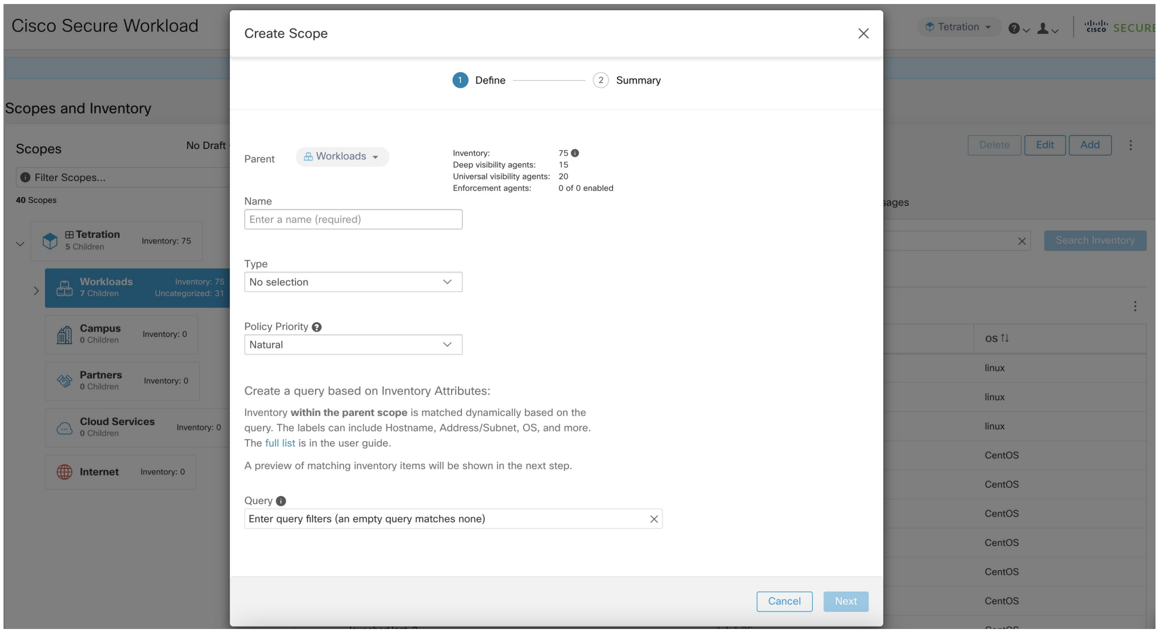
Hostname ↑	Address ⇅	OS ⇅
adhoc-1	1.1.1.47	linux
adhockafkaxl-1	1.1.1.55	linux
appServer-2	1.1.1.6	linux
collectorDatamover-1	100.64.0.1	CentOS
collectorDatamover-2	1.1.1.27	CentOS
collectorDatamover-2	100.64.1.0	CentOS
druidHistoricalBroker-1	1.1.1.30	CentOS
hbaseMaster-2	1.1.1.19	CentOS
launcherHost-1	1.1.1.23	CentOS

Step 4 Enter the appropriate values in the following fields:

Field	Description
Parent	The parent of the new Scope.
Name	The name to identify the Scope. Must be unique under the parent scope

Field	Description
Type	Select a category for the new Scope.
Query	The Query/Filter to match the assets.

Figure 12: Scope Create Modal



Create Scope

1 Define — 2 Summary

Parent: Workloads

Inventory: 75
Deep visibility agents: 15
Universal visibility agents: 20
Enforcement agents: 0 of 0 enabled

Name: Enter a name (required)

Type: No selection

Policy Priority: Natural

Create a query based on Inventory Attributes:

Inventory **within the parent scope** is matched dynamically based on the query. The labels can include Hostname, Address/Subnet, OS, and more. The full list is in the user guide.

A preview of matching inventory items will be shown in the next step.

Query: Enter query filters (an empty query matches none)

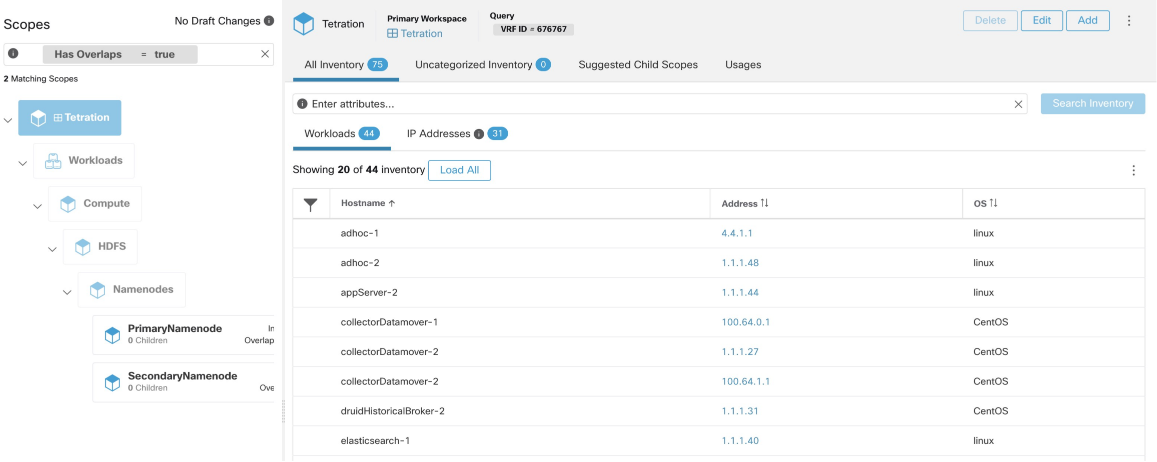
Cancel | Next

Scope Overlap

While adding scopes, it is recommended to avoid overlapping scopes. When scopes overlap, policies generated for overlapping scopes can potentially end up confusing end users. This feature proactively notifies the user if there are any overlapping scope membership, that is, the same inventory belongs to more than one scope at the same depth in scope tree (sibling scopes). The goal is to avoid having the same workload exist in different parts of the scope tree.

To view which inventory items belong to multiple scopes, use the scope filter and enter the **Has Overlaps = true** facet.

Figure 13: Overlap facet in Scope filter



Scopes No Draft Changes

Has Overlaps = true

2 Matching Scopes

- Tetration
  - Workloads
    - Compute
      - HDFS
        - Namenodes
          - PrimaryNamenode, 0 Children, In… Overlap…
          - SecondaryNamenode, 0 Children, Ove…

Tetration | Primary Workspace: Tetration | Query: VRF ID = 676767

Delete | Edit | Add

All Inventory 75 | Uncategorized Inventory 0 | Suggested Child Scopes | Usages

Enter attributes... Search Inventory

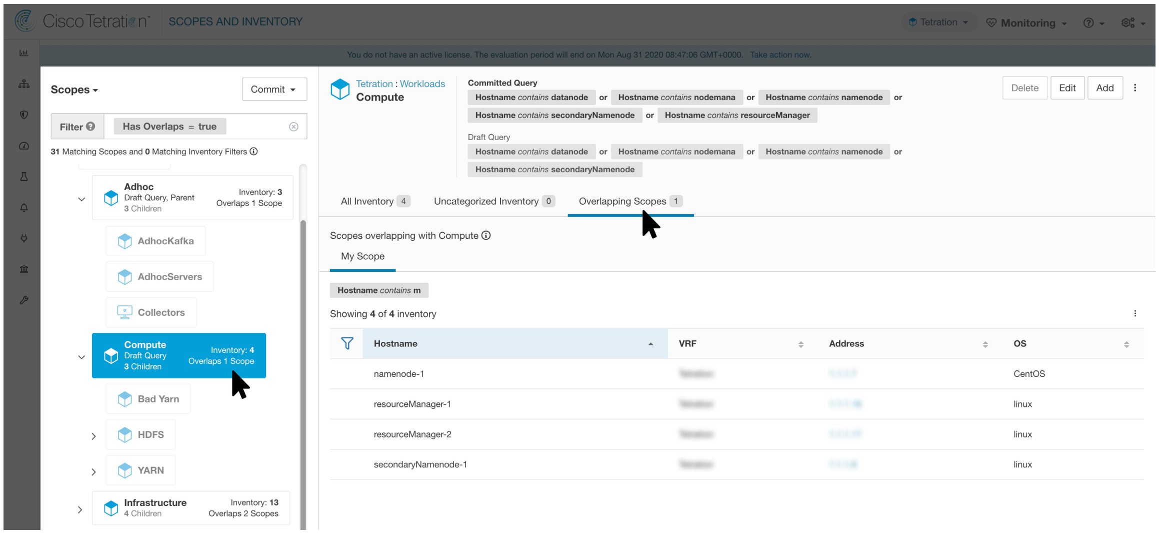
Workloads 44 | IP Addresses 31

Showing **20** of **44** inventory Load All

Hostname ↑	Address	OS
adhoc-1	4.4.1.1	linux
adhoc-2	1.1.1.48	linux
appServer-2	1.1.1.44	linux
collectorDatamover-1	100.64.0.1	CentOS
collectorDatamover-2	1.1.1.27	CentOS
collectorDatamover-2	100.64.1.1	CentOS
druidHistoricalBroker-2	1.1.1.31	CentOS
elasticsearch-1	1.1.1.40	linux

The list of overlapping scopes and the corresponding overlapping IP addresses can be viewed by traversing down the scope tree and selecting the **Overlapping Scopes** tab.

Figure 14: Overlapping Scopes and IPs



Cisco Tetration SCOPES AND INVENTORY Tetration Monitoring

You do not have an active license. The evaluation period will end on Mon Aug 31 2020 08:47:06 GMT+0000. Take action now.

Scopes Commit

Filter Has Overlaps = true

31 Matching Scopes and **0** Matching Inventory Filters

- Adhoc, Draft Query, Parent, 3 Children; Inventory: 3, Overlaps 1 Scope
  - AdhocKafka
  - AdhocServers
  - Collectors
- Compute, Draft Query, 3 Children; Inventory: 4, Overlaps 1 Scope
  - Bad Yarn
  - HDFS
  - YARN
- Infrastructure, 4 Children; Inventory: 13, Overlaps 2 Scopes

Tetration : Workloads
Compute

Committed Query
Hostname *contains* datanode or Hostname *contains* nodemana or Hostname *contains* namenode or Hostname *contains* secondaryNamenode or Hostname *contains* resourceManager

Draft Query
Hostname *contains* datanode or Hostname *contains* nodemana or Hostname *contains* namenode or Hostname *contains* secondaryNamenode

Delete | Edit | Add

All Inventory 4 | Uncategorized Inventory 0 | Overlapping Scopes 1

Scopes overlapping with Compute

My Scope

Hostname *contains* m

Showing **4** of **4** inventory

Hostname	VRF	Address	OS
namenode-1	[redacted]	[redacted]	CentOS
resourceManager-1	[redacted]	[redacted]	linux
resourceManager-2	[redacted]	[redacted]	linux
secondaryNamenode-1	[redacted]	[redacted]	linux

Editing Scopes

Scopes can only be edited by users with the `SCOPE_OWNER` ability on the root scope. Site admins are owners of all scopes.

Editing a scope name

Editing a scope name happens immediately and can take several minutes depending on the number of child scopes that need to be updated.

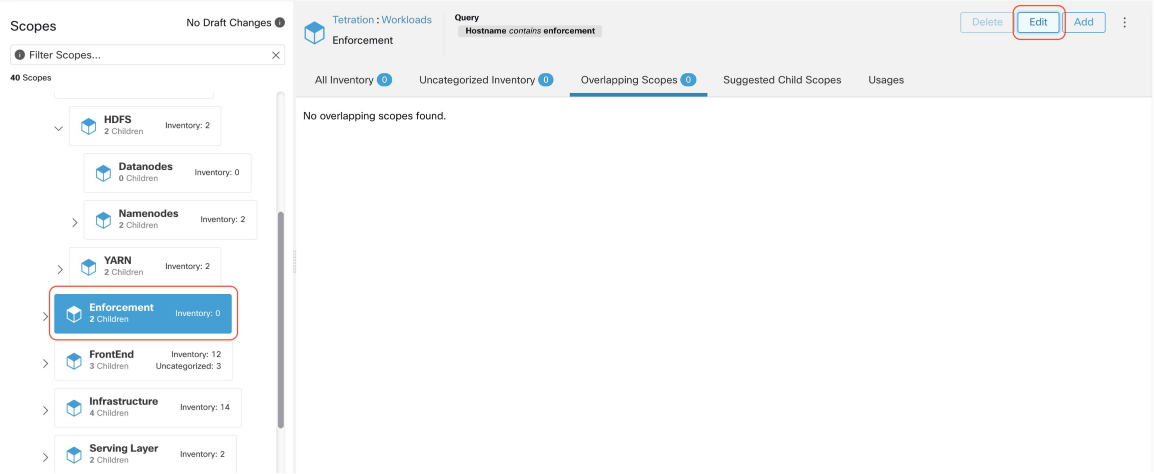
Note Flow searches by scope name will be impacted when changing the scope name.

Editing a scope query

When a scope's query is changed the direct parent and child scopes are impacted. Those scopes are marked as having 'draft changes' indicating changes have been made to the tree that have not been committed. Once all query updates have been completed, the user must click the **Commit Changes** button above the Scope Directory to make the change permanent. This will trigger a background task to update all of the scope queries and 'dynamic cluster queries' in the workspace.

> **Warning** Updating a scope query can impact the scopes inventory membership (the workloads that are members of the scope). Changes will take effect during the **Commit Changes** process. To mitigate risks, you can compare membership changes for further impact analysis from the Review Scope/Filter Change Impact window.
>
> New host firewall rules will be inserted and any existing rules will be deleted on the relevant hosts.

Figure 15: Edit a Scope



Hostname *contains* enforcement

No overlapping scopes found.

To edit a scope:

Procedure

Step 1 Click on the **edit button** on the respective scope to be edited.

Step 2 Edit the Name or Query for the selected scope.

Step 3 Compare changes between the old and new Draft Query by following the **Review query change impact** link.

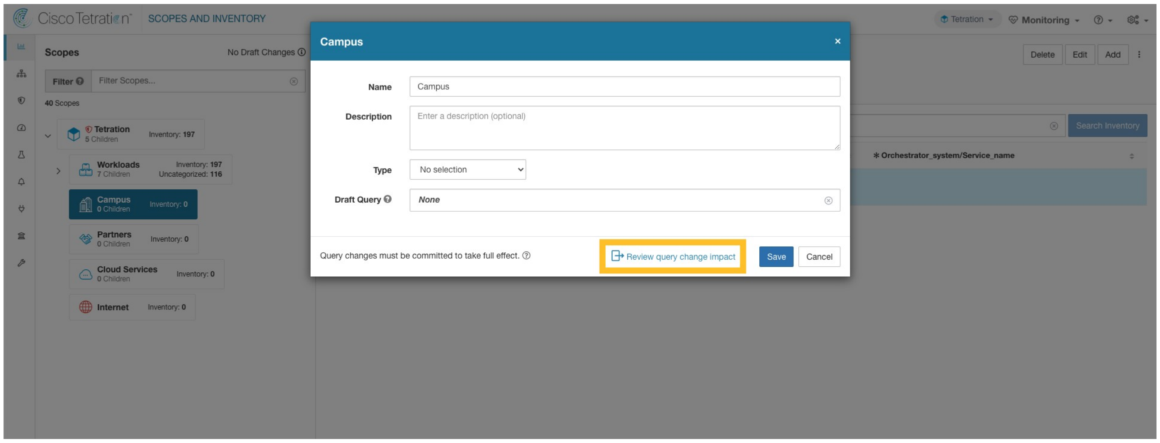
Step 4 Click on **Save**. Name gets updated right away.

Step 5 To update the Query of all scopes, Click the **Commit Changes** button.

Step 6 You will get a popup confirmation which states the consequences of performing scope changes. The update is processed asynchronously in a background task.

Step 7 Click on **Save**. Depending on the number of changes this can a minute or more.

Figure 16: Review query change impact



Name: Campus

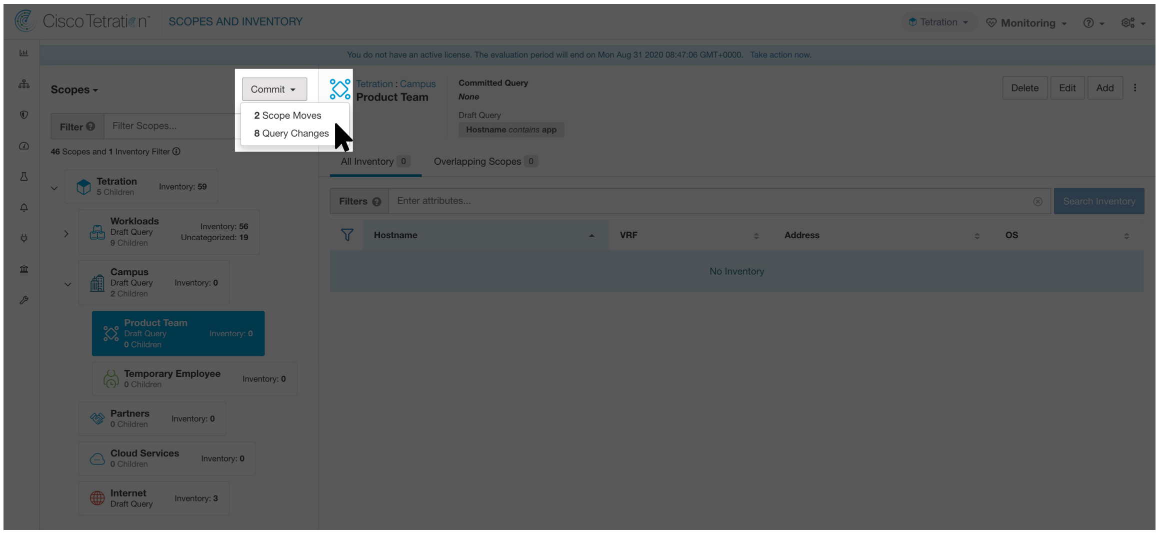
Description: Enter a description (optional)

Type: No selection

Draft Query: None

Query changes must be committed to take full effect.

Figure 17: Commit Changes



You do not have an active license. The evaluation period will end on Mon Aug 31 2020 08:47:06 GMT+0000. Take action now.

Committed Query: None

Draft Query: Hostname contains app

Editing the parent of a scope

When the parent of a scope is updated, the scope query changes. This change effects the membership of both the parent and child scopes. Similar to editing the scope query, these changes are initially saved as ‘draft changes’ and will not go into effect unless they are committed. The user can validate the impact of this change before committing by clicking on “Review query change impact” on the Edit Scope modal. Once validated, the changes can be committed by clicking “Commit” and accepting the “scope moves” and “query changes”.

To edit the parent of a scope:

Procedure

Step 1 Click on the **edit button** on the respective scope to be edited.

Step 2 Edit the parent for the selected scope.

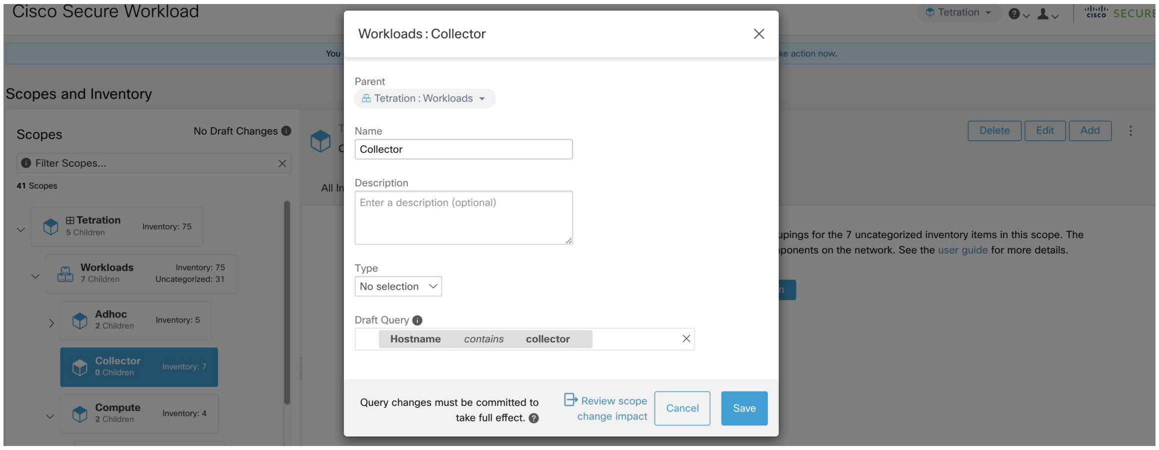
Step 3 Compare changes between the old and new Draft Query by clicking the **Review query change impact** link.

Step 4 Click on **Save**.

Step 5 Click on “Commit” and accept the ‘scope moves’ and ‘query changes’. The update is processed asynchronously in a background task.

Step 6 Depending on the number of workloads this change impacts, this can take a minute or more.

Figure 18: Changing the parent scope from Default scope to Default:ProdHosts



Workloads : Collector

Parent: Tetration : Workloads

Name: Collector

Description: Enter a description (optional)

Type: No selection

Draft Query: Hostname *contains* collector

Query changes must be committed to take full effect.

Deleting Scopes

Scopes can only be deleted by users with the `SCOPE_OWNER` ability on the root scope. Site admins are owners of all scopes.

Deleting a scope will impact the application inventory membership of the parent scope (the workloads that are members of the parent scope). . As a result, the parent scope will be marked as having ‘draft changes’. The changes will need to be committed and dependent structures will need to be updated. See Commit Changes.

Scopes with dependent objects can not be deleted. An error will be returned if:

- A workspace is defined for the Scope.
- There is an Inventory Filter assigned to the Scope.
- A policy exists that uses the Scope to define its consumers or providers.
- An Agent Config Intent is defined on the Scope
- An Interface Config Intent is defined on the Scope.
- A Forensics Config Intent is defined on the Scope.

  To further drill down on scope dependencies, you can visit the **Dependencies** tab from the Review Scope/Filter Change Impact window.

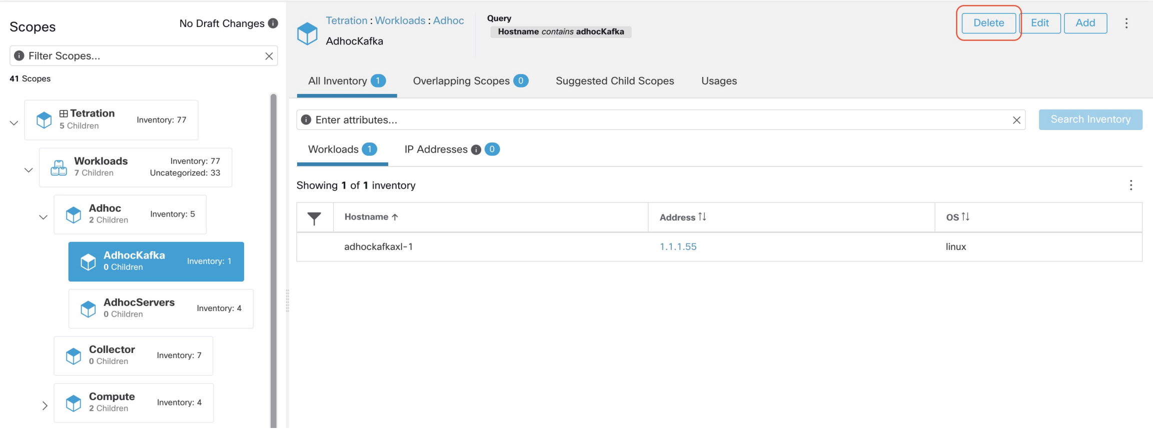
  These objects need to be removed before the Scope can be deleted.

1. In the navigation bar on the left, click **Organize** > **Scopes and Inventory**.

2. Select a “scope” then click again to display child Scopes. Select the child scope you wish to delete.

3. Click the **Delete** button next to the edit and add buttons.

Figure 19: Delete Scope


Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Compute 2 Children Inventory: 4
Tetration : Workloads : Adhoc
AdhocKafka
Query
Hostname contains adhocKafka
Delete
Edit
Add
All Inventory 1
Overlapping Scopes 0
Suggested Child Scopes
Usages
Enter attributes...
Search Inventory
Workloads 1
IP Addresses 0
Showing 1 of 1 inventory

Hostname ↑	Address ⇅	OS ⇅
adhockafkaxl-1	1.1.1.55	linux

Note Only Scopes without children can be deleted

Note Root scopes must be deleted by removing the VRF from the Tenants page.

Reset the Scope Tree

If any of the above configurations exist, you must delete them before you can reset the scope tree. The Reset button is not available until you do so.

To reset the scope tree:

Before you begin

You can delete the entire scope tree and start over.

Resetting the scope tree deletes all scopes, labels, workspaces, and collection rules. It does not delete any ingested data.

Only a user with the `SCOPE_OWNER` ability on the root scope can reset the scope tree.

However, you cannot reset the scope tree if any of the following are defined for any scope in the tree:

- Workspaces (except the single workspace created if you created the scope tree using the wizard)
- Inventory filters
- Policies
- Agent Config Intents

- Interface Config Intents
- Forensics Config Intents

Procedure

Step 1 From the navigation menu on the left, choose **Organize** > **Scopes and Inventory**.

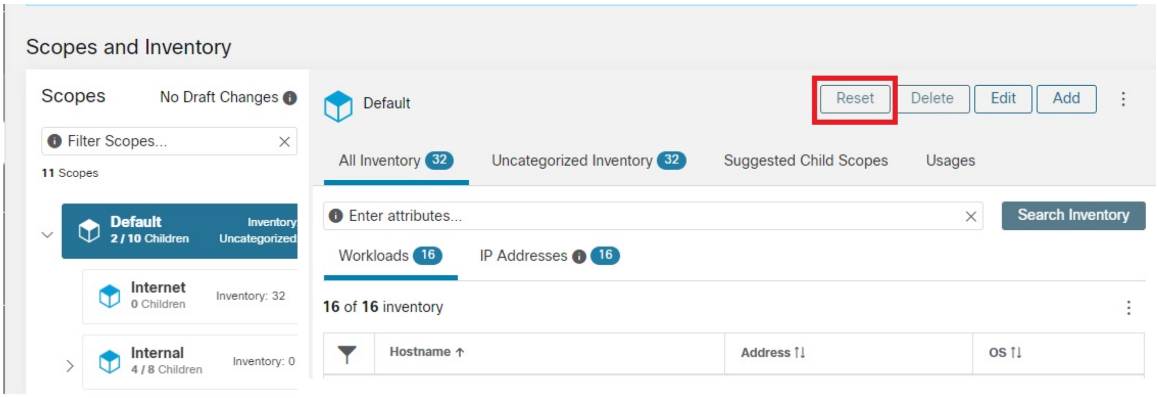
Step 2 Click the scope at the top of the tree.

Step 3 Click **Reset**.

Step 4 Confirm your choice.

Step 5 If necessary, refresh the browser page to continue.

Figure 20: Reset Scope Tree



Commit Changes

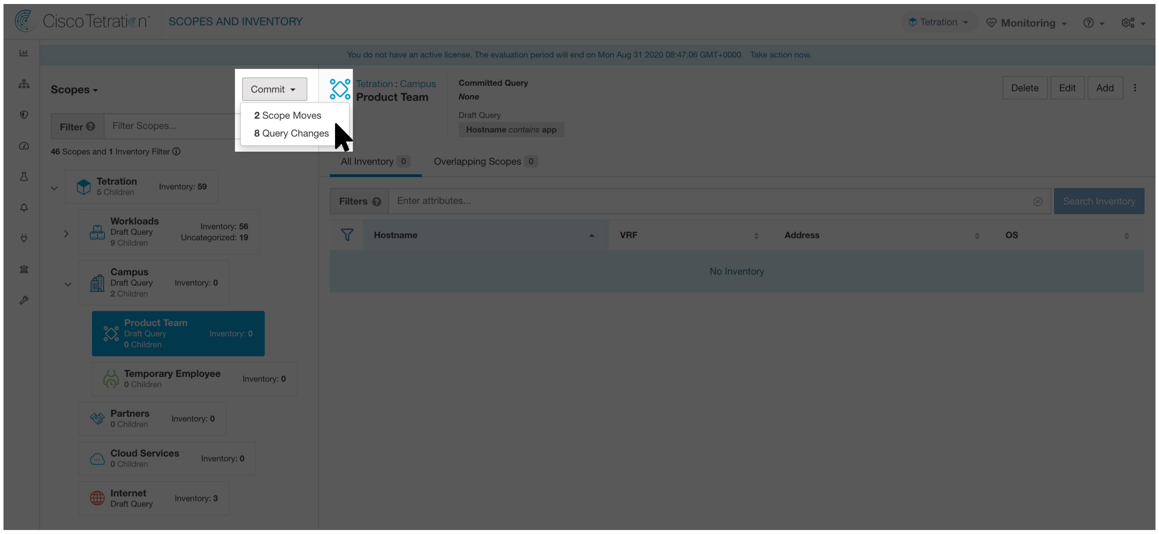
A scope's application inventory query definition is defined by its query and those of its direct children. When this happens the scope is marked as having 'draft changes' and the scope's query, workspaces, and clusters will not be changed until the **Commit Changes** background task is run. When a scope is in draft, the caution triangle is shown by the affected scopes icons, and the 'Commit Changes' button is shown on the Scopes page (top right) and should be clicked to run the **Commit Changes** background task.

Events that can mark a scope as in draft:

- Query update
- The query of any parent is updated.
- Direct child is added.
- Direct child is deleted.
- Direct child's query is updated.

Changing the name of a scope does not change the draft state of the scope.

Figure 21: Commit Changes



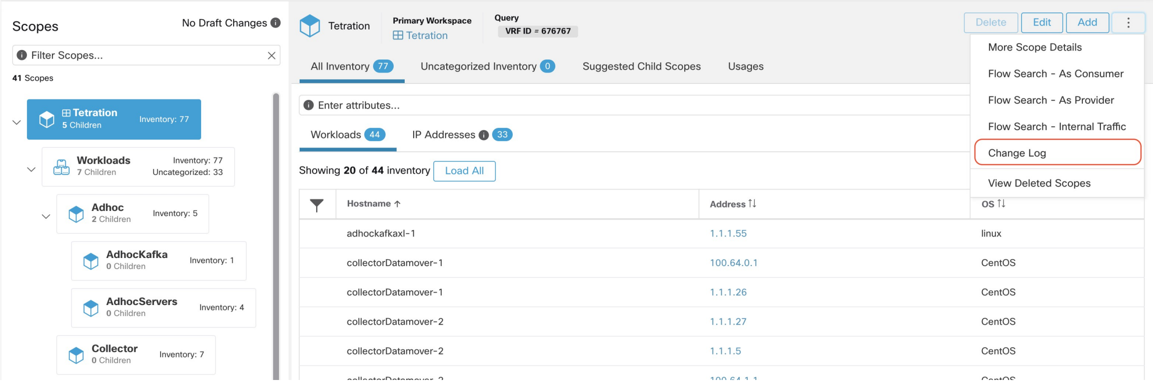
Note The **Commit Changes** task is asynchronous. It usually takes several seconds but large scope trees can take several minutes.

Note The scope update task will be completed when the root scope is no longer in draft. Refresh the page to get the latest state.

Change Log

Site Admins and users with the `SCOPE_OWNER` ability on the root scope can view the change logs for each scope by clicking change log in the overflow menu in the upper right.

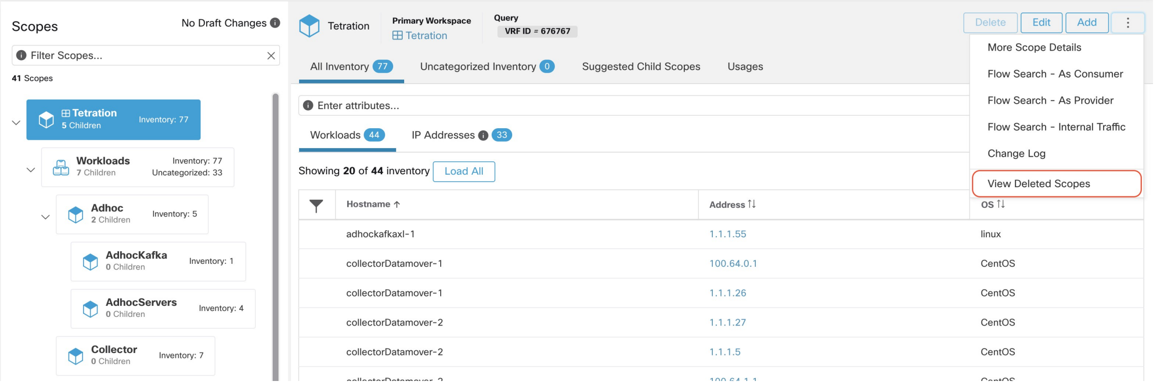
Figure 22: Change Log



Hostname ↑	Address ⇅	OS ⇅
adhockafkaxl-1	1.1.1.55	linux
collectorDatamover-1	100.64.0.1	CentOS
collectorDatamover-1	1.1.1.26	CentOS
collectorDatamover-2	1.1.1.27	CentOS
collectorDatamover-2	1.1.1.5	CentOS

These users can also view a list of deleted scopes by clicking on the **View Deleted Scopes** link is in the overflow menu in the upper right corner.

Figure 23: View Deleted Scopes


Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Tetration
Primary Workspace
Tetration
Query
VRF ID = 676767
Delete
Edit
Add
All Inventory 77
Uncategorized Inventory 0
Suggested Child Scopes
Usages
Enter attributes...
Workloads 44
IP Addresses 33
Showing 20 of 44 inventory
Load All
More Scope Details
Flow Search - As Consumer
Flow Search - As Provider
Flow Search - Internal Traffic
Change Log
View Deleted Scopes

Hostname ↑	Address ⇅	OS ⇅
adhockafkaxl-1	1.1.1.55	linux
collectorDatamover-1	100.64.0.1	CentOS
collectorDatamover-1	1.1.1.26	CentOS
collectorDatamover-2	1.1.1.27	CentOS
collectorDatamover-2	1.1.1.5	CentOS

Creating a New Tenant

Root level scopes map to VRFs that are created under Tenants or through the **Scopes** admin page. This action is only available to **Site Admins** and **Customer Support users**.

Procedure

Step 1 In the navigation bar on the left, click **Platform** > **Tenants**.

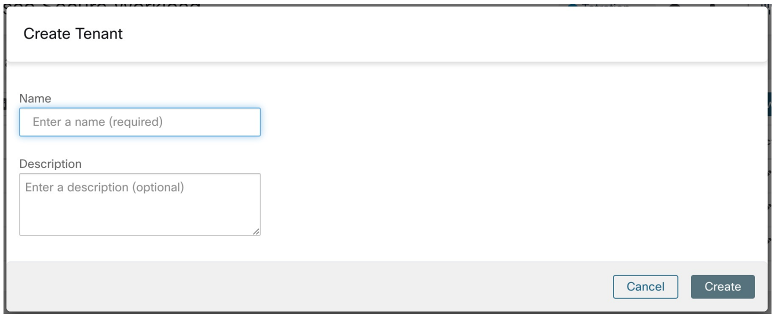
Step 2 Click the **Create New Tenant** button.

Step 3 Enter the appropriate values in the following fields:

Field	Description
Name	The name to identify the Scope. Must be unique under the parent Scope.
Description	An optional description.

Step 4 Click the **Create** button.

Figure 24: Create Tenant



Inventory

To work with inventory, click **Organize** > **Scopes and Inventory** in the left navigation bar.

Inventory Search

All inventory detected on the network is searchable. To search inventory, use the **Search Inventory** button. Each inventory item is uniquely identifiable by IP and VRF and can be used for performing a search. A service inventory item is not searchable using its IP Address. Use any of the User Labels associated to the service such as user_orchestrator_system/service_name for searching a service inventory. After a host has been found, you can view detailed information about the host on the host profile page.

Inventory Building Blocks

1. Root Scope
    - Root of the scope hierarchy under a given tenant
    - Provides a logical separation for L3 address domains
2. Scope
    - Inventory container defined by dynamic query
    - Foundation for hierarchical policy model
    - Anchor point for policy, RBAC, and filter configuration
3. Filter
    - Flexible construct based on dynamic inventory query
    - Anchor point for intent definition, provided services, and policy definition

Note Includes all IP addresses from partners and anything that is communicating in your environment. Whether they have an agent on them or not, you should define what they are through label.

Label Planning Considerations

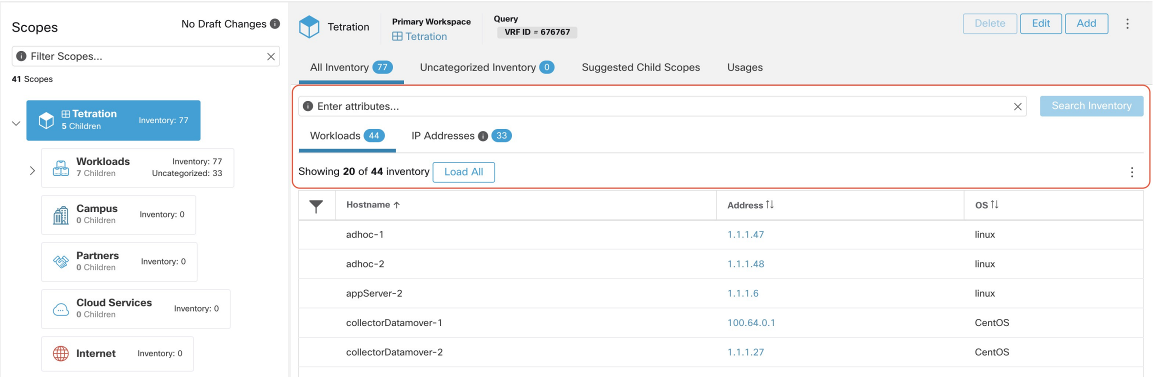
1. Source of data
    - Networks - IPAM? Routing tables? Spreadsheet?
    - Hosts - CMDB, Hypervisor, Cloud, App Owners?
2. Accuracy of data
3. How dynamic the data is and how it will be updated.
    - Manual Upload?
    - API Integration?

4. Start with the basics and grow.
    - Use network labels to build high-level scope structure.
    - Use host labels to build more detailed scope structure at app level.

Searching Inventory

Searching inventory enables you to view information about specific inventory items.

Figure 25: Inventory Search



Showing **20** of **44** inventory

Hostname ↑	Address ⇅	OS ⇅
adhoc-1	1.1.1.47	linux
adhoc-2	1.1.1.48	linux
appServer-2	1.1.1.6	linux
collectorDatamover-1	100.64.0.1	CentOS
collectorDatamover-2	1.1.1.27	CentOS

Procedure

Step 1 From the top-level menu, select **Organize** > **Scopes and Inventory**.

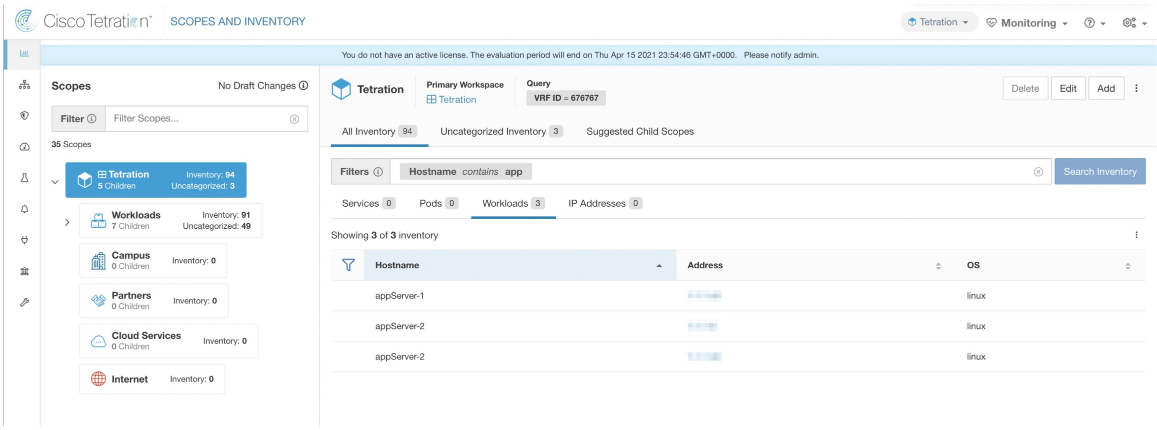
Step 2 Enter the attributes in the **Filters** field for the inventory item you are looking for. The attributes include the following:

Attributes	Description
Hostname	Enter a full or partial hostname.
VRF Name	Enter a VRF name.
VRF ID	Enter a VRF ID (numeric).
Address	Enter a valid IP address or subnet (IPv4 or IPv6).
Address Type	Enter either IPv4 or IPv6.
OS	Enter an OS name (e.g. CentOS).
OS Version	Enter an OS version (e.g. 6.5).
Interface Name	Enter an interface name (e.g. eth0).
MAC	Enter a MAC address.
In Collection Rules?	Enter true or false.

Attributes	Description
Process Command Line	Enter the sub-string of a command that is running on host (Note: this facet cannot be saved as part of inventory filter).
Process Binary Hash	Enter the process hash of a command that is running on host (Note: this facet cannot be saved as part of inventory filter).
Package Info	Enter the package name optionally followed by a package version (prefixed by #).
Package CVE	Enter part of or a complete CVE ID.
CVE Score v2	Enter a CVSSv2 (Common Vulnerability Scoring System) score (numeric).
CVE Score v3	Enter a CVSSv3 (Common Vulnerability Scoring System) score (numeric).
User Labels	Attributes prefixed with come from user labels.

Step 3 Click **Search Inventory**. The results are displayed below the **Filters** field grouped into four tabs. Each tab displays a table with the relevant columns. Additional columns can be displayed by clicking on the funnel icon in the table header. If any user labels are available, they will be prefixed with and can be toggled here.

Figure 26: Inventory Search Results

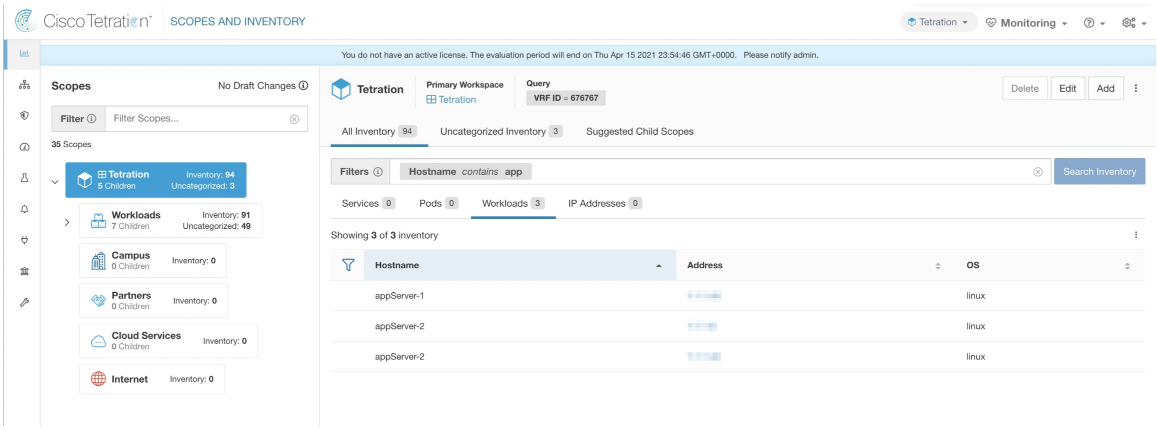


You do not have an active license. The evaluation period will end on Thu Apr 15 2021 23:54:46 GMT+0000. Please notify admin.

Showing 3 of 3 inventory

Hostname	Address	OS
appServer-1	[redacted]	linux
appServer-2	[redacted]	linux
appServer-2	[redacted]	linux

Figure 27: Inventory Search Results



You do not have an active license. The evaluation period will end on Thu Apr 15 2021 23:54:46 GMT+0000. Please notify admin.

Showing 3 of 3 inventory

Hostname	Address	OS
appServer-1	[redacted]	linux
appServer-2	[redacted]	linux
appServer-2	[redacted]	linux

The search results are grouped into four tabs:

Tab	Description
Services	Lists the Kubernetes services and load balancers discovered through External Orchestrators. This tab is hidden unless a related external orchestrator is configured.
Pods	Lists the Kubernetes pods. This tab is hidden unless a related external orchestrator is configured.
Workloads	Lists the inventory items reported by Secure Workload agents.

Note By default, the catch all subnets for IPv4 and IPv6 addresses display in each tenant.

There is also a mention of the inventory count next to each tab. The immediately available information in a search includes hostname, IP Addresses with subnets, OS, OS Version, Service Name and Pod Name. The list of displayed columns can be toggled by clicking the funnel icon in the table header. Search results are restricted to the currently selected scope shown in the scope directory. More information can be seen on the respective profile page by clicking on an item in the search results.

More details about each host is displayed on the **Workload Profile**, which is accessible by clicking on the IP address field of a search result row. See the Workload Profile for more information.

To create Inventory Filters via the sidebar: Choose **Organize** > **Inventory Filters** from the top-level menu. Click on the **Create Filter** button. A modal dialog appears where you can name your saved filter.

Suggest Child Scopes

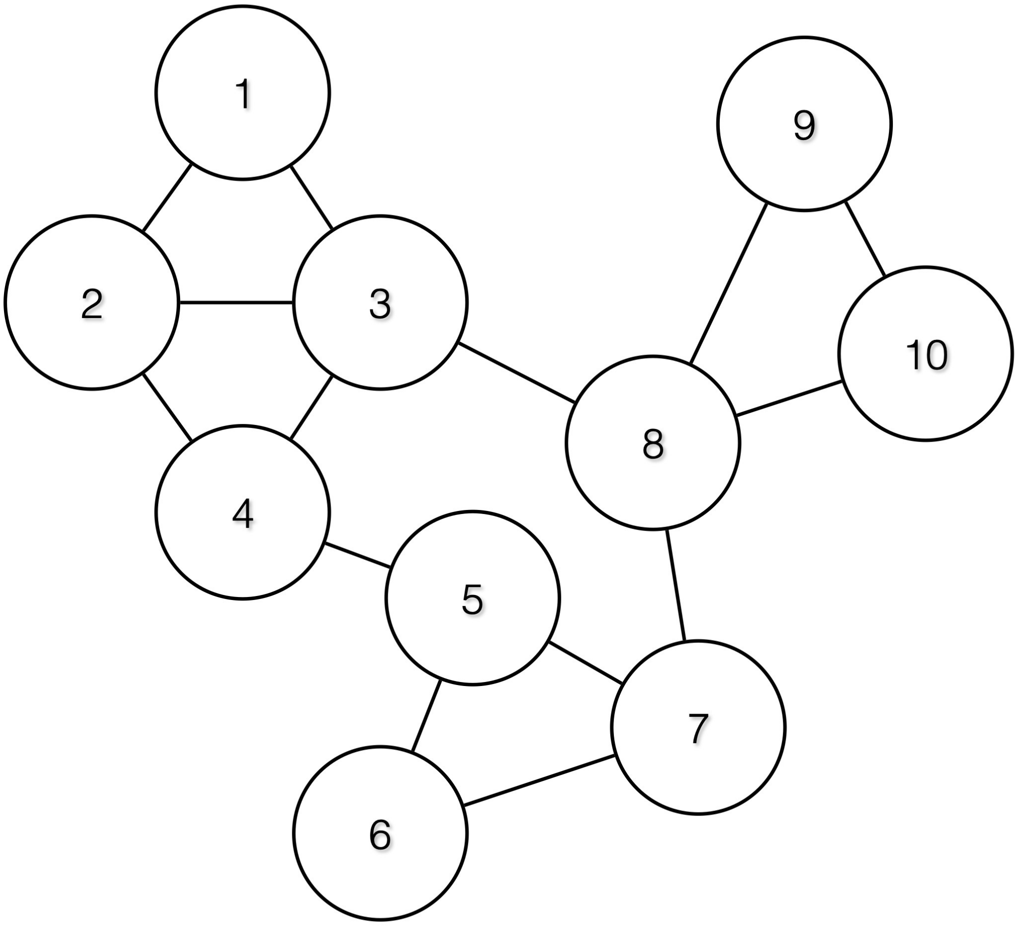
Suggest Child Scopes is a tool that uses machine learning algorithms (such as community detection in networks) to discover groupings that could serve as scopes. This tool is helpful when building a scope hierarchy, and facilitates the process of defining more granular child scopes for a given scope. Candidate child scopes are shown as suggestions that can then be selected and added.

A description of the algorithms at a conceptual level: A graph based on the communications among the unclaimed members of the parent scope is first created (note: unclaimed members are those that do not belong to any child scope of the parent), and the graph is preprocessed, for example the algorithms attempt to identify endpoints that communicate with sufficiently high proportion of other endpoints in the graph. Such a group of endpoints, if found, is displayed to the user as a candidate **common services** grouping. The rest of the graph is processed to detect groups that behave as **communities**, meaning roughly that the endpoints disproportionately communicate with one another more often (or on more provider ports) than to endpoints outside the group. Each such grouping may correspond to an application or a department within the organization. Such a partitioning can also lead to sparser policies among scopes.

Example:

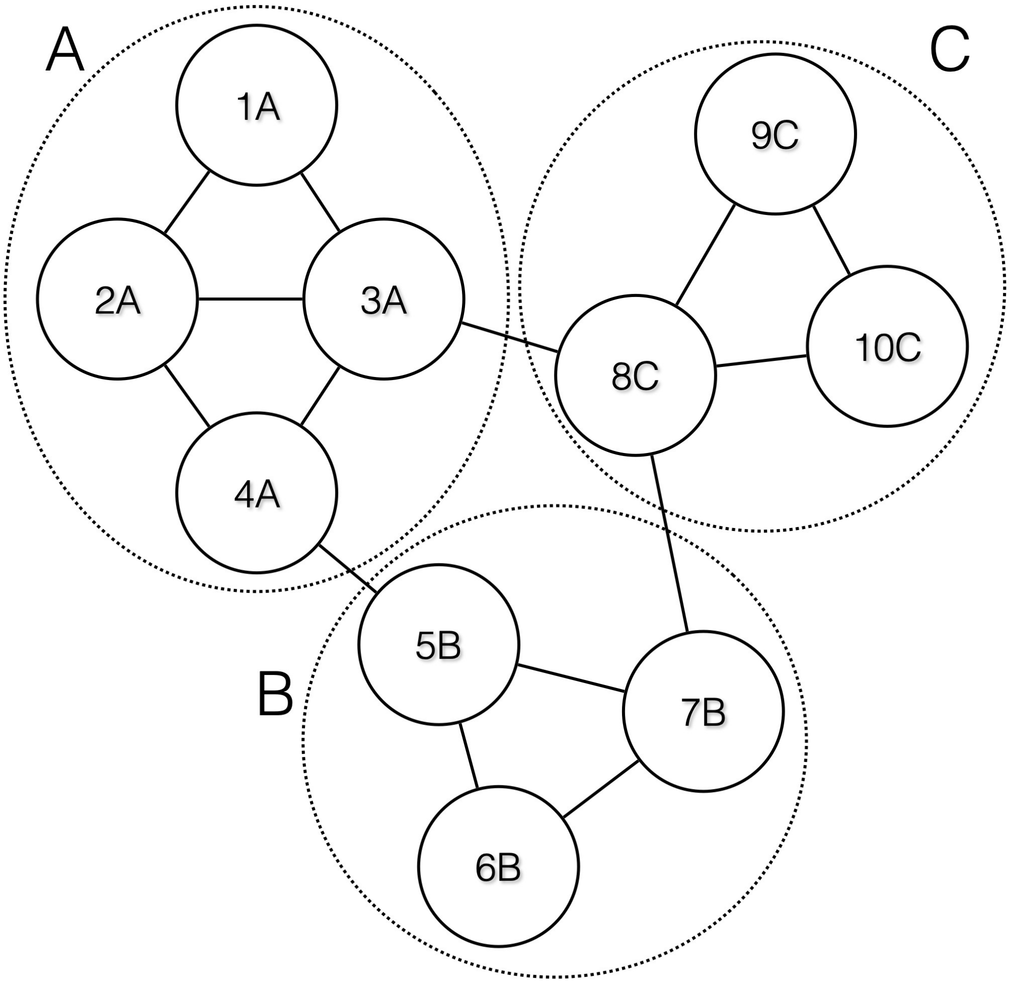
Let 1 through 10 be individual endpoint IPs. Assume the input (communications) graph is as follows:

Figure 28: Input graph



Then the endpoints 1 - 4, 5 - 7 and 8 - 10 will be grouped together because they have relatively high degree of communication (number of edges) among one another, and relatively low communications to other endpoints.

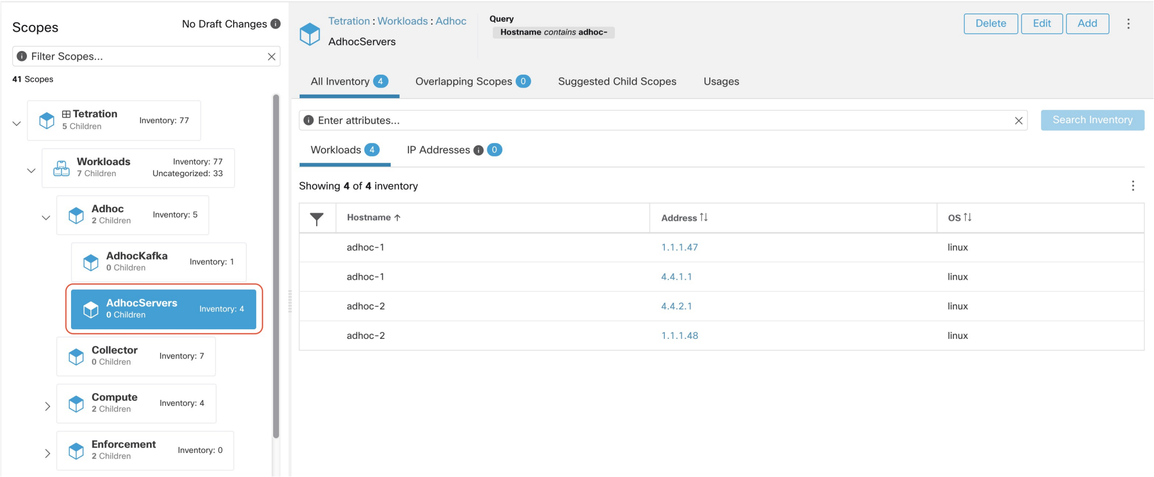
Figure 29: Output groups



Steps to perform scope suggestion

To invoke scope suggestion for a desired scope user should locate on the scopes page and select it.

Figure 30: Example of selecting a scope

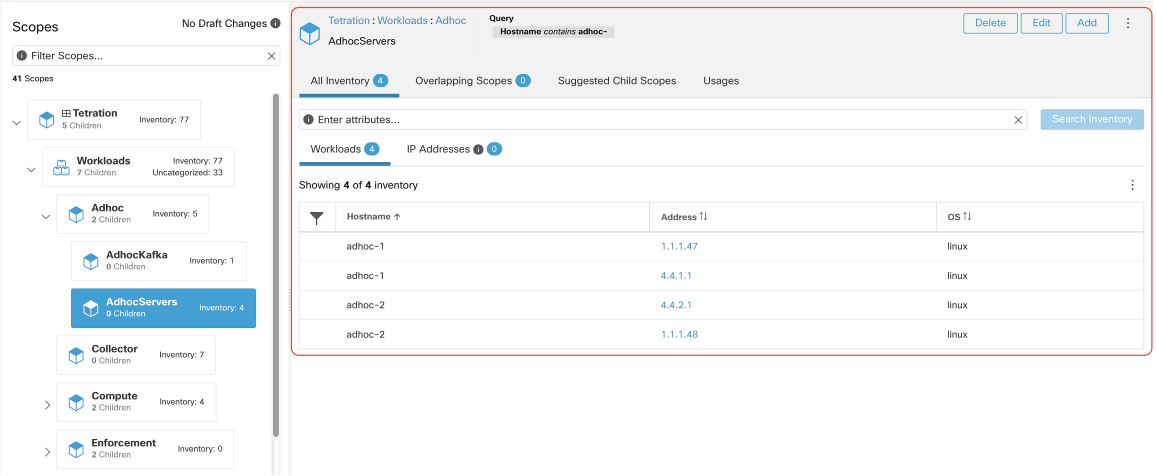

Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Compute 2 Children Inventory: 4
Enforcement 2 Children Inventory: 0
Tetration : Workloads : Adhoc
AdhocServers
Query
Hostname contains adhoc-
Delete
Edit
Add
All Inventory 4
Overlapping Scopes 0
Suggested Child Scopes
Usages
Enter attributes...
Search Inventory
Workloads 4
IP Addresses 0

Showing 4 of 4 inventory

Hostname ↑	Address ↑↓	OS ↑↓
adhoc-1	1.1.1.47	linux
adhoc-1	4.4.1.1	linux
adhoc-2	4.4.2.1	linux
adhoc-2	1.1.1.48	linux

In the window, user can browse the inventory, *uncategorized inventory items*, i.e. those items that belong to the current selected scope and that do not belong to any of the current selected scope's child scopes. Clicking on the **uncategorized inventory items** allows one to view this list.

Figure 31: Example of scope window

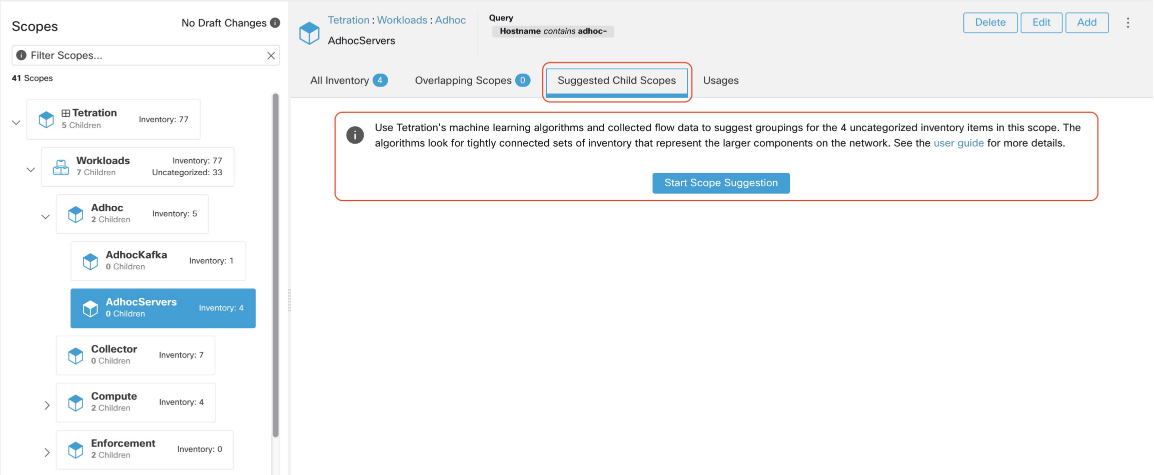

Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Compute 2 Children Inventory: 4
Enforcement 2 Children Inventory: 0
Tetration : Workloads : Adhoc
AdhocServers
Query
Hostname contains adhoc-
Delete
Edit
Add
All Inventory 4
Overlapping Scopes 0
Suggested Child Scopes
Usages
Enter attributes...
Search Inventory
Workloads 4
IP Addresses 0

Showing 4 of 4 inventory

Hostname ↑	Address ↑↓	OS ↑↓
adhoc-1	1.1.1.47	linux
adhoc-1	4.4.1.1	linux
adhoc-2	4.4.2.1	linux
adhoc-2	1.1.1.48	linux

After selecting the scope user can click on **Suggest Child Scopes**, and click on **Start Scope Suggestion** (or click on Rerun, in case this is not the first time). Note that the input for a scope suggestion run will be the uncategorized inventory items.

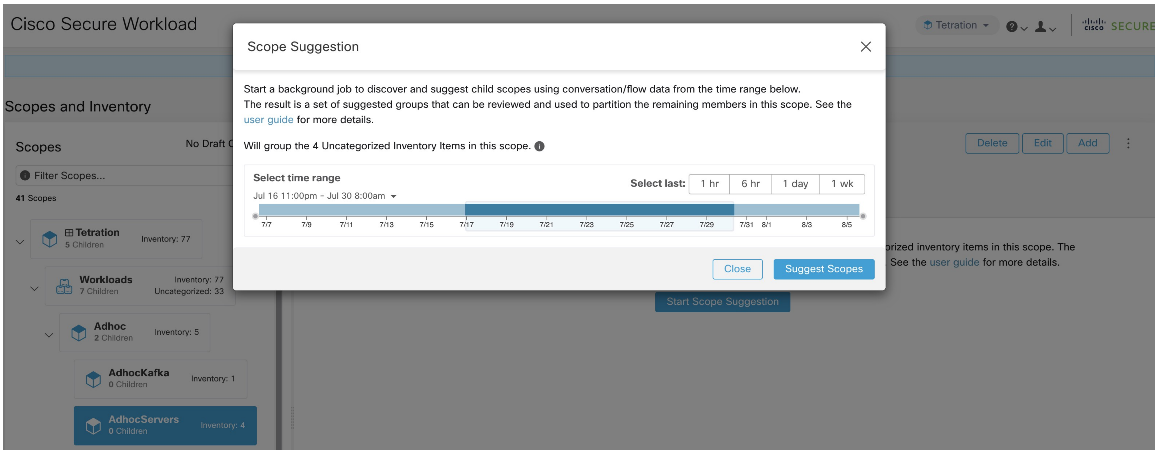
Figure 32: Suggest Child Scopes tab


Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Compute 2 Children Inventory: 4
Enforcement 2 Children Inventory: 0
Tetration : Workloads : Adhoc
AdhocServers
Query
Hostname contains adhoc-
Delete
Edit
Add
All Inventory 4
Overlapping Scopes 0
Suggested Child Scopes
Usages
Start Scope Suggestion

Use Tetration's machine learning algorithms and collected flow data to suggest groupings for the 4 uncategorized inventory items in this scope. The algorithms look for tightly connected sets of inventory that represent the larger components on the network. See the user guide for more details.

User can set the date range as input for scope suggestion and click on **Suggest Scopes**. A scope suggestion run is often fast under medium overall load, and takes only a few minutes for processing ten to thousands of endpoints, with tens of thousands of conversations.

Figure 33: Example of scope suggestion data range selector



Start a background job to discover and suggest child scopes using conversation/flow data from the time range below. The result is a set of suggested groups that can be reviewed and used to partition the remaining members in this scope. See the user guide for more details.

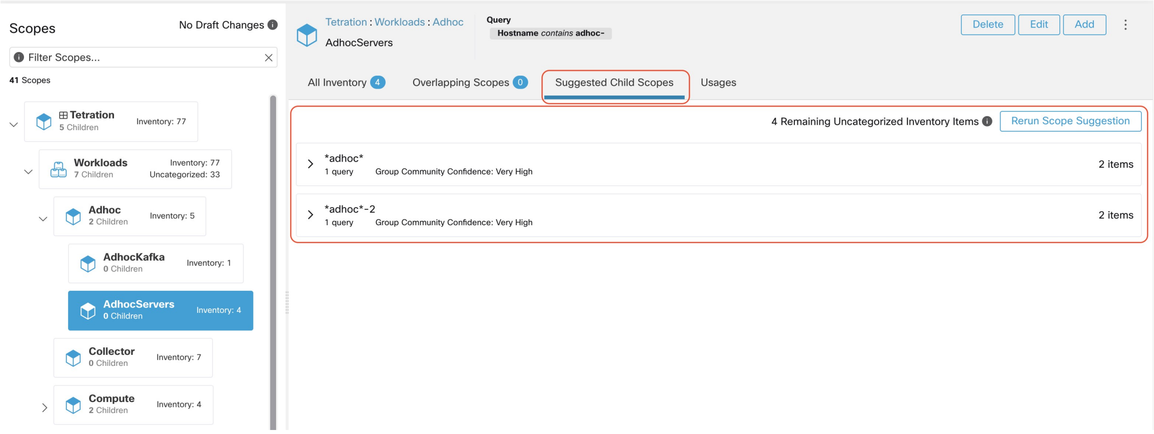
Will group the 4 Uncategorized Inventory Items in this scope.

The output is shown to the user as a list of candidates, currently up to 20 groups (shown), each accompanied with information such as group confidence (quality), a candidate scope name, and queries. Each discovered group has an associated **Group Community Confidence**, the possible values being: **Very High**, **High**, **Medium** and **Low**. This is a measure of the **Community** property of the group: the higher the confidence, the higher the community property of the given group of endpoints (many edges inside the group, relatively few edges to outside). Currently, the subset of groups picked to be shown are selected based on the Group Community Confidence. The groups discovered can currently fall under one of these four group types:

- **Generic Group**: Any group discovered via machine learning based on the community property. Note that any group that is not explicitly designated with the special types below is a generic group.
- **Common Service**: This group consists of endpoints that communicate with much of the input inventory. These endpoints could be running some kind of shared service(s).

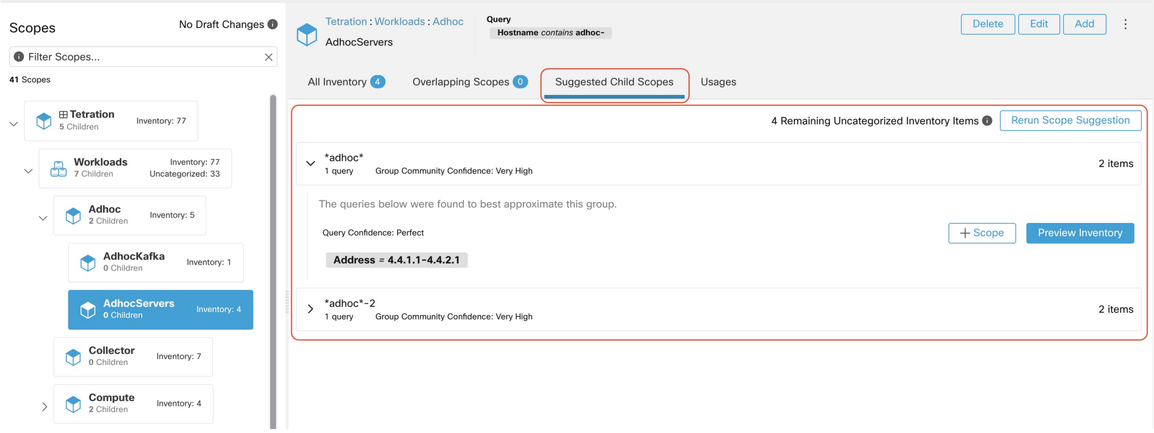
- **Common Service Clients**: This group consists of endpoints that only communicate with the **Common Service** group.
- **Ungrouped**: This group consists of endpoints that cannot be grouped since they don't have sufficient commu- nications.

Figure 34: Example of scope suggestion output


Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Compute 2 Children Inventory: 4
Tetration : Workloads : Adhoc
AdhocServers
Query
Hostname contains adhoc-
Delete
Edit
Add
All Inventory 4
Overlapping Scopes 0
Suggested Child Scopes
Usages
4 Remaining Uncategorized Inventory Items
Rerun Scope Suggestion
adhoc 1 query Group Community Confidence: Very High 2 items
adhoc-2 1 query Group Community Confidence: Very High 2 items

The user can click on a discovered group to view the list of queries generated for the selected group. The user can preview the inventory covered by the query which will closely define the discovered group. The queries consist of IP-ranges, subnets, host names and user uploaded labels. There is a confidence measure associated with each group called **Query confidence** which can have one of the following range of values **Perfect**, **Very High**, **High**, **Medium** and **Low**. For query generation, first the groups are discovered via graph processing and machine learning, then the queries are generated for each group. **Query Confidence** is a measure of how well the query can cover the endpoints. A query confidence of **Perfect** indicates that the query exactly covers the suggested (discovered) group. On the other end of the spectrum, a **Low** query confidence indicates that the query significantly misses out on exactly capturing the suggested group, which means that the query covers many **Extra IPs** (not part of the discovered group) and/or has many **Missing IPs** (not covered by the query).

Figure 35: Example of scope suggestion output queries


The queries below were found to best approximate this group.

Query Confidence: Perfect

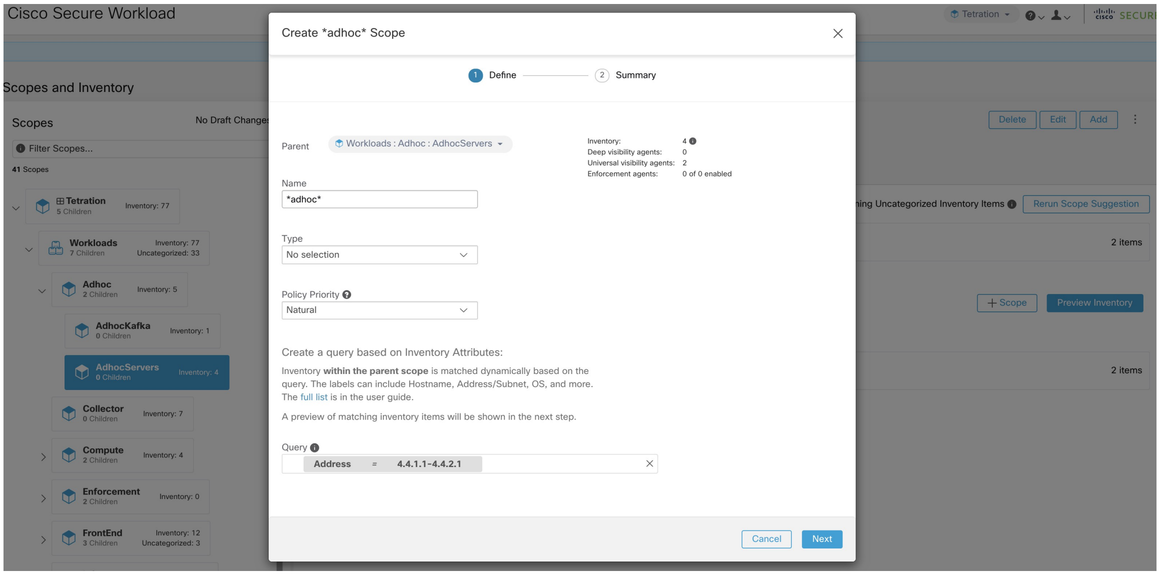
Address = 4.4.1.1-4.4.2.1

Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Compute 2 Children Inventory: 4
Tetration : Workloads : Adhoc
AdhocServers
Query
Hostname contains adhoc-
Delete
Edit
Add
All Inventory 4
Overlapping Scopes 0
Suggested Child Scopes
Usages
4 Remaining Uncategorized Inventory Items
Rerun Scope Suggestion
adhoc 1 query Group Community Confidence: Very High 2 items
+ Scope
Preview Inventory
adhoc-2 1 query Group Community Confidence: Very High 2 items

The user can click on **+ Scope** button which will take the user to an edit window where the user can edit the group name and group query. The user can examine a query, the IPs that it matches, and decide whether some

IPs need to be added or removed by adjusting the query. Once satisfied, the user can then click on **Next**, to review and convert the group to a scope on the draft view canvas.

Figure 36: Example of scope suggestion edit window


Cisco Secure Workload
Scopes and Inventory
Scopes
No Draft Changes
Filter Scopes...
41 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 0 Children Inventory: 4
Collector 0 Children Inventory: 7
Compute 2 Children Inventory: 4
Enforcement 2 Children Inventory: 0
FrontEnd 3 Children Inventory: 12 Uncategorized: 3
Delete
Edit
Add
Rerun Scope Suggestion
2 items
+ Scope
Preview Inventory
2 items
1 Define
2 Summary
Cancel
Next

Create *adhoc* Scope

Parent: Workloads : Adhoc : AdhocServers

Inventory:	4
Deep visibility agents:	0
Universal visibility agents:	2
Enforcement agents:	0 of 0 enabled

Name: *adhoc*

Type: No selection

Policy Priority: Natural

Create a query based on Inventory Attributes:

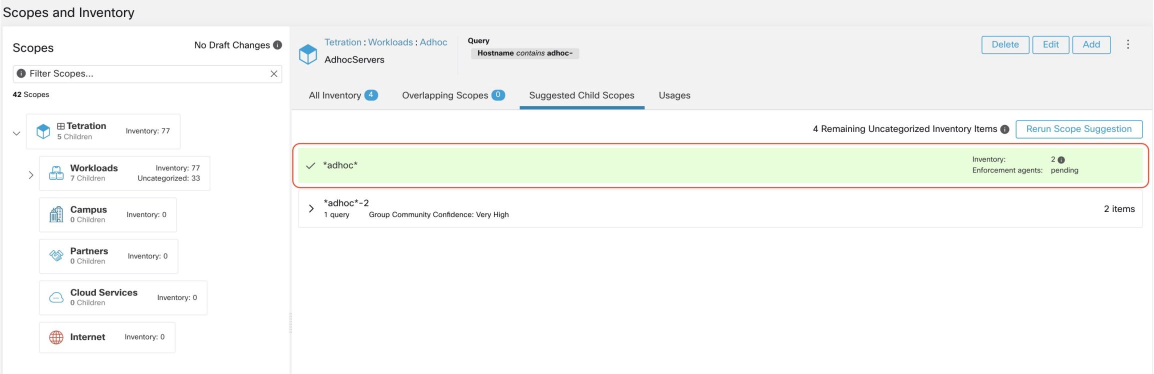
Inventory **within the parent scope** is matched dynamically based on the query. The labels can include Hostname, Address/Subnet, OS, and more. The full list is in the user guide.

A preview of matching inventory items will be shown in the next step.

Query: **Address = 4.4.1.1-4.4.2.1**

After the user has converted a suggested group to a scope, the group slot turns green and the **Uncategorized Inventory Items** count decreases.

Figure 37: Example of scope suggestion output after converting one suggested group to a scope


Scopes and Inventory
Scopes
No Draft Changes
Filter Scopes...
42 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Campus 0 Children Inventory: 0
Partners 0 Children Inventory: 0
Cloud Services 0 Children Inventory: 0
Internet Inventory: 0
Tetration : Workloads : Adhoc
AdhocServers
Delete
Edit
Add
All Inventory 4
Overlapping Scopes 0
Suggested Child Scopes
Usages
Rerun Scope Suggestion

Query: **Hostname** *contains* **adhoc-**

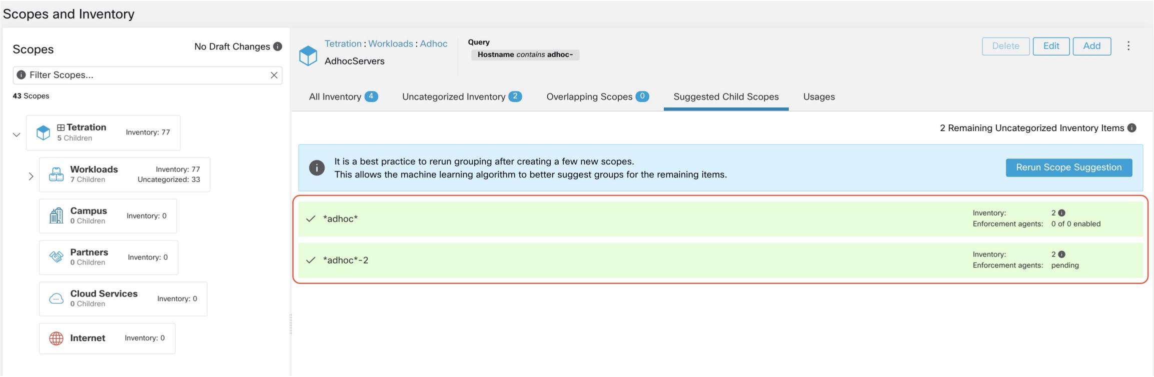
4 Remaining Uncategorized Inventory Items

✓ *adhoc* — Inventory: 2; Enforcement agents: pending

adhoc-2 — 1 query — Group Community Confidence: Very High — 2 items

The user can repeat the process of scope creation from the remaining list of groups. The recommended workflow is to create one or more scopes and then re-run **scope suggestion**. A zero count for **Uncategorized Inventory Items** indicates that there is no inventory left to be further scoped (for the currently selected parent scope).

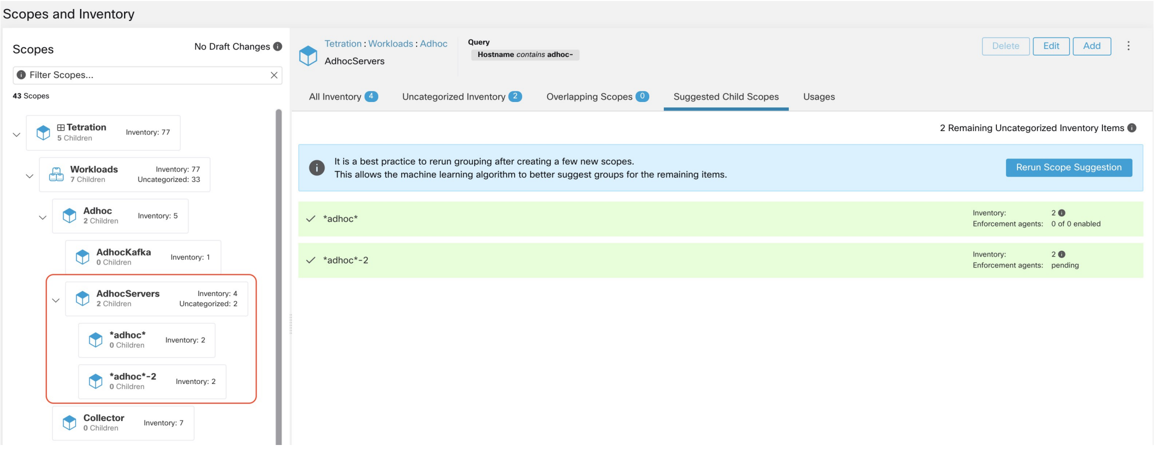
Figure 38: Example of scope suggestion output after multiple scope creations


Scopes and Inventory
Scopes
No Draft Changes
Filter Scopes...
43 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Campus 0 Children Inventory: 0
Partners 0 Children Inventory: 0
Cloud Services 0 Children Inventory: 0
Internet Inventory: 0
Tetration : Workloads : Adhoc
AdhocServers
Query
Hostname contains adhoc-
Delete
Edit
Add
All Inventory 4
Uncategorized Inventory 2
Overlapping Scopes 0
Suggested Child Scopes
Usages
2 Remaining Uncategorized Inventory Items
Rerun Scope Suggestion
✓ *adhoc*
Inventory: 2
Enforcement agents: 0 of 0 enabled
✓ *adhoc*-2
Inventory: 2
Enforcement agents: pending

It is a best practice to rerun grouping after creating a few new scopes.
This allows the machine learning algorithm to better suggest groups for the remaining items.

After the scope creation process is done (the uncategorized count is 0), user can repeat this process on the newly created child scopes in order to generate a deeper scope tree as desired.

Figure 39: Example of the scopes list after the initial scope suggestion and creation


Scopes and Inventory
Scopes
No Draft Changes
Filter Scopes...
43 Scopes
Tetration 5 Children Inventory: 77
Workloads 7 Children Inventory: 77 Uncategorized: 33
Adhoc 2 Children Inventory: 5
AdhocKafka 0 Children Inventory: 1
AdhocServers 2 Children Inventory: 4 Uncategorized: 2
adhoc 0 Children Inventory: 2
adhoc-2 0 Children Inventory: 2
Collector 0 Children Inventory: 7
Tetration : Workloads : Adhoc
AdhocServers
Query
Hostname contains adhoc-
Delete
Edit
Add
All Inventory 4
Uncategorized Inventory 2
Overlapping Scopes 0
Suggested Child Scopes
Usages
2 Remaining Uncategorized Inventory Items
Rerun Scope Suggestion
✓ *adhoc*
Inventory: 2
Enforcement agents: 0 of 0 enabled
✓ *adhoc*-2
Inventory: 2
Enforcement agents: pending

It is a best practice to rerun grouping after creating a few new scopes.
This allows the machine learning algorithm to better suggest groups for the remaining items.

Note There is also a possibility that the uncategorized items in a scope do not partition well (e.g., do not form communities). In that case, the algorithm may return no groupings (an empty result).

Filters

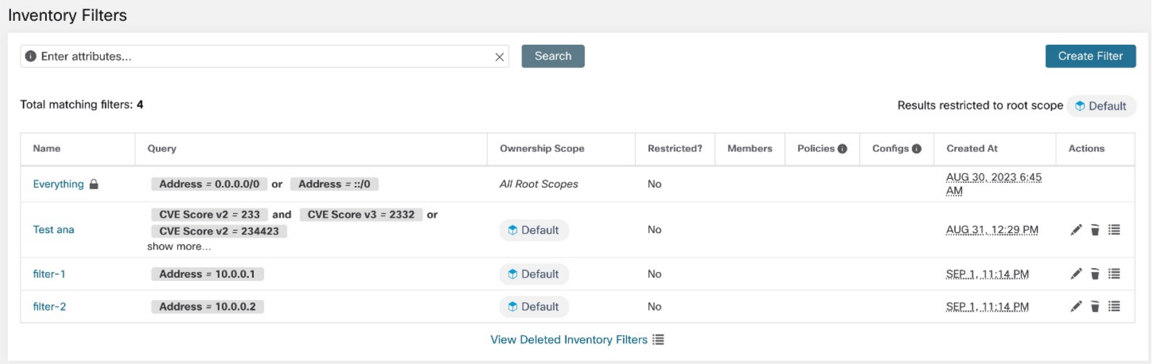
Filters are saved inventory searches that can be used when defining policies, config intents, and so on. Each filter must be associated with a scope, which is defined as the filter’s ownership scope.

To view existing filters, select **Organize** > **Inventory Filters** from the left navigation menu. You can also view inventory filters specific to any scope in any workspace for that scope.

The list of filters are restricted based on the root of the currently selected scope.

The filters also display he number of members, number of policies it is involved in, the sum of draft analysed and enforced policies.

Figure 40: Inventory filters



Inventory Filters

Total matching filters: **4**

Results restricted to root scope Default

Name	Query	Ownership Scope	Restricted?	Members	Policies	Configs	Created At	Actions
Everything	Address = 0.0.0.0/0 or Address = ::/0	*All Root Scopes*	No				AUG 30, 2023 6:45 AM	
Test ana	CVE Score v2 = 233 and CVE Score v3 = 2332 or CVE Score v2 = 234423 show more...	Default	No				AUG 31, 12:29 PM	
filter-1	Address = 10.0.0.1	Default	No				SEP 1, 11:14 PM	
filter-2	Address = 10.0.0.2	Default	No				SEP 1, 11:14 PM	

View Deleted Inventory Filters

You can review inventory membership changes with respect to the selected parent scope by visiting the Review Scope/Filter Change Impact window.

Create an Inventory Filter

You can create inventory filters for many purposes. For example, you can use inventory filters to :

- Create or discover policies specific to subsets of workloads within a scope.

  For example, if you have an application that is accessed only via API interface, you might want to create a group of API servers within the scope so you can create policies that allow that traffic but block access to all other workloads for that application.

- Create policies for workloads that might exist across many scopes.

  For example, if you need to create a policy that applies to all workloads on your network that are running a particular operating system, you could create an inventory filter that spans multiple (or all) scopes.

Tip To convert an existing cluster to an inventory filter, see Convert a Cluster to an Inventory Filter.

Procedure

Step 1 Navigate to one of the following locations:

- Choose **Organize** > **Inventory Filters**.
- Navigate to any workspace in a scope for which you want to create an inventory filter, then click **Manage Policies**, then click **Filters**, then click **Inventory Filters**.

Step 2 Click **Create Filter** or **Add Inventory Filter**.

Step 3 Add a name, description, and query that includes all of, and only, the workloads that you want to include in the filter.

Step 4 If you see **Show advanced options**, click this link.

Step 5 Specify the scope for this filter.

The selected scope determines:

- Who can modify this filter:

  To modify this filter, an administrator must have write access to the specified scope or any of its ancestors.

- (Depending on other settings in this procedure) The workloads included in the filter.

Step 6 Configure options:

To	Do This
Include workloads that meet the filter query criteria, whether or not they are members of the scope specified in this filter.	Deselect **Restrict query to ownership scope**
Include only workloads that are members of the scope specified in this filter.	Select **Restrict query to ownership scope**.
Allow automatic policy discovery to suggest policies specific to the set of workloads defined by this filter. These workloads must be a subset of the scope specified in the filter.	Select both **Restrict query to ownership scope** AND **Provides a service external of its scope**. You must select the former in order to select the latter. In order to use this filter, you must configure external dependencies. See Fine-Tune External Dependencies for a Workspace.

Step 7 Click **Next**.

Step 8 Review the details and click **Create**.

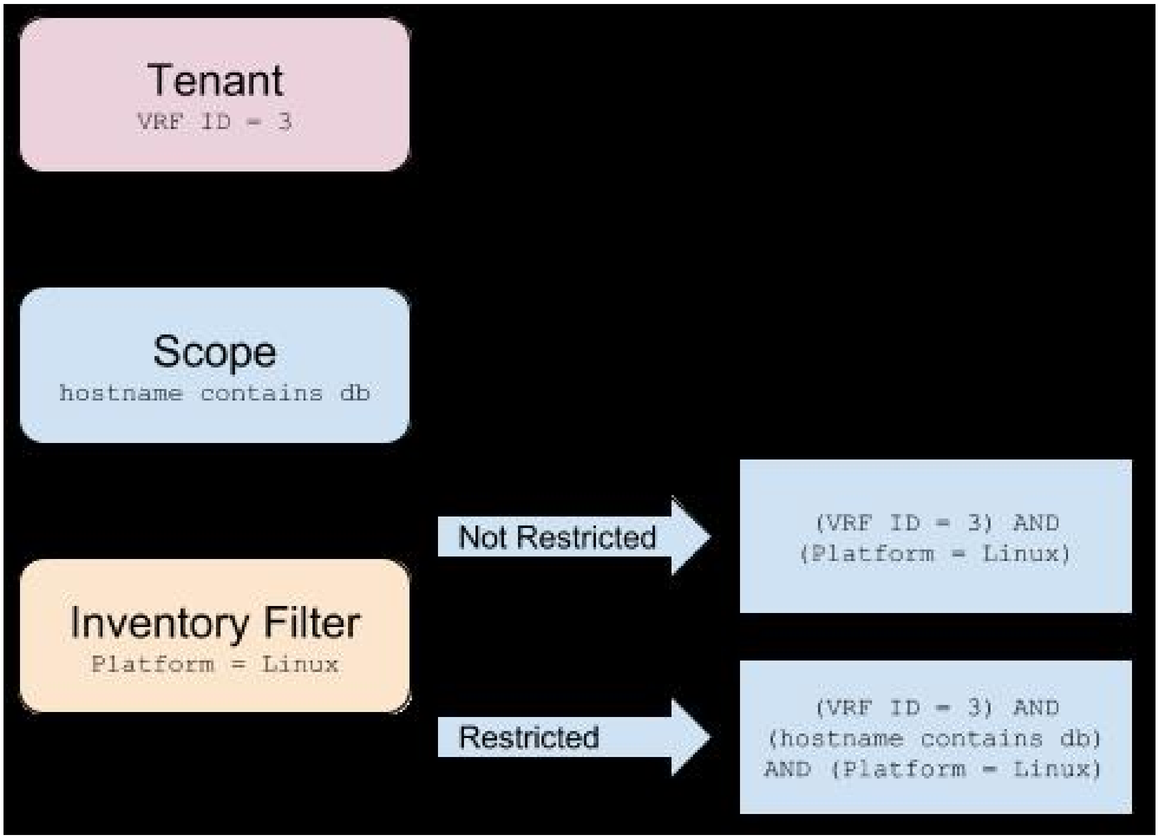
Restrict to Ownership Scope

Whether or not the scope impacts the inventory matched by a filter is determined by the **Restrict to Ownership Scope?** checkbox.

For example, given the following structure:

1. Tenant with query `VRF ID = 3`
2. Scope within this tenant with query `hostname contains db`
3. Inventory filter with query `Platform = Linux` attached to this scope.

Figure 41: Tenant, Scope and Inventory Filter Structure

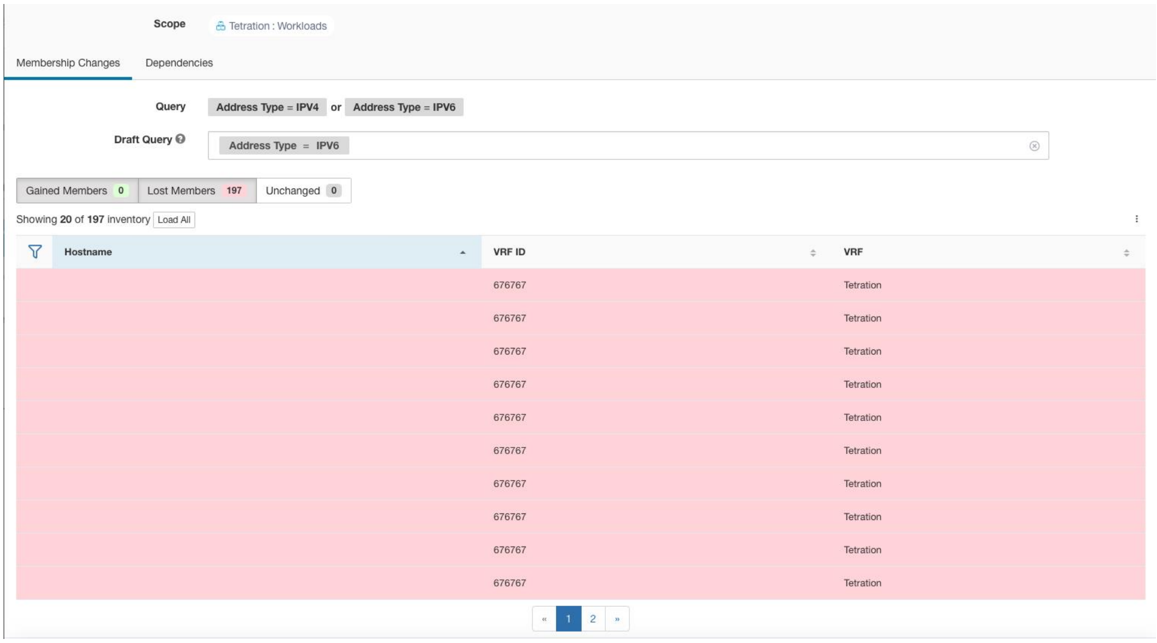


- When **Restrict to Ownership Scope** is not checked: The filter matches all hosts within the tenant that also match the filter. The effective query would be: `(VRF ID = 3) AND (Platform = Linux)`.
- When **Restrict to Ownership Scope** is checked: The filter only matches hosts within the tenant and the scope that also match the filter. The effective query would be: `(VRF ID = 3) AND (hostname contains db) AND (Platform = Linux)`.

Review Scope/Filter Change Impact

Updating a scope query can impact the scope's inventory membership after it gets committed. Likewise filter query change, which gets saved directly, can also impact the scope inventory memberships. You can identify membership changes between the new and old queries by following the **Review query change impact** link on either Scope or Filter Edit modals. In addition, knowing the scope or filter dependencies can be helpful for impact analysis and removing all necessary objects preventing Scope deletion. Visit the **Dependencies** tab as well, to traverse the Scope Dependencies tree for further information.

Figure 42: Download Membership Table



Scope Tetration : Workloads

Query: Address Type = IPV4 or Address Type = IPV6

Draft Query: Address Type = IPV6

Showing 20 of 197 inventory Load All

Hostname	VRF ID	VRF
	676767	Tetration
	676767	Tetration
	676767	Tetration
	676767	Tetration
	676767	Tetration
	676767	Tetration
	676767	Tetration
	676767	Tetration
	676767	Tetration
	676767	Tetration

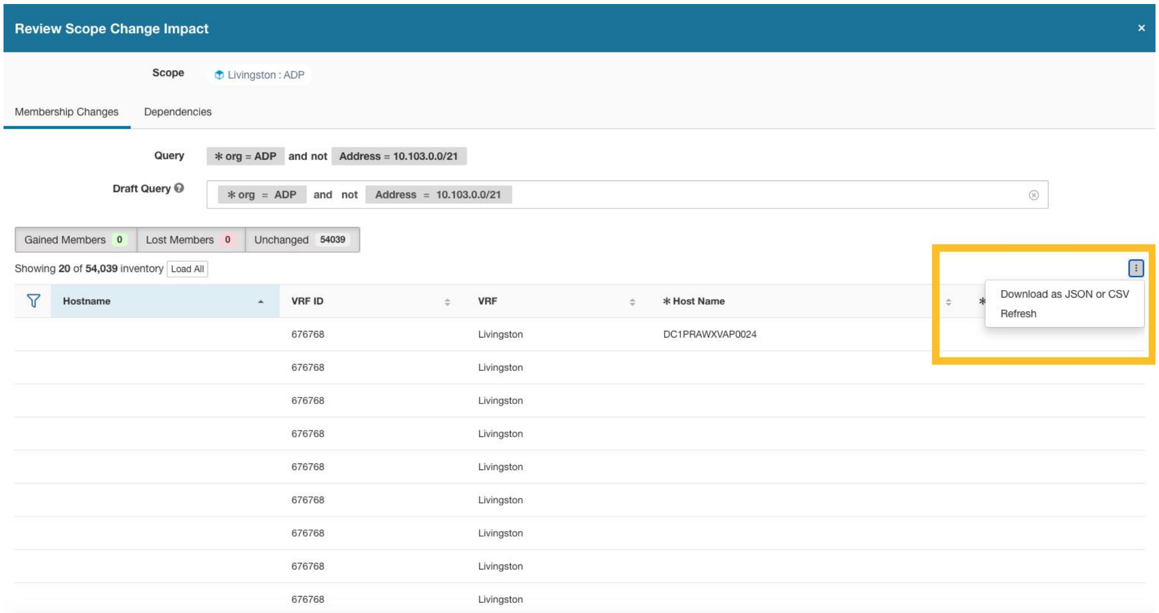
Scope Query Change Impact Modal

Both **Membership Changes** and **Dependencies** tab can be accessed by following the link to **Review query change impact** on Scope Edit window.

Membership Changes

The inventory table under Membership view displays all columns by default. You can choose the columns to display. Furthermore, you can download the csv or json of chosen Membership columns and rows with an additional Diff column identifying whether the inventory is **Gained**, **Lost** or **Unchanged**. Be sure that all table selection desired for download is visible to the table view.

Figure 43: Scope Membership Changes



Review Scope Change Impact ×

Scope: Livingston : ADP

Membership Changes | Dependencies

Query: ∗ org = ADP and not Address = 10.103.0.0/21

Draft Query: ∗ org = ADP and not Address = 10.103.0.0/21

Gained Members 0 | Lost Members 0 | Unchanged 54039

Showing 20 of 54,039 inventory Load All

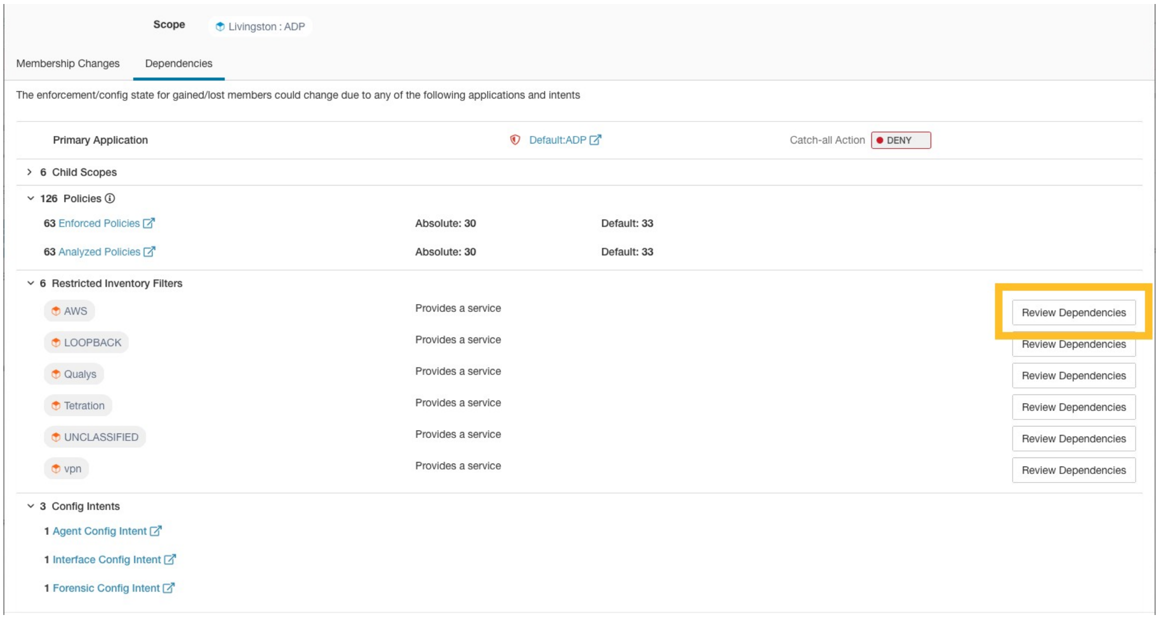
Download as JSON or CSV
Refresh

Hostname	VRF ID	VRF	∗ Host Name
	676768	Livingston	DC1PRAWXVAP0024
	676768	Livingston	
	676768	Livingston	
	676768	Livingston	
	676768	Livingston	
	676768	Livingston	
	676768	Livingston	
	676768	Livingston	
	676768	Livingston	

Dependencies

You can traverse down to nested dependencies by further selecting **Review Dependencies**

Figure 44: Review Dependencies



Scope: Livingston : ADP

Membership Changes | Dependencies

The enforcement/config state for gained/lost members could change due to any of the following applications and intents

Primary Application: Default:ADP — Catch-all Action: DENY

› 6 Child Scopes

⌄ 126 Policies

63 Enforced Policies	Absolute: 30	Default: 33
63 Analyzed Policies	Absolute: 30	Default: 33

⌄ 6 Restricted Inventory Filters

AWS	Provides a service	Review Dependencies
LOOPBACK	Provides a service	Review Dependencies
Qualys	Provides a service	Review Dependencies
Tetration	Provides a service	Review Dependencies
UNCLASSIFIED	Provides a service	Review Dependencies
vpn	Provides a service	Review Dependencies

⌄ 3 Config Intents

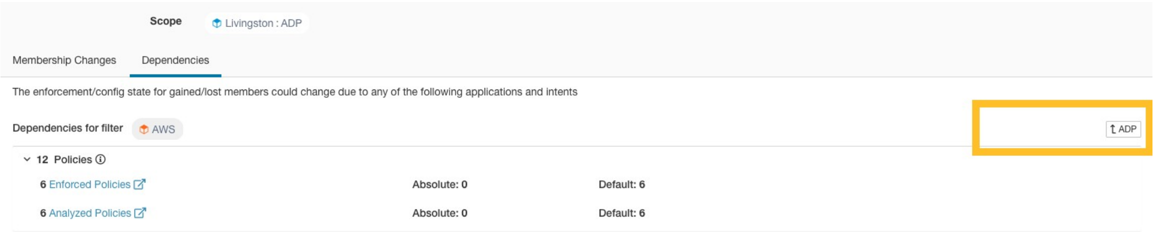
1 Agent Config Intent

1 Interface Config Intent

1 Forensic Config Intent

You can traverse back up the dependencies tree by selecting the selected Parent link:

Figure 45: Parent Link



The enforcement/config state for gained/lost members could change due to any of the following applications and intents

Dependencies for filter AWS

12 Policies

6 Enforced Policies Absolute: 0 Default: 6

6 Analyzed Policies Absolute: 0 Default: 6

The following are Scope Dependencies which may exist:

Table 3: The following are Scope Dependencies which may exist

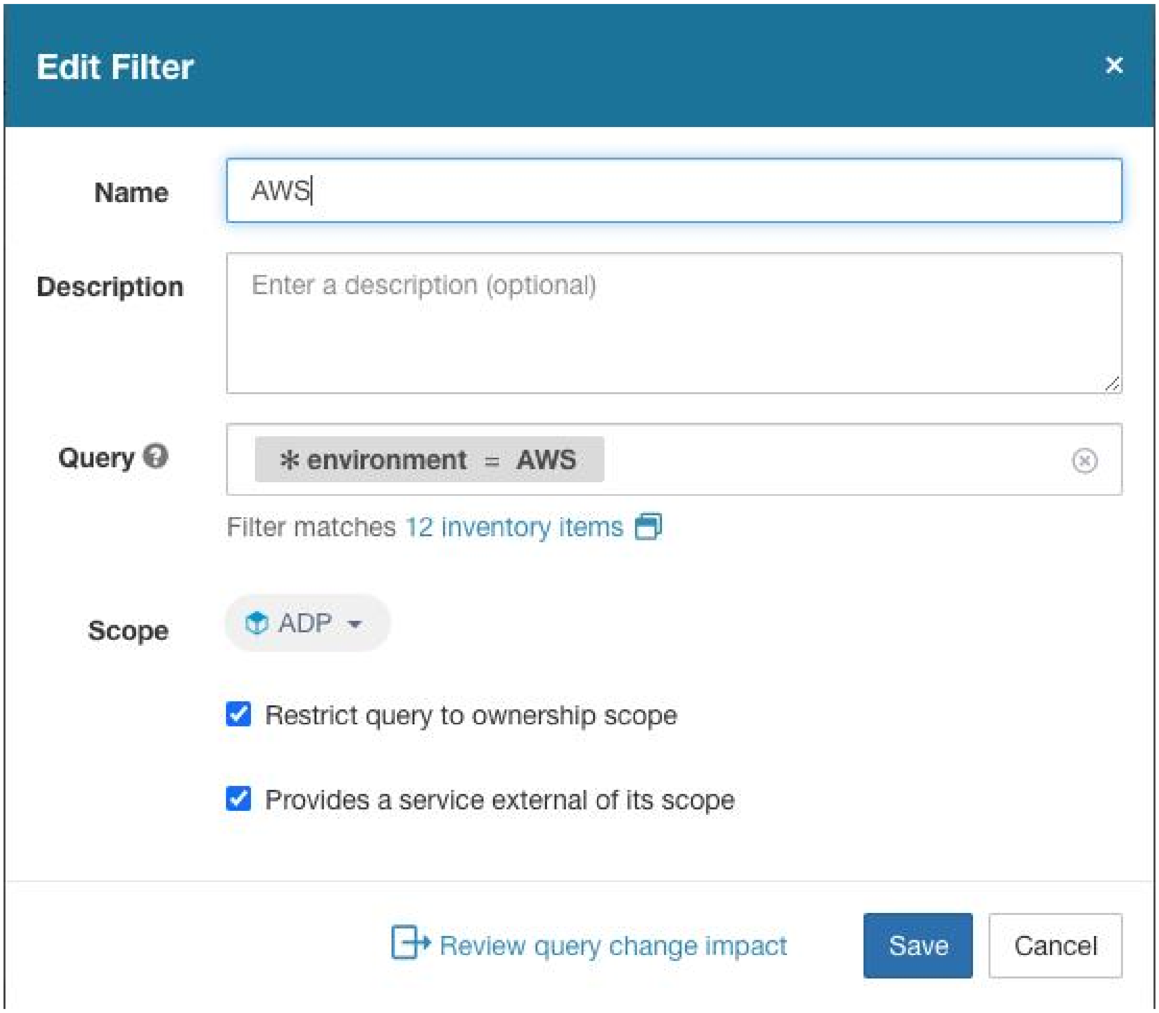
Type	Description
Application	Has primary and secondary application names and links to the specific workspaces under Segmentation.
Child Scopes	Has names and links to child Scope Detail views. Allows drill down to lower level Dependencies.
Policies	Has analyzed and enforced policies counts and links to respective Global Policy Views filtered by selected scope.
Restricted Inventory Filters	Has names and links to child Filter Detail views. Allows drill down to lower level Dependencies.
Config Intents	Has names and links to Agent, Interface and Forensics Config Intents views.

Filter Query Change Impact Modal

Both **Membership Changes** and **Dependencies** tab can be accessed by following the link to **Review query change impact** on Inventory Filter Edit window.

Membership Changes

Figure 46: Inventory Filter Membership Changes



Edit Filter ×

Name: AWS

Description: Enter a description (optional)

Query: ✻ environment = AWS

Filter matches 12 inventory items

Scope: ADP

☑ Restrict query to ownership scope

☑ Provides a service external of its scope

Dependencies

The following are Filter Dependencies which may exist:

Type	Description
Policies	Has analyzed and enforced policies counts and links to respective Global Policy Views filtered by selected scope
Config Intents	Has names and links to Agent, Interface and Forensics Config Intents views

Inventory Profile

Note An inventory profile page is linked from various places. One of the ways to see an inventory profile is to perform a search for inventory, then click an IP address to go to its profile. If you are working in the Scopes and Inventory page, click an IP address in the IP addresses tab, not an IP address in the Workloads tab. (Clicking an IP address in the Workloads tab displays the Workload Profile, not the Inventory Profile.)

The following information is available for the inventory:

Field	Description
Scopes	List of scopes that the inventory belongs to.
Inventory Type	• **Flow Learnt** inventory was registered based on the observed flows. • **Labeled** inventory was manually uploaded using the inventory upload utility. • **Agent** inventory was reported by the software agent installed on a host. • **Tagged** inventory was either reported by connectors or external orchestrators.
User Labels	The list of user uploaded attributes for this inventory. See Workload Labels for more details.

Additional information is available only if both of the following are true:

1. Inventory has been ingested through a cloud connector.
2. Segmentation is enabled for the virtual network in which the inventory resides.

Field	Description
Enforcement Health	The status information of the host software agent. See Agent Health Tab for more details.
Concrete Policies	This tab shows Secure Workload concrete enforcement policies applied on the host. See Concrete Policies Tab for more details.
Security Groups	The list of security groups and their policies applied to this inventory.

Inventory Profile Information

Field	Description
Experimental Groups	A list of cluster or user-defined inventory filters that are used for policy live analysis.
Enforcement Groups	A list of cluster or user-defined inventory filters that are used for policy enforcement. They can be different from experimental groups depending on the versions of policies being analyzed and/or enforced in the system.

Note The inventory profile details may not be available for an IP address when:

- The inventory is excluded from collection rules.
- In a unidirectional flow, the inventory is available only for two minutes, and then it is removed.
- In a bidirectional flow, the inventory is available for 30 days. If no more flows are observed during these 30 days then the inventory details are removed.

Workload Profile

Workload profile displays detailed information about a host where Secure Workload software agent is installed. This section explains how to view a workload profile and the information it contains.

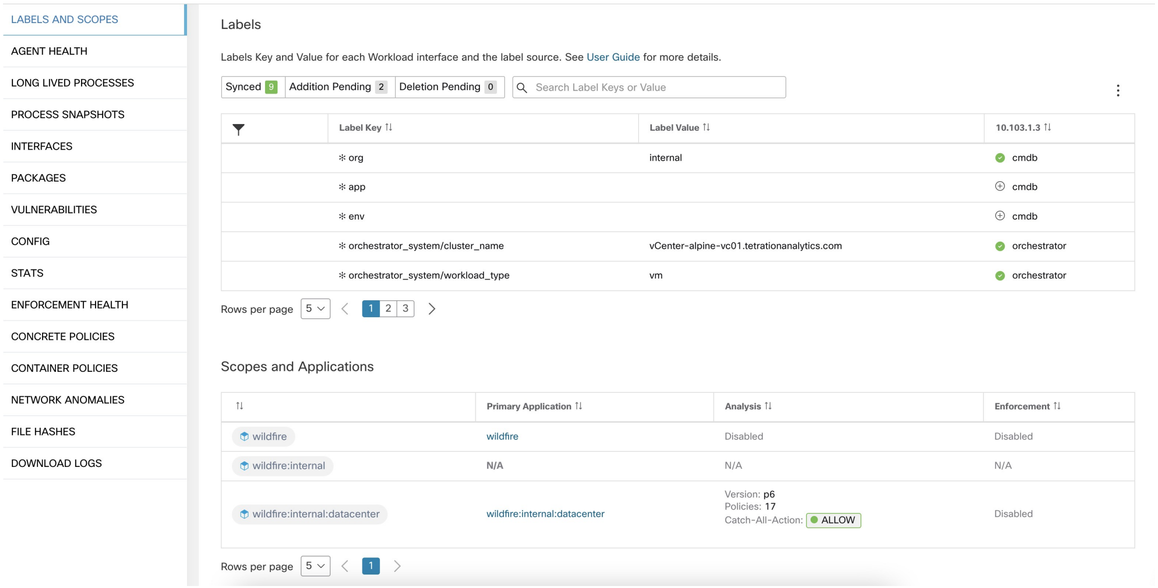
Note A workload profile page is linked from various places. One of the ways to see a workload profile is to perform a search for host as described in search

From the results of inventory search, click on IP address of the host to go to it’s profile. Based on the type of agent installed on the host, the following tabs are available on the page. Note that you may end up on inventory profile page if Secure Workload software agent is not installed on the host that this inventory belongs to.

Labels and Scopes Tab

This tab includes the enforcement and experimental groups, scopes that the host belongs to. The experimental groups are inventory filters that are used for policy live analysis, while the enforcement groups are the filters that are used for policy enforcement. They can be different depending on the versions of policies being analyzed and/or enforced in the system.

Figure 47: Workload Labels and Scopes



LABELS AND SCOPES

AGENT HEALTH

LONG LIVED PROCESSES

PROCESS SNAPSHOTS

INTERFACES

PACKAGES

VULNERABILITIES

CONFIG

STATS

ENFORCEMENT HEALTH

CONCRETE POLICIES

CONTAINER POLICIES

NETWORK ANOMALIES

FILE HASHES

DOWNLOAD LOGS

Labels

Labels Key and Value for each Workload interface and the label source. See User Guide for more details.

Synced 9 | Addition Pending 2 | Deletion Pending 0 | Search Label Keys or Value

	Label Key ⇅	Label Value ⇅	10.103.1.3 ⇅
	✻ org	internal	✓ cmdb
	✻ app		⊕ cmdb
	✻ env		⊕ cmdb
	✻ orchestrator_system/cluster_name	vCenter-alpine-vc01.tetrationanalytics.com	✓ orchestrator
	✻ orchestrator_system/workload_type	vm	✓ orchestrator

Rows per page 5 < 1 2 3 >

Scopes and Applications

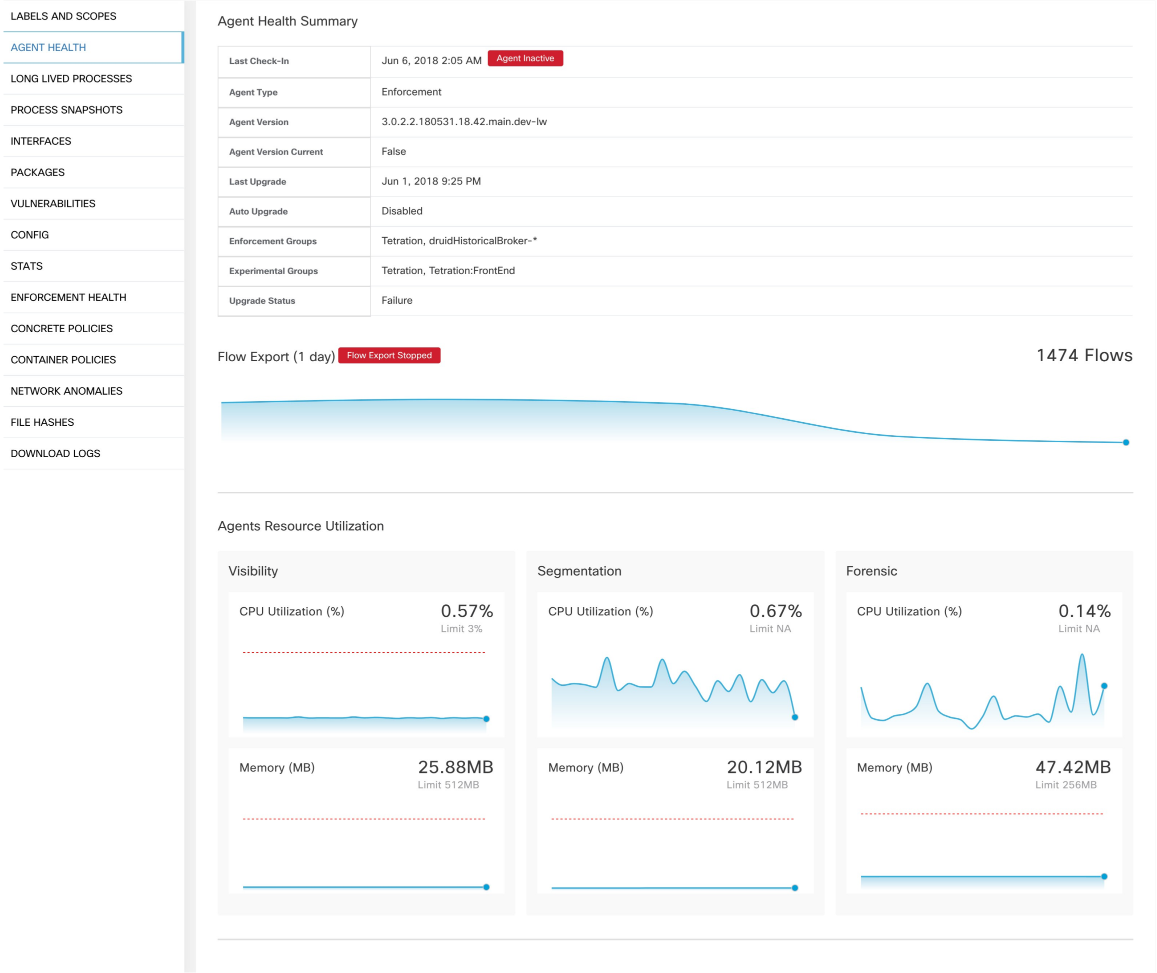
⇅	Primary Application ⇅	Analysis ⇅	Enforcement ⇅
wildfire	wildfire	Disabled	Disabled
wildfire:internal	N/A	N/A	N/A
wildfire:internal:datacenter	wildfire:internal:datacenter	Version: p6 Policies: 17 Catch-All-Action: ● ALLOW	Disabled

Rows per page 5 < 1 >

Agent Health Tab

The status information of the host software agent such as it's type, OS platform, agent version and last check-in time are also shown in the **Agent Health** tab. See Software Agent Config for more details. This tab also shows detailed time series data for traffic bytes and packets occurred per one day.

Figure 48: Workload Agent Health Details

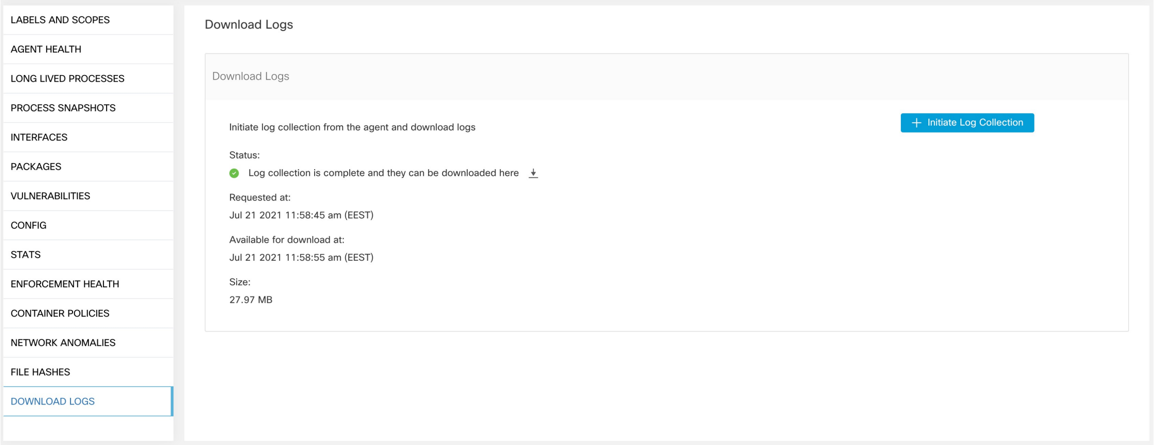


Agent Health Summary

Last Check-In	Jun 6, 2018 2:05 AM Agent Inactive
Agent Type	Enforcement
Agent Version	3.0.2.2.180531.18.42.main.dev-lw
Agent Version Current	False
Last Upgrade	Jun 1, 2018 9:25 PM
Auto Upgrade	Disabled
Enforcement Groups	Tetration, druidHistoricalBroker-*
Experimental Groups	Tetration, Tetration:FrontEnd
Upgrade Status	Failure

For users with root scope owner privileges, summary page also includes a section to collect and download agent logs for deep visibility and enforcement agents (versions 3.3 or later) within that root scope. Also note that this feature is not available for agents running on platforms AIX and SUSE Linux Enterprise Server (s390x-Linux on IBM Z architectures). Use “Initiate Log Collection” button to collect logs from the agent and then logs are available for download in a few minutes. If the download fails, retry collection of logs, and then attempt download again.

Figure 49: Agent Logs



Download Logs

Download Logs

Initiate log collection from the agent and download logs

Status:
Log collection is complete and they can be downloaded here

Requested at:
Jul 21 2021 11:58:45 am (EEST)

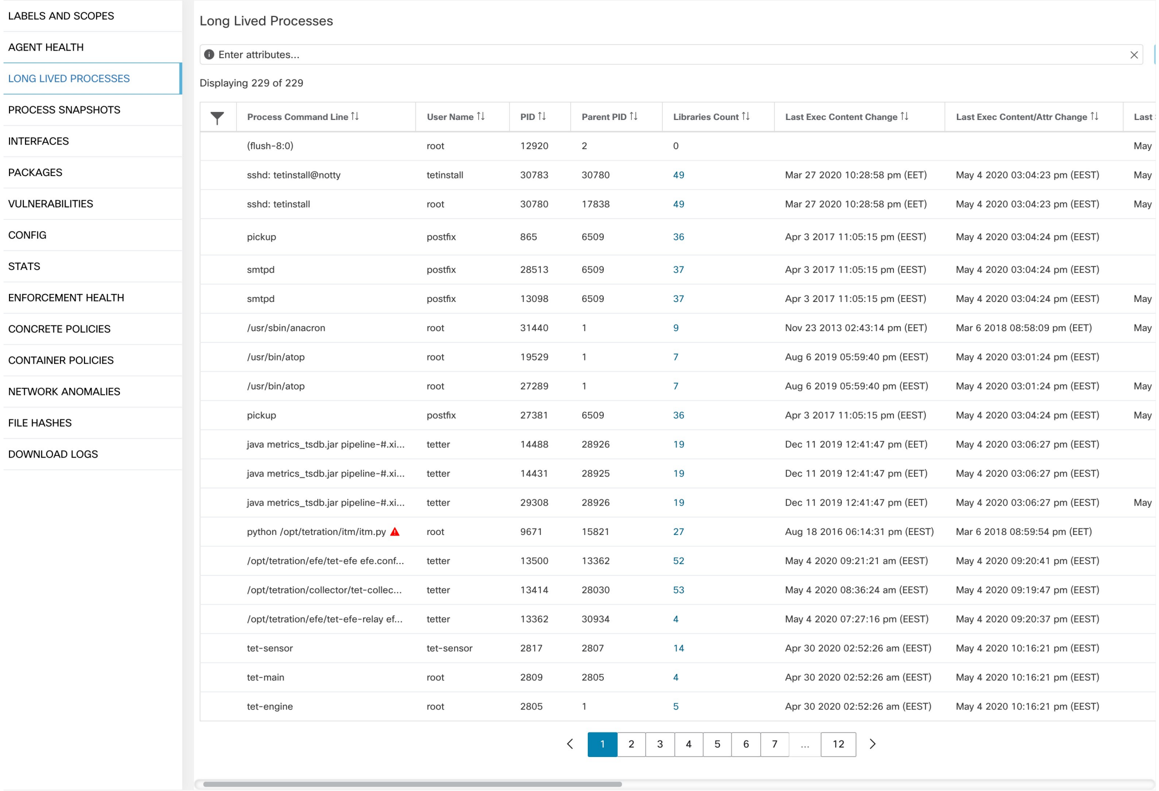
Available for download at:
Jul 21 2021 11:58:55 am (EEST)

Size:
27.97 MB

Process List Tab

This tab shows list of processes running on the host. A filter is also available to narrow down the list of processes based on the attributes of a process shown in table header below.

Figure 50: Workload Process List



Long Lived Processes

Enter attributes...

Displaying 229 of 229

Process Command Line	User Name	PID	Parent PID	Libraries Count	Last Exec Content Change	Last Exec Content/Attr Change	Last
(flush-8:0)	root	12920	2	0			May
sshd: tetinstall@notty	tetinstall	30783	30780	49	Mar 27 2020 10:28:58 pm (EET)	May 4 2020 03:04:23 pm (EEST)	May
sshd: tetinstall	root	30780	17838	49	Mar 27 2020 10:28:58 pm (EET)	May 4 2020 03:04:23 pm (EEST)	May
pickup	postfix	865	6509	36	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	
smtpd	postfix	28513	6509	37	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	
smtpd	postfix	13098	6509	37	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	May
/usr/sbin/anacron	root	31440	1	9	Nov 23 2013 02:43:14 pm (EET)	Mar 6 2018 08:58:09 pm (EET)	May
/usr/bin/atop	root	19529	1	7	Aug 6 2019 05:59:40 pm (EEST)	May 4 2020 03:01:24 pm (EEST)	
/usr/bin/atop	root	27289	1	7	Aug 6 2019 05:59:40 pm (EEST)	May 4 2020 03:01:24 pm (EEST)	May
pickup	postfix	27381	6509	36	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	May
java metrics_tsdb.jar pipeline-#.xi...	tetter	14488	28926	19	Dec 11 2019 12:41:47 pm (EET)	May 4 2020 03:06:27 pm (EEST)	
java metrics_tsdb.jar pipeline-#.xi...	tetter	14431	28925	19	Dec 11 2019 12:41:47 pm (EET)	May 4 2020 03:06:27 pm (EEST)	
java metrics_tsdb.jar pipeline-#.xi...	tetter	29308	28926	19	Dec 11 2019 12:41:47 pm (EET)	May 4 2020 03:06:27 pm (EEST)	May
python /opt/tetration/itm/itm.py ⚠	root	9671	15821	27	Aug 18 2016 06:14:31 pm (EEST)	Mar 6 2018 08:59:54 pm (EET)	
/opt/tetration/efe/tet-efe efe.conf...	tetter	13500	13362	52	May 4 2020 09:21:21 am (EEST)	May 4 2020 09:20:41 pm (EEST)	
/opt/tetration/collector/tet-collec...	tetter	13414	28030	53	May 4 2020 08:36:24 am (EEST)	May 4 2020 09:19:47 pm (EEST)	
/opt/tetration/efe/tet-efe-relay ef...	tetter	13362	30934	4	May 4 2020 07:27:16 pm (EEST)	May 4 2020 09:20:37 pm (EEST)	
tet-sensor	tet-sensor	2817	2807	14	Apr 30 2020 02:52:26 am (EEST)	May 4 2020 10:16:21 pm (EEST)	
tet-main	root	2809	2805	4	Apr 30 2020 02:52:26 am (EEST)	May 4 2020 10:16:21 pm (EEST)	
tet-engine	root	2805	1	5	Apr 30 2020 02:52:26 am (EEST)	May 4 2020 10:16:21 pm (EEST)	

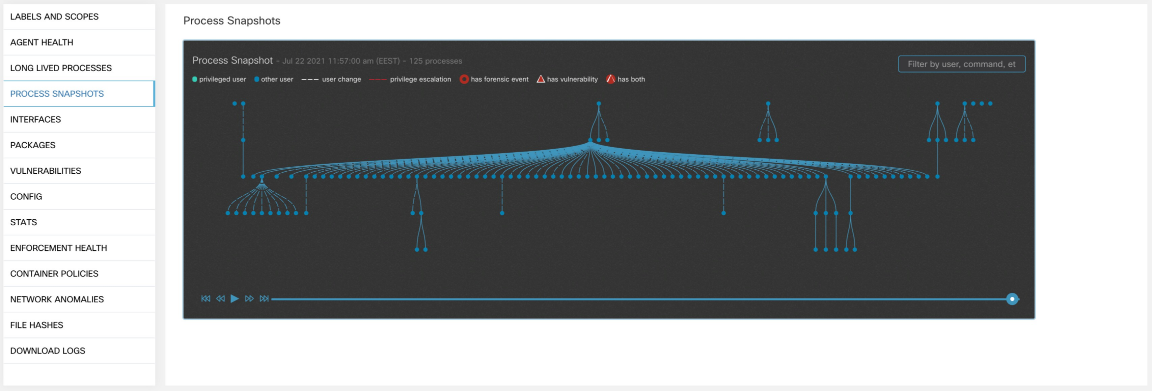
Attribute Descriptions:

Attribute	Description
Last Exec Content Change	Similar to mtime in linux. It is the timestamp when only the file content changes.
Last Exec Content Change	Similar to ctime in linux. It is the timestamp when either the file content or attribute changes.
Last Seen	Last time when the process is observed. Available when the process is dead.
CPU Usage	CPU usage trend by the process in the past hour.
Memory Usage	Memory usage trend by the process in the past hour.
Process Binary Hash	SHA256 hash of the process binary in hex string, also known as process hash for short. Not available for kernel processes.
Anomaly Score	Process hash (anomaly) score. See Process hash anomaly detection for more information.
Verdict	Verdict of the process hash (either Malicious or Benign). The verdict is determined based on whether the process hash belongs to any user-defined hash list or known threat-intelligence hash database. See Process hash anomaly detection for more information.
Verdict Source	Source of the verdict. The verdict source can be either User Defined, or Secure Workload Cloud, or NIST. This attribute is known as Hash DB Source in previous releases. See Process hash anomaly detection for more information.

Process Snapshot Tab

This tab shows searchable process tree observed on the workload.

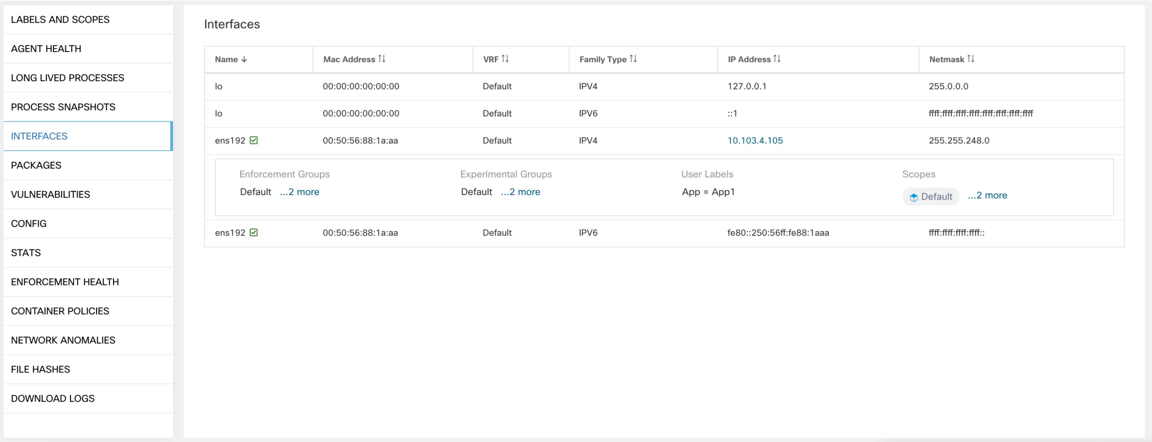
Figure 51: Workload Process Snapshot



Interfaces Tab

This tab shows details about the network interfaces installed on the host. It's available for all types of software agents.

Figure 52: Workload Interface List



Interfaces

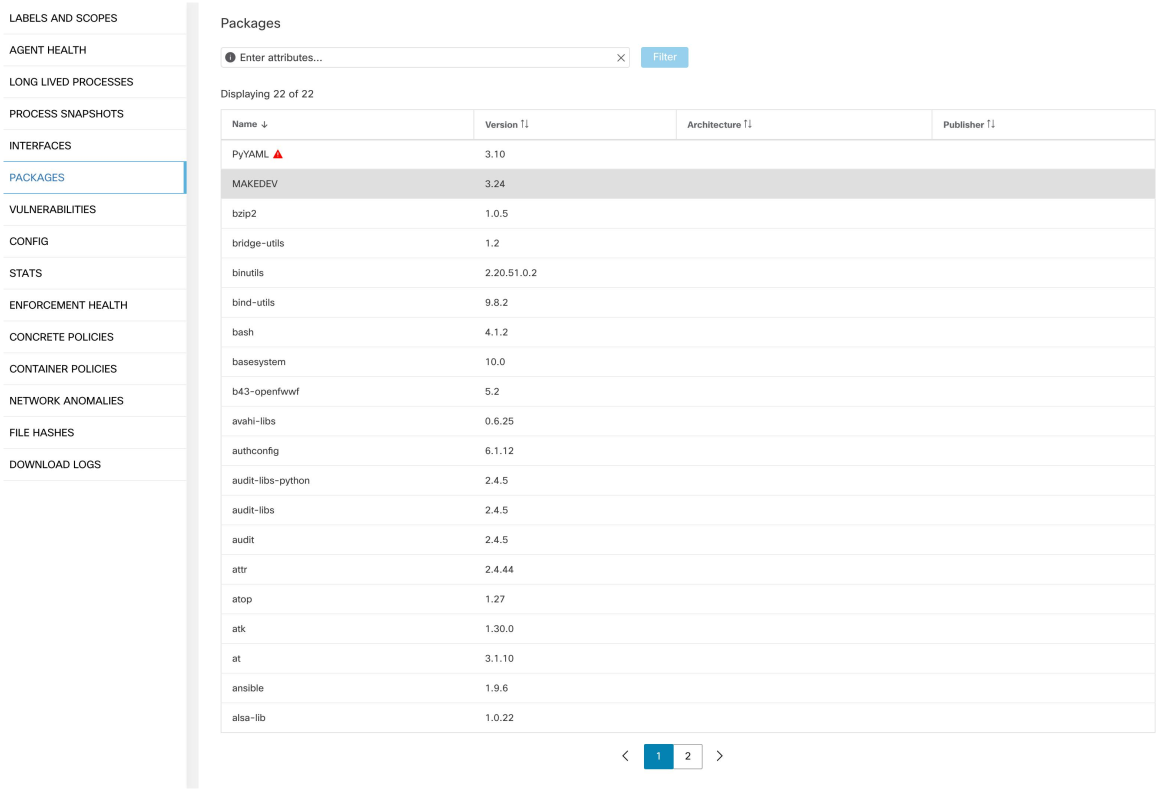
Name ↓	Mac Address ↑↓	VRF ↑↓	Family Type ↑↓	IP Address ↑↓	Netmask ↑↓
lo	00:00:00:00:00:00	Default	IPV4	127.0.0.1	255.0.0.0
lo	00:00:00:00:00:00	Default	IPV6	::1	ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff
ens192 ☑	00:50:56:88:1a:aa	Default	IPV4	10.103.4.105	255.255.248.0
ens192 ☑	00:50:56:88:1a:aa	Default	IPV6	fe80::250:56ff:fe88:1aaa	ffff:ffff:ffff:ffff::

Enforcement Groups	Experimental Groups	User Labels	Scopes
Default ...2 more	Default ...2 more	App = App1	Default ...2 more

Software Packages Tab

This tab shows the list of packages installed on the host. You can selectively view software packages based on package attributes in the table header.

Figure 53: Software Packages List



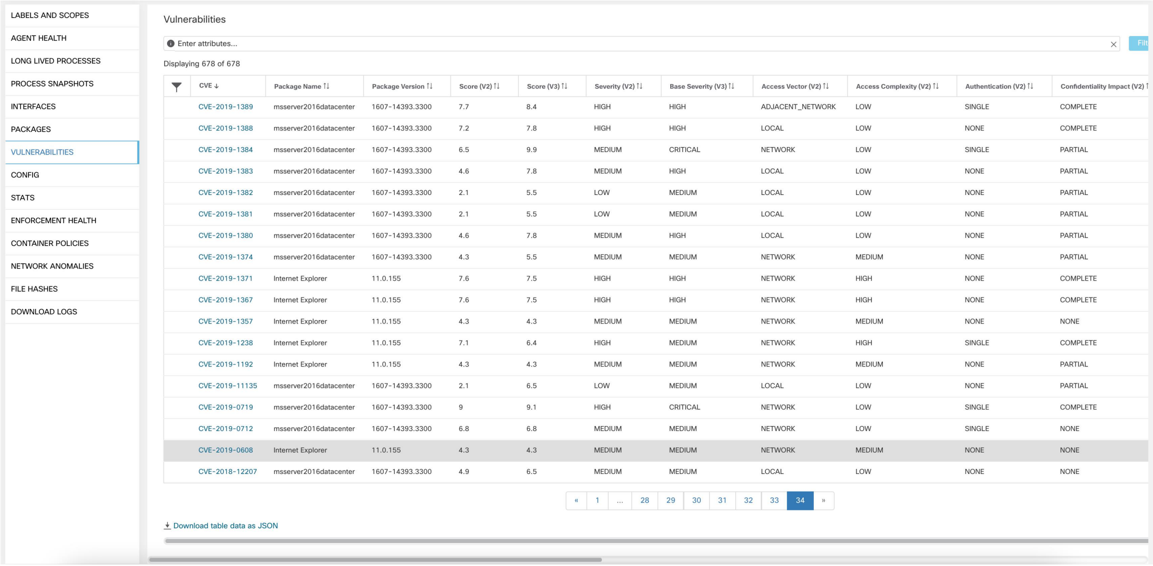
Displaying 22 of 22

Name ↓	Version ⇅	Architecture ⇅	Publisher ⇅
PyYAML ⚠	3.10		
MAKEDEV	3.24		
bzip2	1.0.5		
bridge-utils	1.2		
binutils	2.20.51.0.2		
bind-utils	9.8.2		
bash	4.1.2		
basesystem	10.0		
b43-openfwwf	5.2		
avahi-libs	0.6.25		
authconfig	6.1.12		
audit-libs-python	2.4.5		
audit-libs	2.4.5		
audit	2.4.5		
attr	2.4.44		
atop	1.27		
atk	1.30.0		
at	3.1.10		
ansible	1.9.6		
alsa-lib	1.0.22		

Vulnerabilities Tab

This tab shows searchable vulnerabilities observed on the workload based on the Common Vulnerabilities and Exposures (CVE) system. See Vulnerability data visibility

Figure 54: Vulnerabilities Tab



Vulnerabilities

Enter attributes...

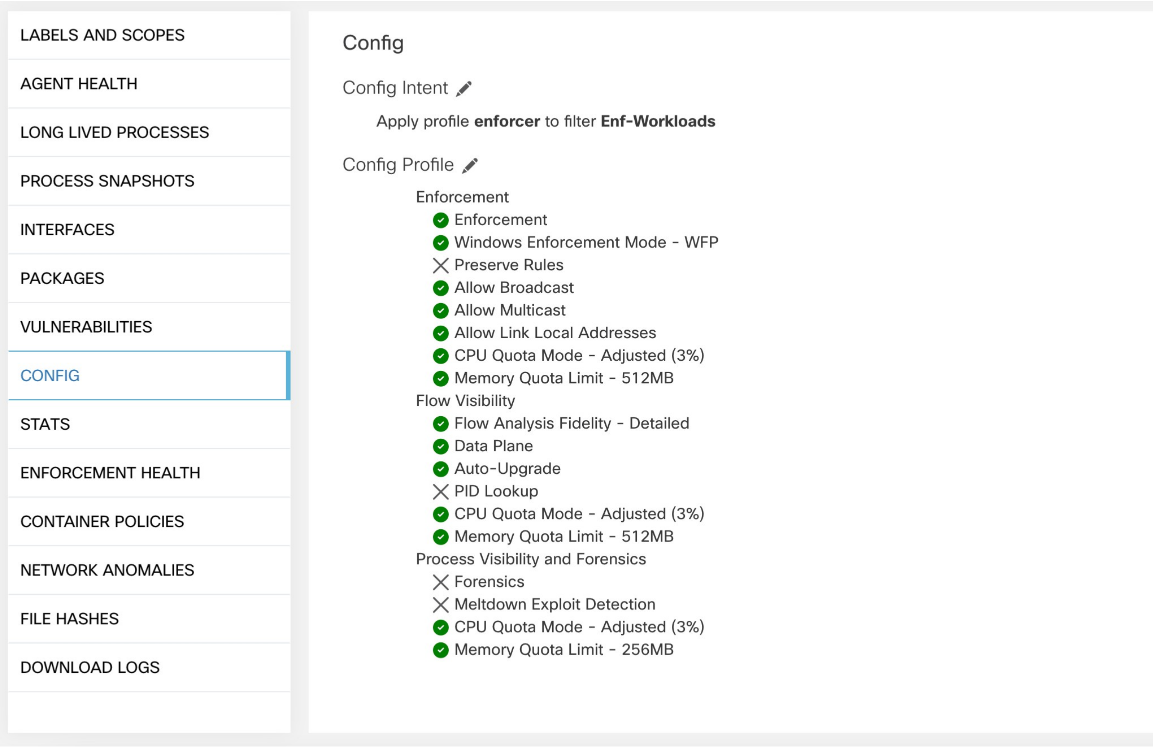
Displaying 678 of 678

CVE ↓	Package Name ↑↓	Package Version ↑↓	Score (V2) ↑↓	Score (V3) ↑↓	Severity (V2) ↑↓	Base Severity (V3) ↑↓	Access Vector (V2) ↑↓	Access Complexity (V2) ↑↓	Authentication (V2) ↑↓	Confidentiality Impact (V2) ↑
CVE-2019-1389	msserver2016datacenter	1607-14393.3300	7.7	8.4	HIGH	HIGH	ADJACENT_NETWORK	LOW	SINGLE	COMPLETE
CVE-2019-1388	msserver2016datacenter	1607-14393.3300	7.2	7.8	HIGH	HIGH	LOCAL	LOW	NONE	COMPLETE
CVE-2019-1384	msserver2016datacenter	1607-14393.3300	6.5	9.9	MEDIUM	CRITICAL	NETWORK	LOW	SINGLE	PARTIAL
CVE-2019-1383	msserver2016datacenter	1607-14393.3300	4.6	7.8	MEDIUM	HIGH	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1382	msserver2016datacenter	1607-14393.3300	2.1	5.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1381	msserver2016datacenter	1607-14393.3300	2.1	5.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1380	msserver2016datacenter	1607-14393.3300	4.6	7.8	MEDIUM	HIGH	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1374	msserver2016datacenter	1607-14393.3300	4.3	5.5	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	PARTIAL
CVE-2019-1371	Internet Explorer	11.0.155	7.6	7.5	HIGH	HIGH	NETWORK	HIGH	NONE	COMPLETE
CVE-2019-1367	Internet Explorer	11.0.155	7.6	7.5	HIGH	HIGH	NETWORK	HIGH	NONE	COMPLETE
CVE-2019-1357	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	NONE
CVE-2019-1238	Internet Explorer	11.0.155	7.1	6.4	HIGH	MEDIUM	NETWORK	HIGH	SINGLE	COMPLETE
CVE-2019-1192	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	PARTIAL
CVE-2019-11135	msserver2016datacenter	1607-14393.3300	2.1	6.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-0719	msserver2016datacenter	1607-14393.3300	9	9.1	HIGH	CRITICAL	NETWORK	LOW	SINGLE	COMPLETE
CVE-2019-0712	msserver2016datacenter	1607-14393.3300	6.8	6.8	MEDIUM	MEDIUM	NETWORK	LOW	SINGLE	NONE
CVE-2019-0608	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	NONE
CVE-2018-12207	msserver2016datacenter	1607-14393.3300	4.9	6.5	MEDIUM	MEDIUM	LOCAL	LOW	NONE	NONE

Agent Configuration Tab

This tab shows software agent settings. It is only available for Deep Visibility and Enforcement Agents. These settings can be modified using Agent Configuration Intents via the agent config page. See Software Agent Config

Figure 55: Applied Workload Configuration



Config

Config Intent

Apply profile **enforcer** to filter **Enf-Workloads**

Config Profile

Enforcement
- ✓ Enforcement
- ✓ Windows Enforcement Mode - WFP
- ✗ Preserve Rules
- ✓ Allow Broadcast
- ✓ Allow Multicast
- ✓ Allow Link Local Addresses
- ✓ CPU Quota Mode - Adjusted (3%)
- ✓ Memory Quota Limit - 512MB

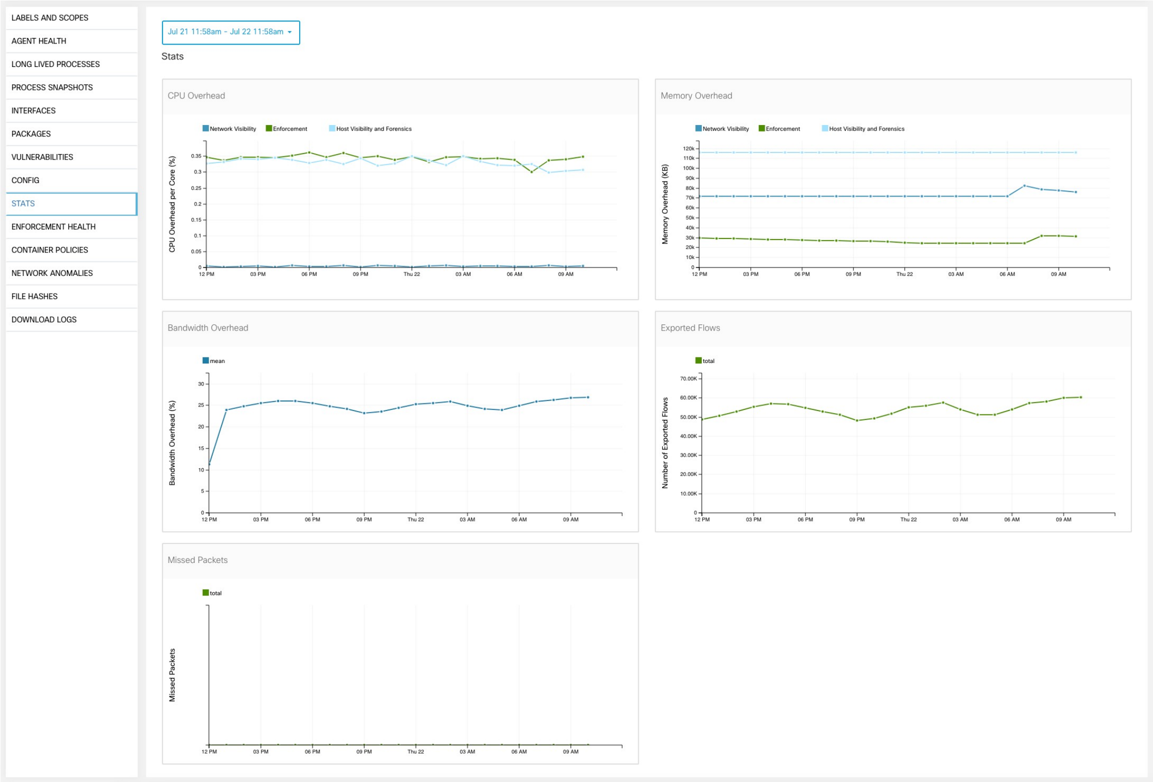
Flow Visibility
- ✓ Flow Analysis Fidelity - Detailed
- ✓ Data Plane
- ✓ Auto-Upgrade
- ✗ PID Lookup
- ✓ CPU Quota Mode - Adjusted (3%)
- ✓ Memory Quota Limit - 512MB

Process Visibility and Forensics
- ✗ Forensics
- ✗ Meltdown Exploit Detection
- ✓ CPU Quota Mode - Adjusted (3%)
- ✓ Memory Quota Limit - 256MB

Agent Statistics Tab

This tab shows statistics about the Secure Workload agent installed on the host. It's only available for Deep Visibility and Enforcement Agents.

Figure 56: Agent Statistics



Concrete Policies Tab

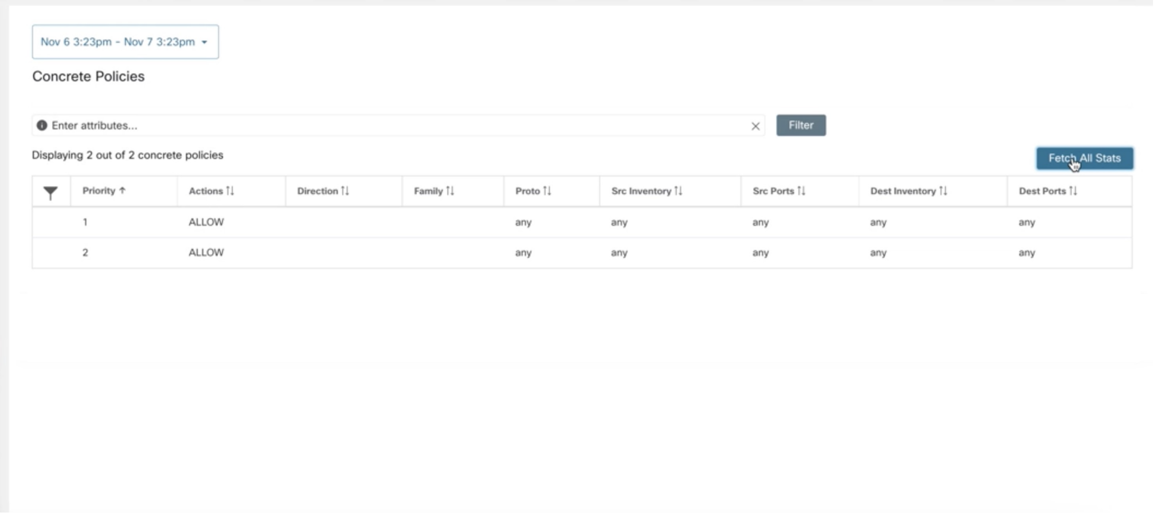
When a workspace is enforced, each workload receives only the policies in that workspace that are specific to that workload. These policies that are actually programmed on each workload are called *concrete policies*.

For example, suppose the provider specified in a policy with action ALLOW includes all inventory in the subnet 1.1.1.0/24. When this policy is installed on a workload with a Secure Workload agent and having IP address 1.1.1.2, the firewall rules look like this:

1. For incoming traffic firewall rules allow traffic destined to 1.1.1.2 specifically, not to the whole subnet 1.1.1.0/24.
2. For outgoing traffic firewall rules allow traffic sourced from 1.1.1.2 specifically, not from the whole subnet 1.1.1.0/24.

The CONCRETE POLICIES tab in the Workload Profile shows Secure Workload concrete enforcement policies applied on the host. Each row in this table corresponds to a firewall rule implemented on the host. Each policy row can be further expanded to display the logical intent from which this concrete policy derived. Packet and byte count time series view is also available for each rule. Click the **Fetch All Stats** button to view packets and bytes count for each rule. A filter is also available in this tab to narrow the list of enforced policies based on attributes of a policy shown in table header below. This tab is only available when the installed agent is enabled for enforcement.

Figure 57: Concrete Policy List



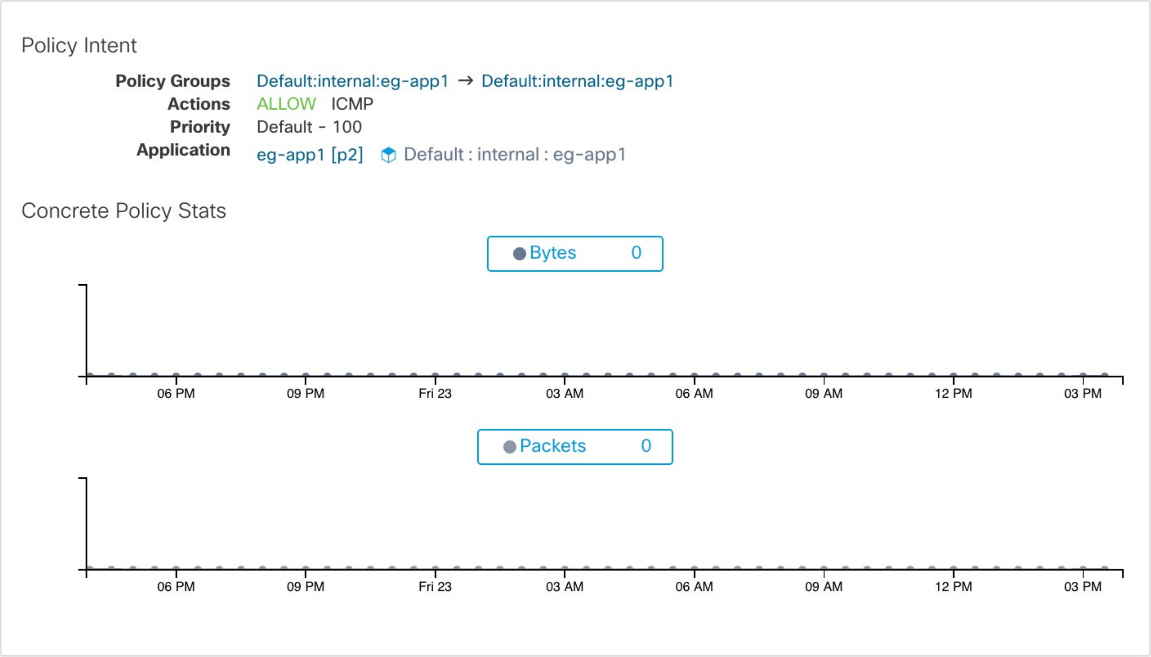
Concrete Policies

Displaying 2 out of 2 concrete policies

Priority	Actions	Direction	Family	Proto	Src Inventory	Src Ports	Dest Inventory	Dest Ports
1	ALLOW			any	any	any	any	any
2	ALLOW			any	any	any	any	any

In the image below, **Policy Groups** shows the consumer and provider:

Figure 58: Concrete Policy Row



Policy Intent

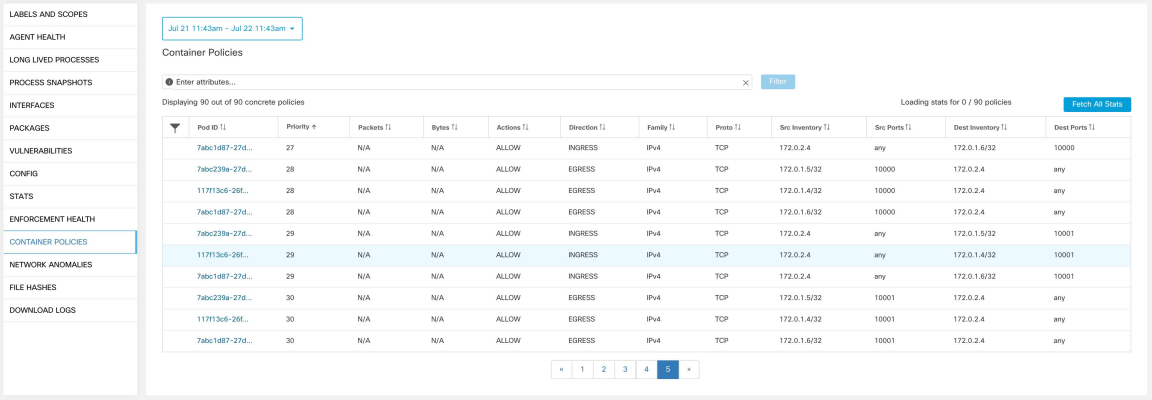
Policy Groups: Default:internal:eg-app1 → Default:internal:eg-app1
Actions: ALLOW ICMP
Priority: Default - 100
Application: eg-app1 [p2] Default : internal : eg-app1

Concrete Policy Stats

Container Policies Tab

This tab shows Secure Workload concrete enforcement policies applied on the containers. Each row in this table corresponds to a firewall rule implemented on the container pod.

Figure 59: Container Concrete Policy List



Container Policies

Enter attributes...

Displaying 90 out of 90 concrete policies

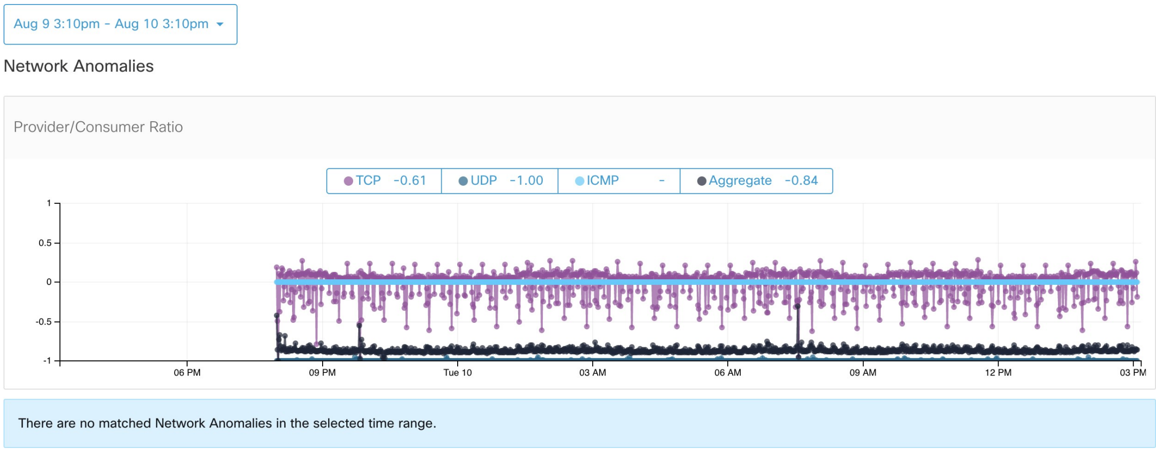
Loading stats for 0 / 90 policies

Pod ID ↑↓	Priority ↑	Packets ↑↓	Bytes ↑↓	Actions ↑↓	Direction ↑↓	Family ↑↓	Proto ↑↓	Src Inventory ↑↓	Src Ports ↑↓	Dest Inventory ↑↓	Dest Ports ↑↓
7abc1d87-27d...	27	N/A	N/A	ALLOW	INGRESS	IPv4	TCP	172.0.2.4	any	172.0.1.6/32	10000
7abc239a-27d...	28	N/A	N/A	ALLOW	EGRESS	IPv4	TCP	172.0.1.5/32	10000	172.0.2.4	any
117f13c6-26f...	28	N/A	N/A	ALLOW	EGRESS	IPv4	TCP	172.0.1.4/32	10000	172.0.2.4	any
7abc1d87-27d...	28	N/A	N/A	ALLOW	EGRESS	IPv4	TCP	172.0.1.6/32	10000	172.0.2.4	any
7abc239a-27d...	29	N/A	N/A	ALLOW	INGRESS	IPv4	TCP	172.0.2.4	any	172.0.1.5/32	10001
117f13c6-26f...	29	N/A	N/A	ALLOW	INGRESS	IPv4	TCP	172.0.2.4	any	172.0.1.4/32	10001
7abc1d87-27d...	29	N/A	N/A	ALLOW	INGRESS	IPv4	TCP	172.0.2.4	any	172.0.1.6/32	10001
7abc239a-27d...	30	N/A	N/A	ALLOW	EGRESS	IPv4	TCP	172.0.1.5/32	10001	172.0.2.4	any
117f13c6-26f...	30	N/A	N/A	ALLOW	EGRESS	IPv4	TCP	172.0.1.4/32	10001	172.0.2.4	any
7abc1d87-27d...	30	N/A	N/A	ALLOW	EGRESS	IPv4	TCP	172.0.1.6/32	10001	172.0.2.4	any

Network Anomalies Tab

This tab helps to identify the events with large data movements in or out of this workload. See PCR-based Network Anomaly detection for more information.

Figure 60: Workload Network Anomalies



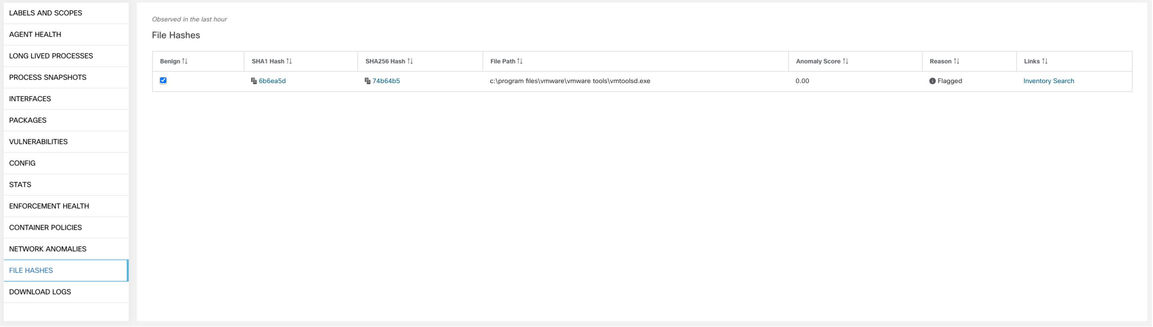
Network Anomalies

There are no matched Network Anomalies in the selected time range.

File Hashes Tab

This tab detects process hash anomalies by assessing the consistency of process binary hashes across the system. See Process hash anomaly detection for more info.

Figure 61: Workload File Hashes



Observed in the last hour

File Hashes

Benign ↑↓	SHA1 Hash ↑↓	SHA256 Hash ↑↓	File Path ↑↓	Anomaly Score ↑↓	Reason ↑↓	Links ↑↓
☑	6b6ea5d	74b64b5	c:\program files\vmware\vmware tools\vmtoolsd.exe	0.00	Flagged	Inventory Search

Software Packages

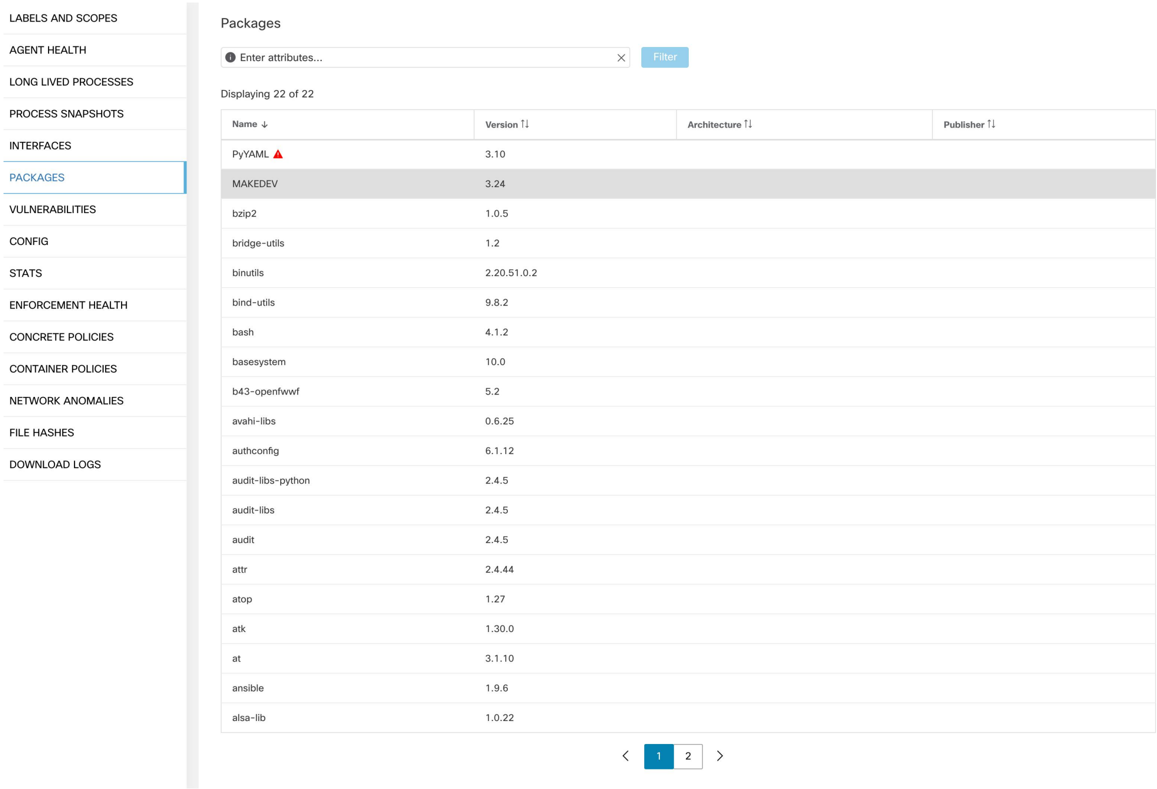
The **Software Packages** feature set allows viewing packages installed on hosts and the vulnerabilities affecting them. Specifically, it allows to:

- View packages registered with the following package managers:
  - Linux: Redhat Package Manager (RPM) and Debian Package Manager (dpkg)
  - Windows: Windows Registry Service
- View Common Vulnerabilities and Exposures (CVEs) affecting packages installed on a host.
- Define inventory filters using the package name and version.

Packages Tab

To view packages installed on a host, navigate to the packages tab on the workload profile Workload Profile page.

Figure 62: Workload profile packages



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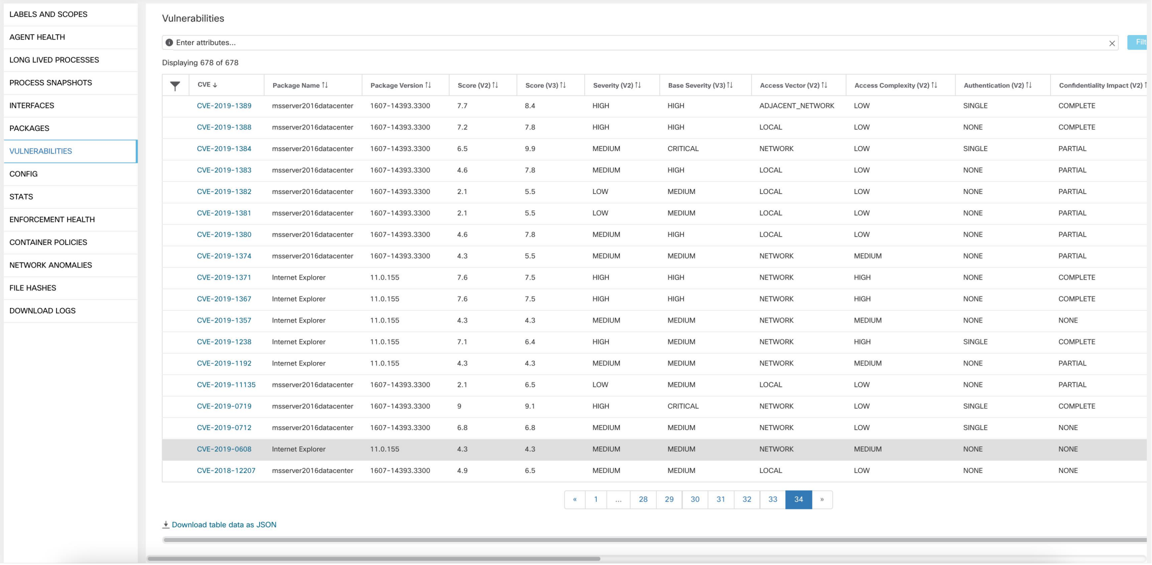
Name ↓	Version ↑↓	Architecture ↑↓	Publisher ↑↓
PyYAML ⚠	3.10		
MAKEDEV	3.24		
bzip2	1.0.5		
bridge-utils	1.2		
binutils	2.20.51.0.2		
bind-utils	9.8.2		
bash	4.1.2		
basesystem	10.0		
b43-openfwwf	5.2		
avahi-libs	0.6.25		
authconfig	6.1.12		
audit-libs-python	2.4.5		
audit-libs	2.4.5		
audit	2.4.5		
attr	2.4.44		
atop	1.27		
atk	1.30.0		
at	3.1.10		
ansible	1.9.6		
alsa-lib	1.0.22		

Common Vulnerabilities and Exposures (CVEs)

In addition to displaying packages under the packages tab, we display common vulnerabilities affecting them along with their severity. Each vulnerability contains a link to the Nation Vulnerability Database (NVD) which provides more information on the specific vulnerability. In addition to displaying the CVE ID, we also display the impact score (on a scale of 10), indicative of the severity of the vulnerability.

Figure 63: Workload profile packages CVE



Vulnerabilities

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CVE ↓	Package Name ↑↓	Package Version ↑↓	Score (V2) ↑↓	Score (V3) ↑↓	Severity (V2) ↑↓	Base Severity (V3) ↑↓	Access Vector (V2) ↑↓	Access Complexity (V2) ↑↓	Authentication (V2) ↑↓	Confidentiality Impact (V2) ↑
CVE-2019-1389	msserver2016datacenter	1607-14393.3300	7.7	8.4	HIGH	HIGH	ADJACENT_NETWORK	LOW	SINGLE	COMPLETE
CVE-2019-1388	msserver2016datacenter	1607-14393.3300	7.2	7.8	HIGH	HIGH	LOCAL	LOW	NONE	COMPLETE
CVE-2019-1384	msserver2016datacenter	1607-14393.3300	6.5	9.9	MEDIUM	CRITICAL	NETWORK	LOW	SINGLE	PARTIAL
CVE-2019-1383	msserver2016datacenter	1607-14393.3300	4.6	7.8	MEDIUM	HIGH	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1382	msserver2016datacenter	1607-14393.3300	2.1	5.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1381	msserver2016datacenter	1607-14393.3300	2.1	5.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1380	msserver2016datacenter	1607-14393.3300	4.6	7.8	MEDIUM	HIGH	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1374	msserver2016datacenter	1607-14393.3300	4.3	5.5	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	PARTIAL
CVE-2019-1371	Internet Explorer	11.0.155	7.6	7.5	HIGH	HIGH	NETWORK	HIGH	NONE	COMPLETE
CVE-2019-1367	Internet Explorer	11.0.155	7.6	7.5	HIGH	HIGH	NETWORK	HIGH	NONE	COMPLETE
CVE-2019-1357	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	NONE
CVE-2019-1238	Internet Explorer	11.0.155	7.1	6.4	HIGH	MEDIUM	NETWORK	HIGH	SINGLE	COMPLETE
CVE-2019-1192	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	PARTIAL
CVE-2019-11135	msserver2016datacenter	1607-14393.3300	2.1	6.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-0719	msserver2016datacenter	1607-14393.3300	9	9.1	HIGH	CRITICAL	NETWORK	LOW	SINGLE	COMPLETE
CVE-2019-0712	msserver2016datacenter	1607-14393.3300	6.8	6.8	MEDIUM	MEDIUM	NETWORK	LOW	SINGLE	NONE
CVE-2019-0608	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	NONE
CVE-2018-12207	msserver2016datacenter	1607-14393.3300	4.9	6.5	MEDIUM	MEDIUM	LOCAL	LOW	NONE	NONE

Windows Packages and CVEs

Following section lists the behavior of Windows agent with regard to reporting package information to Secure Workload.

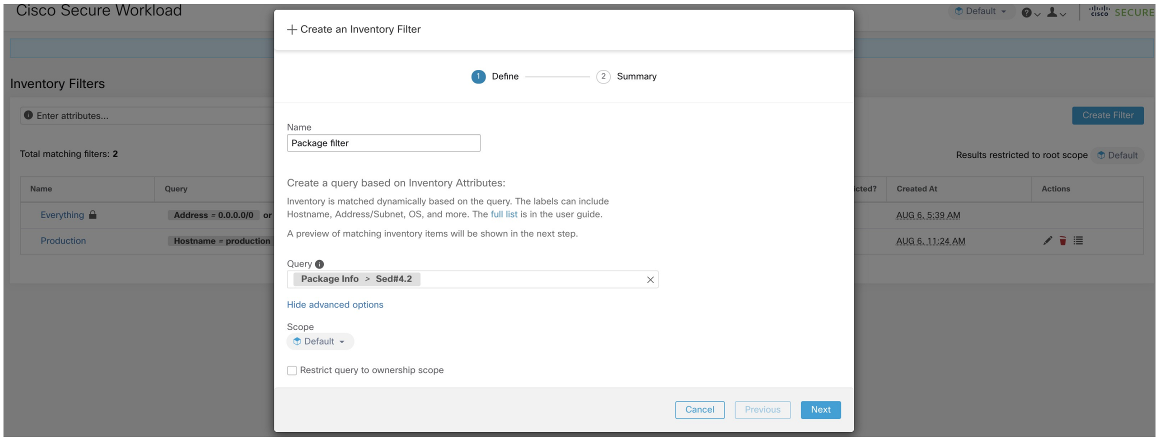
- Windows applications, PowerShell, IE are reported as packages. .net framework is also reported as a package.
- Other Windows applications like notepad.exe, cmd.exe, mstsc.exe, and so on are not reported.
- Windows server configured roles and features are reported as packages but the version may be incorrect. For example: If the DNS server is configured, reported version will either 0 or 8.
- Windows agent reports 3rd party products installed using MSI installer or exe installer:
  - For MSI installers, MSI APIs are used to retrieve package information. For example, version, publisher, package name.
  - If the exe installer is used to install the package, package information is retrieved from the registry.
  - Package installer fields like version, publisher is optional. If version is missing, the package will not be reported.
  - If a product is extracted from zip file or installed as an app, it will not be reported in the package list.

Inventory Filters

Package related information can be searched by defining an inventory filter with the package name and version (optional).

The syntax for this filter is as follows: PackageName#PackageVersion

Figure 64: Inventory package



Create an Inventory Filter

Name: Package filter

Create a query based on Inventory Attributes:

Inventory is matched dynamically based on the query. The labels can include Hostname, Address/Subnet, OS, and more. The full list is in the user guide.

A preview of matching inventory items will be shown in the next step.

Query: Package Info > Sed#4.2

Scope: Default

□ Restrict query to ownership scope

The following operations are supported:

- Equality - returns hosts with packages matching PackageName and the PackageVersion (if provided).
- Inequality - returns hosts with packages matching PackageName but not the PackageVersion (if provided).
- Greater Than - returns hosts with packages matching PackageName and with version greater than PackageVersion.
- Greater Than or Equal To - returns hosts with packages matching PackageName and with version greater than or equal to PackageVersion.
- Less Than - returns hosts with packages matching PackageName and with version less than PackageVersion.
- Less Than or Equal To - returns hosts with packages matching PackageName and with version less than or equal to PackageVersion.

Vulnerability data visibility

The **Vulnerability data visibility** feature allows for detecting and viewing vulnerabilities affecting packages and processes on a host. Inventory filters can be defined using:

```
- CVE IDs.- CVSS v2 and v3 scores.- CVSS v2 access vector and access complexity.- CVSS v3
attack vector, attack complexity, and privilege required.
```

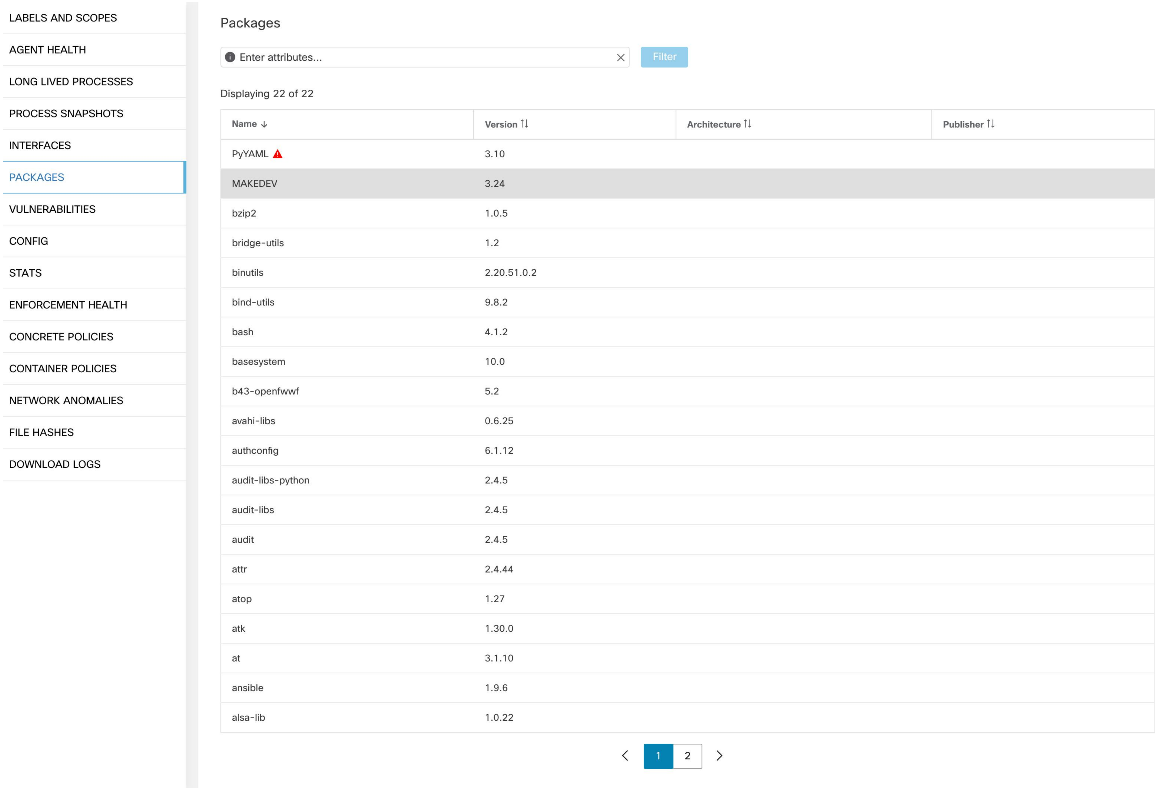
Workload Profile Page

Vulnerability related information affecting packages and processes on a system is displayed on the Workload Profile page.

Packages Tab

The packages tab lists packages installed on a host and vulnerabilities affecting them.

Figure 65: Workload profile packages



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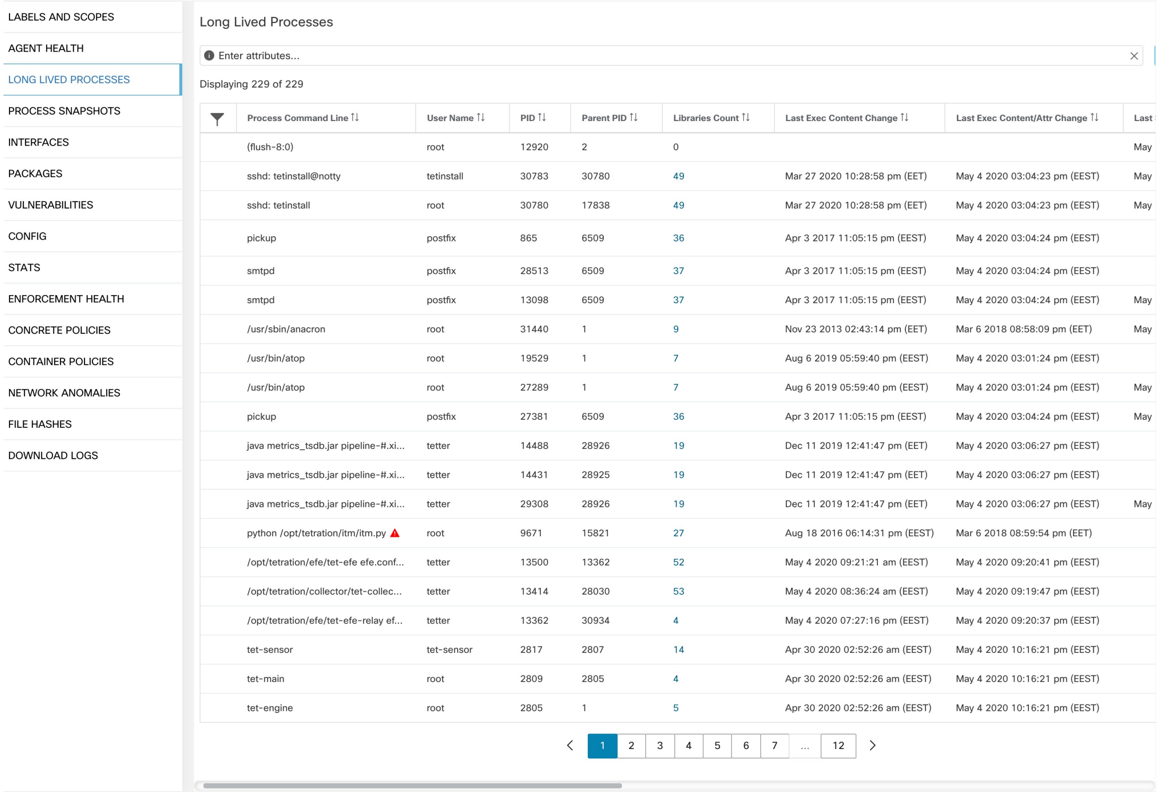
Name ↓	Version ⇅	Architecture ⇅	Publisher ⇅
PyYAML ⚠	3.10		
MAKEDEV	3.24		
bzip2	1.0.5		
bridge-utils	1.2		
binutils	2.20.51.0.2		
bind-utils	9.8.2		
bash	4.1.2		
basesystem	10.0		
b43-openfwwf	5.2		
avahi-libs	0.6.25		
authconfig	6.1.12		
audit-libs-python	2.4.5		
audit-libs	2.4.5		
audit	2.4.5		
attr	2.4.44		
atop	1.27		
atk	1.30.0		
at	3.1.10		
ansible	1.9.6		
alsa-lib	1.0.22		

Process List Tab

Long-lived processes are displayed under the process list tab.

Figure 66: Workload profile process list



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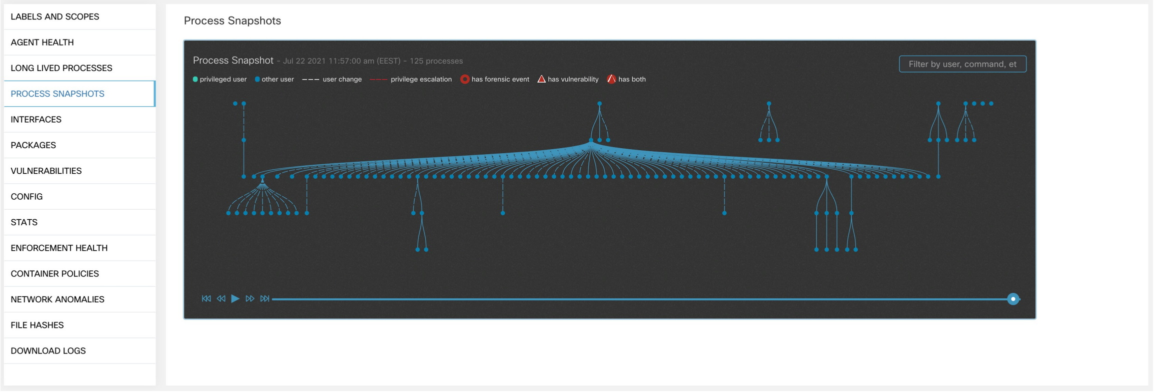
Process Command Line ⇅	User Name ⇅	PID ⇅	Parent PID ⇅	Libraries Count ⇅	Last Exec Content Change ⇅	Last Exec Content/Attr Change ⇅	Last
(flush-8:0)	root	12920	2	0			May
sshd: tetinstall@notty	tetinstall	30783	30780	49	Mar 27 2020 10:28:58 pm (EET)	May 4 2020 03:04:23 pm (EEST)	May
sshd: tetinstall	root	30780	17838	49	Mar 27 2020 10:28:58 pm (EET)	May 4 2020 03:04:23 pm (EEST)	May
pickup	postfix	865	6509	36	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	
smtpd	postfix	28513	6509	37	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	
smtpd	postfix	13098	6509	37	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	May
/usr/sbin/anacron	root	31440	1	9	Nov 23 2013 02:43:14 pm (EET)	Mar 6 2018 08:58:09 pm (EET)	May
/usr/bin/atop	root	19529	1	7	Aug 6 2019 05:59:40 pm (EEST)	May 4 2020 03:01:24 pm (EEST)	
/usr/bin/atop	root	27289	1	7	Aug 6 2019 05:59:40 pm (EEST)	May 4 2020 03:01:24 pm (EEST)	May
pickup	postfix	27381	6509	36	Apr 3 2017 11:05:15 pm (EEST)	May 4 2020 03:04:24 pm (EEST)	May
java metrics_tsdb.jar pipeline-#.xi...	tetter	14488	28926	19	Dec 11 2019 12:41:47 pm (EET)	May 4 2020 03:06:27 pm (EEST)	
java metrics_tsdb.jar pipeline-#.xi...	tetter	14431	28925	19	Dec 11 2019 12:41:47 pm (EET)	May 4 2020 03:06:27 pm (EEST)	
java metrics_tsdb.jar pipeline-#.xi...	tetter	29308	28926	19	Dec 11 2019 12:41:47 pm (EET)	May 4 2020 03:06:27 pm (EEST)	May
python /opt/tetration/itm/itm.py ⚠	root	9671	15821	27	Aug 18 2016 06:14:31 pm (EEST)	Mar 6 2018 08:59:54 pm (EET)	
/opt/tetration/efe/tet-efe efe.conf...	tetter	13500	13362	52	May 4 2020 09:21:21 am (EEST)	May 4 2020 09:20:41 pm (EEST)	
/opt/tetration/collector/tet-collec...	tetter	13414	28030	53	May 4 2020 08:36:24 am (EEST)	May 4 2020 09:19:47 pm (EEST)	
/opt/tetration/efe/tet-efe-relay ef...	tetter	13362	30934	4	May 4 2020 07:27:16 pm (EEST)	May 4 2020 09:20:37 pm (EEST)	
tet-sensor	tet-sensor	2817	2807	14	Apr 30 2020 02:52:26 am (EEST)	May 4 2020 10:16:21 pm (EEST)	
tet-main	root	2809	2805	4	Apr 30 2020 02:52:26 am (EEST)	May 4 2020 10:16:21 pm (EEST)	
tet-engine	root	2805	1	5	Apr 30 2020 02:52:26 am (EEST)	May 4 2020 10:16:21 pm (EEST)	

Process Snapshot Tab

Vulnerability information is displayed for all processes in the process tree under the process snapshot tab.

Figure 67: Workload profile process snapshot tab



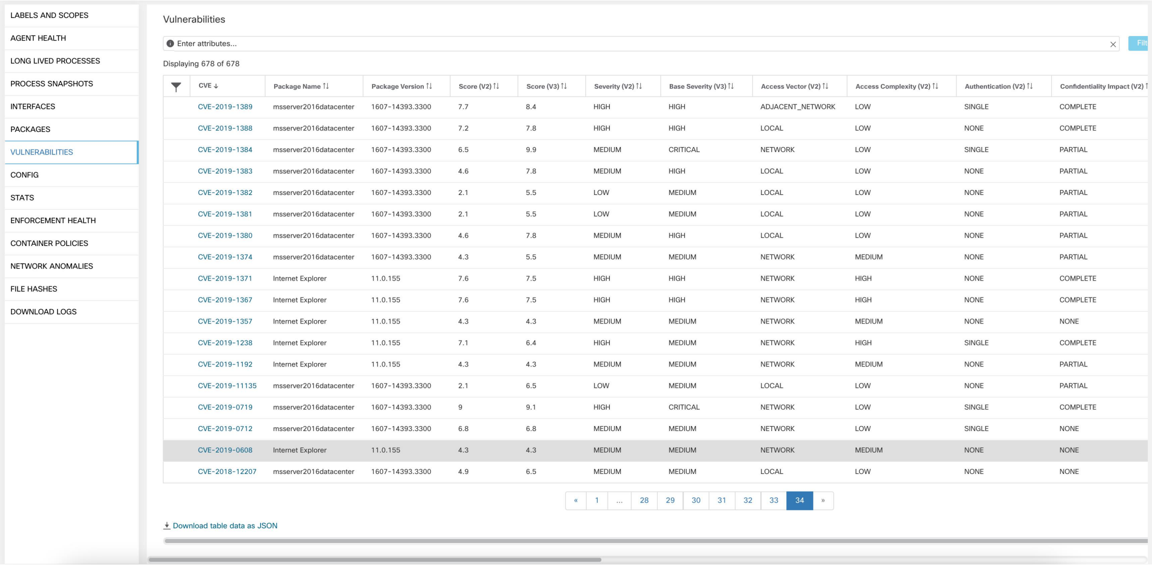
Vulnerabilities Tab

The vulnerability tab shows a list of vulnerabilities observed on the workload.

For each CVE, besides basic impact metrics, exploit information based on our threat intelligence is displayed:

- Exploit Count: number of times CVE was seen exploited in the wild in the last year
- Last Exploited: last time CVE was seen exploited in the wild by our threat intelligence

Figure 68: Workload profile vulnerabilities tab



Vulnerabilities

Enter attributes...

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CVE ↓	Package Name ⇅	Package Version ⇅	Score (V2) ⇅	Score (V3) ⇅	Severity (V2) ⇅	Base Severity (V3) ⇅	Access Vector (V2) ⇅	Access Complexity (V2) ⇅	Authentication (V2) ⇅	Confidentiality Impact (V2) ⇅
CVE-2019-1389	msserver2016datacenter	1607-14393.3300	7.7	8.4	HIGH	HIGH	ADJACENT_NETWORK	LOW	SINGLE	COMPLETE
CVE-2019-1388	msserver2016datacenter	1607-14393.3300	7.2	7.8	HIGH	HIGH	LOCAL	LOW	NONE	COMPLETE
CVE-2019-1384	msserver2016datacenter	1607-14393.3300	6.5	9.9	MEDIUM	CRITICAL	NETWORK	LOW	SINGLE	PARTIAL
CVE-2019-1383	msserver2016datacenter	1607-14393.3300	4.6	7.8	MEDIUM	HIGH	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1382	msserver2016datacenter	1607-14393.3300	2.1	5.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1381	msserver2016datacenter	1607-14393.3300	2.1	5.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1380	msserver2016datacenter	1607-14393.3300	4.6	7.8	MEDIUM	HIGH	LOCAL	LOW	NONE	PARTIAL
CVE-2019-1374	msserver2016datacenter	1607-14393.3300	4.3	5.5	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	PARTIAL
CVE-2019-1371	Internet Explorer	11.0.155	7.6	7.5	HIGH	HIGH	NETWORK	HIGH	NONE	COMPLETE
CVE-2019-1367	Internet Explorer	11.0.155	7.6	7.5	HIGH	HIGH	NETWORK	HIGH	NONE	COMPLETE
CVE-2019-1357	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	NONE
CVE-2019-1238	Internet Explorer	11.0.155	7.1	6.4	HIGH	MEDIUM	NETWORK	HIGH	SINGLE	COMPLETE
CVE-2019-1192	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	PARTIAL
CVE-2019-11135	msserver2016datacenter	1607-14393.3300	2.1	6.5	LOW	MEDIUM	LOCAL	LOW	NONE	PARTIAL
CVE-2019-0719	msserver2016datacenter	1607-14393.3300	9	9.1	HIGH	CRITICAL	NETWORK	LOW	SINGLE	COMPLETE
CVE-2019-0712	msserver2016datacenter	1607-14393.3300	6.8	6.8	MEDIUM	MEDIUM	NETWORK	LOW	SINGLE	NONE
CVE-2019-0608	Internet Explorer	11.0.155	4.3	4.3	MEDIUM	MEDIUM	NETWORK	MEDIUM	NONE	NONE
CVE-2018-12207	msserver2016datacenter	1607-14393.3300	4.9	6.5	MEDIUM	MEDIUM	LOCAL	LOW	NONE	NONE

Inventory Filters

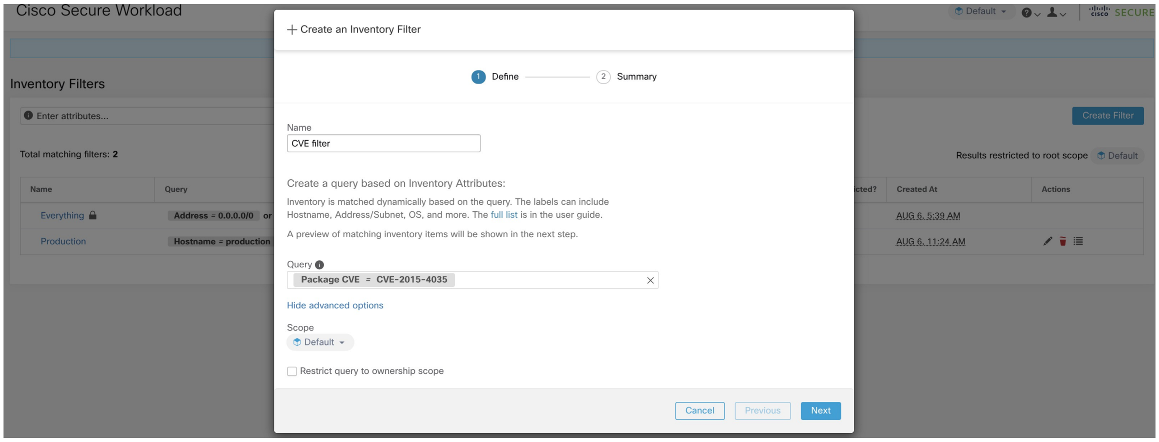
The following types of inventory filters can be defined to identify hosts with vulnerable packages:

CVE ID based filter

This filter allows searching for hosts affected by a specific CVE or any CVE.

To search for a host affected by a specific CVE, provide the CVE ID in the format: CVE-XXXX-XXXX

Figure 69: Inventory filter CVE



Create an Inventory Filter

1 Define — 2 Summary

Name: CVE filter

Create a query based on Inventory Attributes:

Inventory is matched dynamically based on the query. The labels can include Hostname, Address/Subnet, OS, and more. The full list is in the user guide.

A preview of matching inventory items will be shown in the next step.

Query: Package CVE = CVE-2015-4035

Hide advanced options

Scope: Default

□ Restrict query to ownership scope

The following operations are supported:

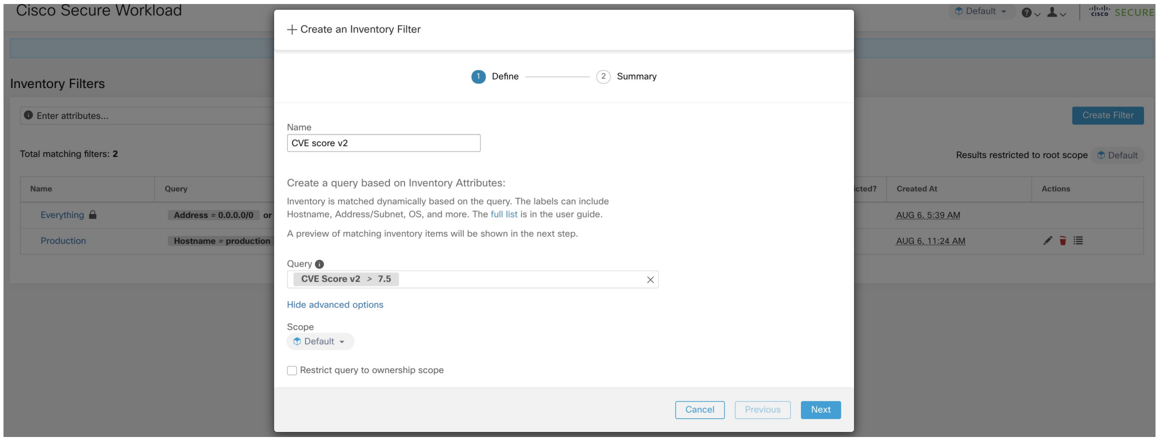
- Equality - returns hosts with packages affected by a CVE ID.
- Inequality - returns hosts with packages not affected by a CVE ID.
- Contains - returns hosts with packages affected by a CVE present in the input string (entering “cve” will return hosts affected by a CVE).
- Doesn’t contain - returns hosts with packages not affected by a CVE present in the input string (entering “cve” will return hosts not affected by a CVE).

CVSS (Common Vulnerability Scoring System) impact score based filter

This filter allows searching for hosts that have CVE with the specified CVSSv2 or CVSSv3 impact score. To search for hosts which have any CVE with impact score (v2 or v3), user can provide the score in numeric format.

To search for hosts which have CVE with CVSSv2 impact score greater than 7.5.

Figure 70: Inventory filter CVSS



Cisco Secure Workload

Create an Inventory Filter

Name: CVE score v2

Create a query based on Inventory Attributes:

Inventory is matched dynamically based on the query. The labels can include Hostname, Address/Subnet, OS, and more. The full list is in the user guide.

A preview of matching inventory items will be shown in the next step.

Query: CVE Score v2 > 7.5

Scope: Default

□ Restrict query to ownership scope

Inventory Filters

Total matching filters: 2

Results restricted to root scope Default

Name	Query	cted?	Created At	Actions
Everything	Address = 0.0.0.0/0 or		AUG 6, 5:39 AM	
Production	Hostname = production		AUG 6, 11:24 AM	

The following operations are supported:

- Equality - returns hosts which have CVE with the specified CVSSv2 or CVSSv3 impact scores.
- Inequality - returns hosts which don’t have CVE with the specified CVSSv2 or CVSSv3 impact scores.
- Greater Than - returns hosts which have CVE with CVSSv2 or CVSSv3 impact scores greater than the specified CVSSv2 or CVSSv3 impact scores respectively.
- Greater Than or Equal To - returns hosts which have CVE with CVSSv2 or CVSSv3 impact scores greater than or equal to the specified CVSSv2 or CVSSv3 impact scores respectively.
- Less Than - returns hosts which have CVE with CVSSv2 or CVSSv3 impact scores less than the specified CVSSv2 or CVSSv3 impact scores respectively.
- Less Than or Equal To - returns hosts which have CVE with CVSSv2 or CVSSv3 impact scores less than or equal to the specified CVSSv2 or CVSSv3 impact scores respectively.

CVSSv2 based filters

Inventory filters can be created using access vectors and access complexities to identify vulnerable hosts. These filters support the following types of operations:

- Equality - returns hosts with packages affected by vulnerabilities matching the filter.
- Inequality - returns hosts with packages not affected by vulnerabilities matching the filter.

Access Vector

Access vector reflects how the vulnerability is exploited. The farther the attacker can get from the vulnerable system, the higher the base score. The table below lists different access vectors with their access requirements:

Value	Type of access
LOCAL	Physical or local (shell).
ADJACENT_NETWORK	Broadcast or collision.
NETWORK	Remotely exploitable.

Access Complexity

This metric measures the complexity in exploiting a vulnerability once the attacker is able to access the target system. The base score is inversely proportional to the access complexity. The different types of access complexities are as follows:

Value	Description
HIGH	Specialized access conditions exist.
MEDIUM	Access conditions are somewhat specialized.
LOW	Specialized access conditions do not exist.

CVSSv3 based filters

Attack vectors, attack complexities, and privilege required to influence the CVSSv3 score and can be used in inventory filters. These filters support the following operations:

- Equality - returns hosts with packages affected by vulnerabilities matching the filter.
- Inequality - returns hosts with packages not affected by vulnerabilities matching the filter.

Attack Vector

This metric reflects the context by which vulnerability exploitation is possible. The farther an attacker can get from the vulnerable component, the higher the base score. The table below lists different attack vectors with their access requirements:

Value	Type of access
LOCAL	Local (keyboard, console) or remote (SSH).

Value	Type of access
PHYSICAL	Physical access is needed.
ADJACENT_NETWORK	Broadcast or collision.
NETWORK	Remotely exploitable.

Attack Complexity

This metric describes the conditions that must exist in order to exploit the vulnerability. The base score is greatest for least complex attacks. The different types of access complexities are as follows:

Value	Description
HIGH	Significant effort needed in setting up and executing the attack.
LOW	Specialized access conditions do not exist.

Privileges Required

This metric describes the level of privileges an attacker must possess before successfully exploiting the vulnerability. The base score is highest when privileges aren’t needed to carry out an attack. The different values of privilege required are as follows:

Value	Privileges required
HIGH	Privileges providing significant control over the vulnerable component.
LOW	Low privileges that grant access to non-sensitive resources.
NONE	Privileges aren’t needed to carry out an attack.

Service Profile

Secure Workload provides visibility of all Kubernetes services and other Load Balancers ingested through an external orchestrator. Service profile page shows the details for a given service.

Note Service profile page is linked from various places. One of the ways to see a service profile is to perform a search for service as described in search

From the results of search, click on a Service Name under the Services tab to go to its profile. The following information is available for the service:

Header

Header consists of:

- **Orchestrator Name:** Name of the external orchestrator which reported this service.
- **Orchestrator Type:** Type of the external orchestrator.
- **Namespace:** Namespace of the service.
- **Service Type:** Type of the service. Possible values include ClusterIP, Node, Port, and LoadBalancer.

IP and Ports

This table lists all the possible IP and port combinations through which this service is accessible. For services of type NodePort, this table shows both ClusterIP:Port and NodeIp:NodePort association.

User Labels

The list of user uploaded and orchestrator system generated labels for this service.

Scopes

List of scopes that the pod belongs to.

Pod Profile

Secure Workload provides visibility of all Kubernetes pods ingested through a Kubernetes external orchestrator. Pod profile page shows the details for a given pod.

Note Pod profile page is linked from various places. One of the ways to see a pod profile is to perform a search for pod as described in search

From the results of search, click on a Pod Name under the Pods tab to go to its profile. The following information is available for the pod:

Header

Header consists of:

- **Orchestrator Name:** Name of the external orchestrator which reported this pod.
- **Orchestrator Type:** Type of the external orchestrator.
- **Namespace:** Namespace of the pod.
- **IP Address:** Pod’s IP Address.

User Labels

The list of user uploaded and orchestrator system generated labels for this pod.

Scopes

List of scopes that the service belongs to.

Container Vulnerability Scanning

To maintain health and identify potential security weaknesses, we recommend scanning the Kubernetes pods regularly.

Prerequisites

- Ensure that a Kubernetes cluster is on board.
- Install the CSW Kubernetes daemonset agent as part of the Kubernetes cluster. For more information, see Installing Kubernetes or OpenShift Agents for Deep Visibility and Enforcement.

Procedure

Step 1 Navigate to **Manage** > **Workloads** > **Kubernetes**.

Note The **Clusters** tab displays a list of all on-boarded clusters along with the associated inventory, such as services and pods.

Step 2 Click **Pod Vulnerability Scanning**.

Step 3 To start the scan, enable the toggle under **Actions**. By default, the toggle is disabled.

Step 4 Click the edit icon to modify the query and select a subset of pods running on the cluster.

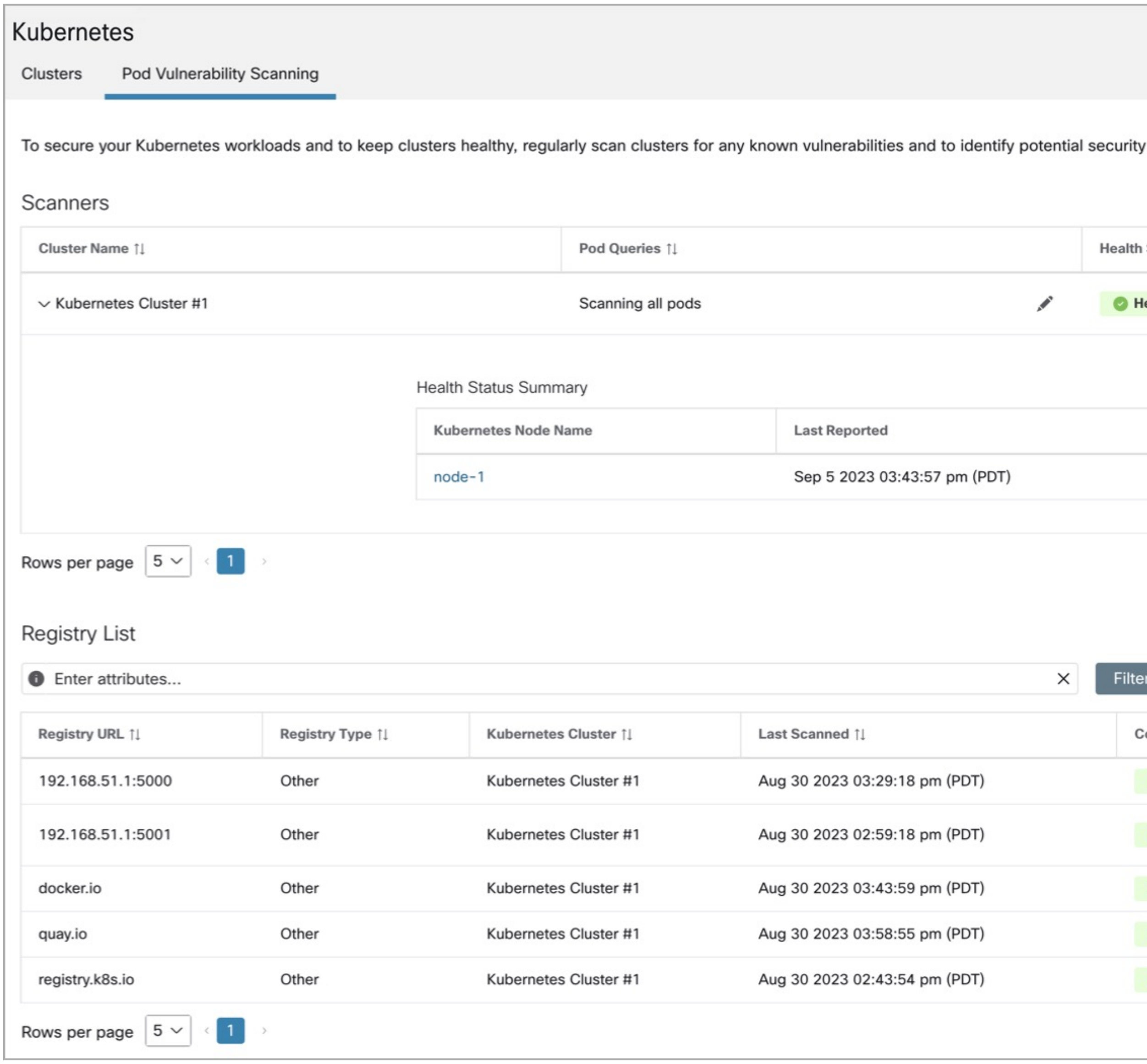
Note

- A pod query is populated by default to scan all pod inventories in the cluster. However, you can edit pod queries to select the pods to scan.
- Currently, scanning Windows container images is not supported.

Step 5 Expand a cluster to view the **Health Status Summary**.

- Click on a Kubernetes Node Name to view the Workload Profile.
- Enable the toggle to automatically download additional information to the host so that the scanner can execute.

Figure 71: Pod Vulnerability Scanning



Kubernetes

To secure your Kubernetes workloads and to keep clusters healthy, regularly scan clusters for any known vulnerabilities and to identify potential security

Scanners

Cluster Name	Pod Queries	Health
Kubernetes Cluster #1	Scanning all pods	He

Health Status Summary

Kubernetes Node Name	Last Reported
node-1	Sep 5 2023 03:43:57 pm (PDT)

Registry List

Registry URL	Registry Type	Kubernetes Cluster	Last Scanned	C
192.168.51.1:5000	Other	Kubernetes Cluster #1	Aug 30 2023 03:29:18 pm (PDT)	
192.168.51.1:5001	Other	Kubernetes Cluster #1	Aug 30 2023 02:59:18 pm (PDT)	
docker.io	Other	Kubernetes Cluster #1	Aug 30 2023 03:43:59 pm (PDT)	
quay.io	Other	Kubernetes Cluster #1	Aug 30 2023 03:58:55 pm (PDT)	
registry.k8s.io	Other	Kubernetes Cluster #1	Aug 30 2023 02:43:54 pm (PDT)	

Step 6 Verify the connection status and enter the credentials, if necessary. The **Registry List** displays all detected registries.

Note Credentials vary based on the registry type.

Registry Type	Credentials
Azure	Tenant ID, Client ID, Secret Key
AWS	Access Key, Secret Key
GCP	Service account key in JSON format
Other	Username, Password

Troubleshooting

Follow these steps to ensure a successful connection:

a. The scanner pod is able to connect to the registry.

b. The required network policies are in place.

c. Credentials are entered, if necessary.